

# Research Trends of Rheumatoid Arthritis and Depression from 2019 to 2023: A Bibliometric Analysis

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**Background:** The co-occurrence of rheumatoid arthritis and depression typically exacerbates pain and leads to a range of adverse consequences, becoming a research hotspot in recent years. This study conducted the systematic retrieval of relevant articles within the past five years and employed bibliometric methods for scientometric analysis.

**Methods:** Setting the keywords “Rheumatoid arthritis”, “Depression” and “Depressive Disorder”, relevant literature published between 2019 and 2023 was retrieved from the Web of Science database. Subsequently, the core information from the literature was subjected to visual analysis via CiteSpace software and bibliometric techniques.

**Results:** A total of 974 articles related to rheumatoid arthritis and depression were identified through the search strategy, and 877 articles were retained for further analysis after duplicates. The United States (n=173), England (n=82), China (n=69), Canada (n=68), and Germany (n=54) ranked top five countries by publication count. The King’s College London was the leading institution with the highest number of publications (n = 20). LANCET PSYCHIATRY was the most frequently cited journal (n = 72) despite having only one article. The top five authors with the largest number of publications include CHARLES N BERNSTEIN (n=14), RUTH ANN MARRIE (n=13), JOHN D FISK (n=12), CAROL A HITCHON (n=12) and SCOTT B PATTEN (n=12), and all these are based in Canada. The keywords with a centrality score exceeding 0.1 were depression, rheumatoid arthritis, symptom, quality of life, impact, fibromyalgia, disease activity, prevalence, inflammation, health, anxiety, pain, fatigue, disease, arthritis and disability.

**Conclusion:** Related research between the co-occurrence of rheumatoid arthritis and depression was a persistent hotspot, but it still lacks of international collaboration and in-depth mechanistic exploration.

**Keywords:** rheumatoid arthritis, depression, bibliometric analysis, Web of Science, CiteSpace

## Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune disease that features symmetric joint synovitis and bone erosion.<sup>1</sup> Under usual circumstance, RA triggers a series of inflammation response, resulting in joint pain and dysfunction.<sup>2</sup> With RA progression, it can lead to extra-articular manifestations and contribute to a range of emotional disorders.<sup>2,3</sup> As an example, long-term RA patients are susceptible to depression. A meta-analysis involving 13,189 RA individuals found a prevalence rate of 16.8% for depressive disorder.<sup>4</sup> Depression can heighten pain sensitivity, resulting in increased pain experienced among patients with comorbid rheumatoid arthritis.<sup>5</sup> However, the co-presence of depression appears to impact quality of life, reduce treatment adherence, raise medical burden, and even increase the hospitalization risk and all-cause mortality of RA patients.<sup>6-9</sup>

Growing evidence demonstrates a strong interaction between disease activity of RA and the degree of depression.<sup>10,11</sup> Effective management of depression contributes to reducing RA patients’ perception of pain and improving their quality of life.<sup>12</sup> Despite the sever influence of depression, many rheumatologists easily overlook or underrate the negative

influence of this kind of comorbid.<sup>13</sup> Only a small proportion of patients are referred to the psychiatry department, which underscores the need for greater attention to recognizing the mental health of RA patients. Bibliometric analysis enables researchers to understand the future trend of research in the field and navigate the design of further investigations. The study is intended to review and examine the literature between rheumatoid arthritis and depression within the recent five years, so as to identify the focus point and lift the clinical attention of this field via bibliometric analysis.

## Method

### Data Acquisition and Search Strategy

From PubMed database (<https://pubmed.ncbi.nlm.nih.gov/>), MeSH (Medical Subject Headings) function was used to determine search terms (Table 1). The data for this study were gathered from the Web of Science Core Collection (WoSCC) (<https://www.webofscience.com/wos/woscc/>), and the literature included in this study spanned from January 1, 2019 to December 31, 2023. Only papers written in English were considered, with no restrictions imposed on the country or study category.

### Analysis Tool

Descriptive statistical analysis, co-occurrence analysis, co-citation analysis, and cluster analysis were conducted using CiteSpace (v.5.7.R2) and Microsoft Excel (16.79.1). CiteSpace was primarily utilized for analyzing journals, authors, references, countries, institutions, and keywords, while Excel was employed for describing annual publications. The parameters for CiteSpace were configured as follows: (1) time slicing: from January 1, 2019 to December 31, 2023, with each slice representing one year; (2) selection criteria: a g-index scale of  $k = 25$ ; (3) pruning: pathfinder, pruning sliced networks, and pruning the merged network were applied. In the visual representations, each node corresponds to a specific element. The size of the circle is proportional to the frequency of occurrence of the items, while the thickness of the lines indicates the strength of connections between the items. The relationships between countries were visualized through bibliometric (<https://bibliometric.com/>).

## Results

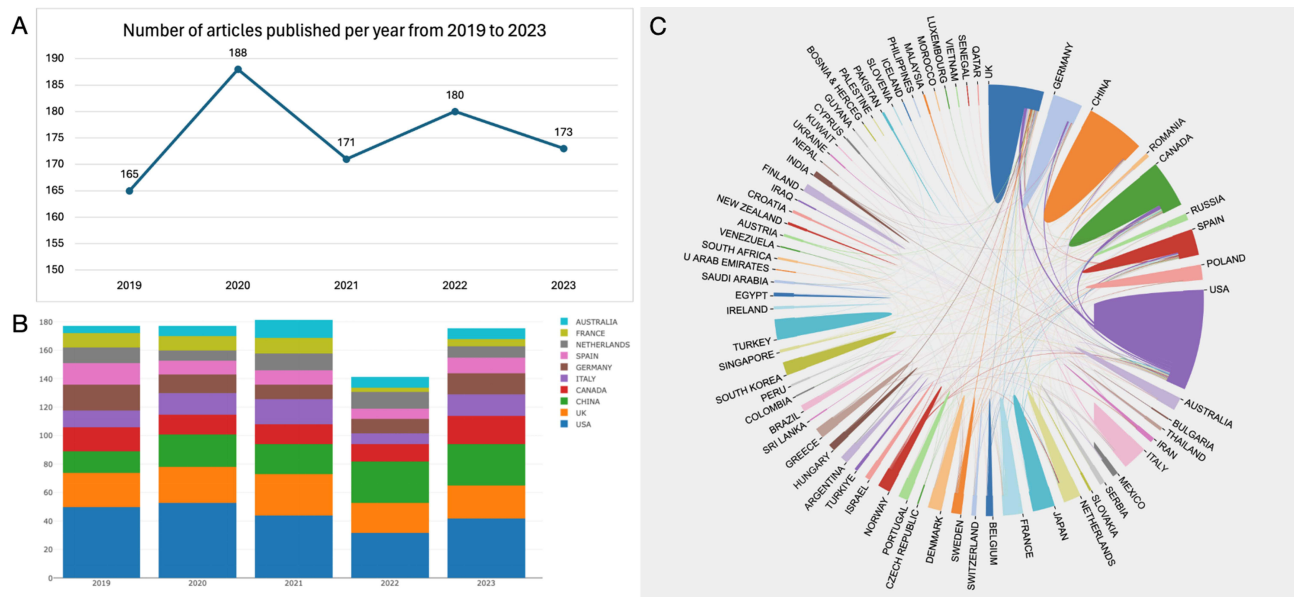
### Annual Publication Outputs and Distribution of Countries

WosCC (Web of Science Core Collection) found that a total of 974 articles have been published in this field within the past five years. After removing duplicates, 877 articles were finally enrolled and analyzed. The number of articles published per year from 2019 to 2023 was represented in Figure 1A. The top five countries with the largest number of publications consisted of the United States (173), England (82), China (69), Canada (68), and Germany (54), and the top five countries with highest centrality were composed of Belgium (1.02), Switzerland (0.92), Sweden (0.85), Canada (0.67), and Spain (0.51) (Table 2). The annual publication output for each country is depicted in Figure 1B. Illustrations of the collaborative relationships among nations are shown Figure 1C.

Obviously, 2019 could be viewed as a cutoff point. Before 2019, the annual average remained below 170; however, 2020 witnessed a significant surge, with the number of articles increasing by 23 compared to the previous year. The number of articles kept relatively stable between 170 and 180 during the subsequent years. Overall, there was no apparent linear or consistent trend in the number of articles over the five-year period. Further data and in-depth analysis would be necessary to determine whether there are any significant patterns or shift.

**Table 1** The Topic Search Query

Set	Results	Search Query
#1	38,495	TS=("Rheumatoid arthritis")
#2	165,938	TS=(Depression OR "Depressive Disorder")
#3	974	#1 AND #2



**Figure 1** (A) Number of articles published per year from 2019 to 2023. (B) The annual publication output for each country. (C) The collaborative relationships among nations.

### Analysis of Journals and Cited Journals

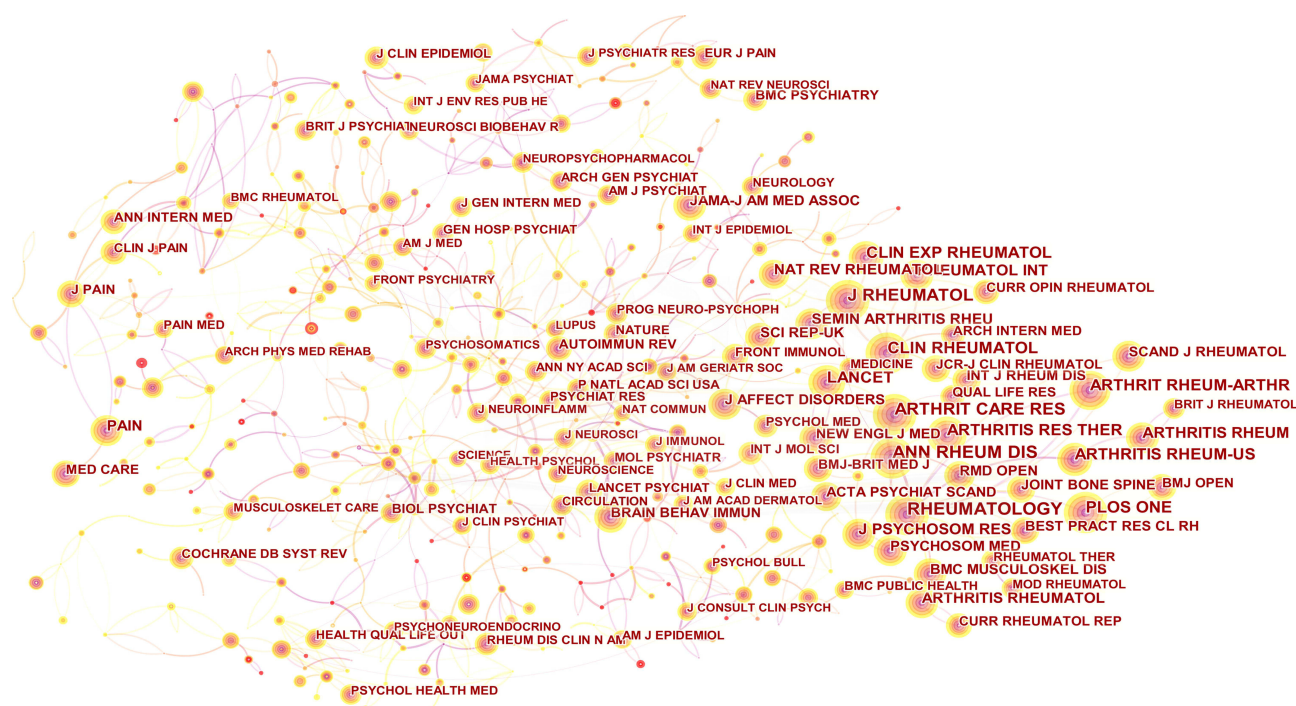
The co-citation map of cited journals was established by CiteSpace, encompassing 557 Nodes and 1286 Links (Figure 2). In this network, the top 8 cited journals with the highest number of frequencies are shown in Table 3, comprising one in the field of psychiatry (*LANCET PSYCHIATRY*), one in the field of orthopedics (*JOINT BONE SPINE*) and seven in the field of rheumatology (*RHEUMATOLOGY*, *ARTHRITIS CARE & RESEARCH*, *CLINICAL RHEUMATOLOGY*, *INTERNATIONAL JOURNAL OF RHEUMATIC DISEASES*, *CLINICAL AND EXPERIMENTAL RHEUMATOLOGY* and *CURRENT OPINION IN RHEUMATOLOGY*). The most cited journals were *LANCET PSYCHIATRY*, with 72 articles cited, though only one article has been published. *LANCET PSYCHIATRY* also had the highest impact factor (IF) of 64.3.

### Distribution of Institutions

The institutions that had published articles related to rheumatoid arthritis and depression are depicted in Figure 3, including a cluster-like co-occurrence subnetwork comprising seven clusters. Most institutions in various countries usually involve domestic collaborations. The top five institutions are shown in Table 4, consisting of Kings Coll London (20), Univ Calgary (16), Univ Manitoba (16), Johns Hopkins Univ (15) and Univ Penn (15). In terms of centrality, the top five institutions were Univ Calif San Diego, Univ Montreal, McGill Univ, Northwestern Univ, Aarhus Univ.

**Table 2** The Top 5 Countries with the Largest Number of Publishes and Highest Centrality

Rank	Country	Centrality	Rank	Country	Frequency
1	BELGIUM	1.02	1	USA	173
2	SWITZERLAND	0.92	2	ENGLAND	82
3	SWEDEN	0.85	3	CHINA	69
4	CANADA	0.67	4	CANADA	68
5	SPAIN	0.51	5	GERMANY	54



**Figure 2** Co-citation map of cited journals between rheumatoid arthritis and depression.

### Analysis of Authors and Cited Authors

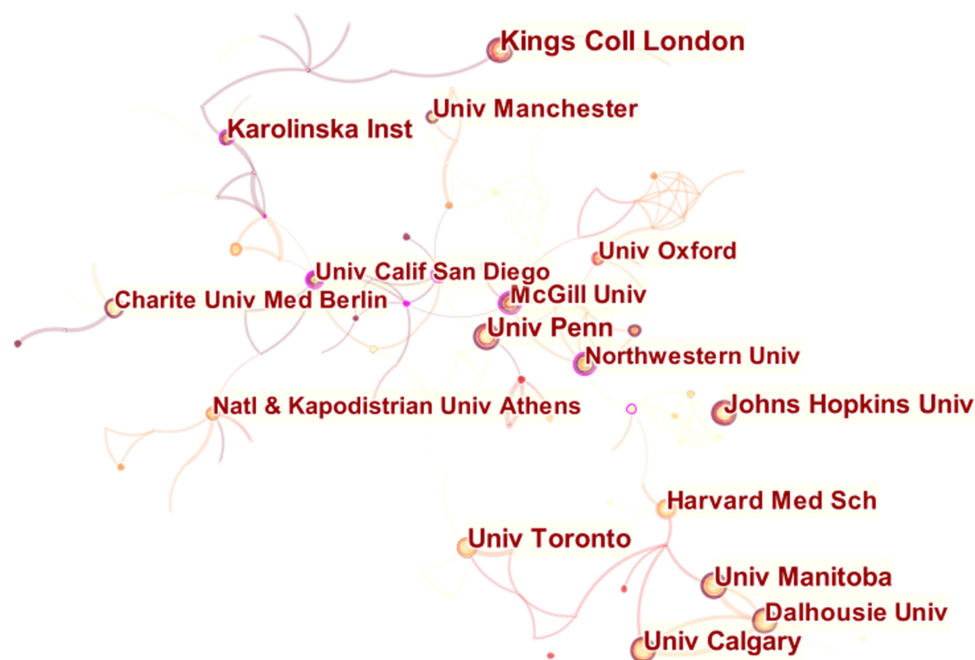
The co-occurrence relationship between authors who had published papers between rheumatoid arthritis and depression is shown in Figure 4, including 206 nodes and 435 links. The operation network between them was displayed as subnetworks that are either interknitted or isolated. For the most part, Canadian authors are inclined to collaborate with compatriots who serve in the same institution. Also, some authors are prone to choose multinational cooperation. When considering the number of published papers, the top five authors are CHARLES N BERNSTEIN (14), RUTH ANN MARRIE (13), JOHN D FISK (12), CAROL A HITCHON (12) and SCOTT B PATTEN (12), and these top-ranking authors are all from Canada (Table 5).

The co-occurrence relationship of cited authors publishing articles on the relationship between rheumatoid arthritis and depression consisted of 427 nodes and 913 links (Figure 5).

The top five cited authors with the largest number of publications were MATCHAM F (200), ANONYMOUS (187), SMOLEN JS (130), WOLFE F (122), and ALETAHA D (119), and the top five cited authors with the highest centrality were OGDIE A (0.44), LEE YC (0.32), RAISON CL (0.29), ANG DC (0.24), and NIKOLAUS S (0.24) (Table 6).

**Table 3** The Top 8 Cited Journals with the Highest Frequency Between Rheumatoid Arthritis and Depression

Rank	Publication Title	Number	Frequency	Frequency/Number	IF (2022)
1	LANCET PSYCHIATRY	1	72	72	64.3
2	RHEUMATOLOGY	28	66	2.4	5.5
3	ARTHRITIS CARE & RESEARCH	31	62	2	4.7
4	CLINICAL RHEUMATOLOGY	33	58	1.8	2.83
5	INTERNATIONAL JOURNAL OF RHEUMATIC DISEASES	20	50	2.5	2.5
6	CLINICAL AND EXPERIMENTAL RHEUMATOLOGY	22	34	1.6	3.7
7	JOINT BONE SPINE	8	28	3.5	4.2
8	CURRENT OPINION IN RHEUMATOLOGY	1	28	28	5.1



**Figure 3** Co-occurrence map of institutions publishing articles between rheumatoid arthritis and depression.

## Analysis of Keywords

The co-occurrence relationship between keywords in the published papers of the interplay between rheumatoid arthritis and depression is shown in [Figure 6A](#), including 35 nodes and 73 links. The keywords with a centrality score greater than 0.1 were depression, rheumatoid arthritis, symptom, quality of life, impact, fibromyalgia, disease activity, prevalence, inflammation, health, anxiety, pain, fatigue, disease, arthritis and disability ([Table 7](#)). In the cluster analysis, a total of 16 clusters were identified. For optimal visualization, only 6 clusters are presented herein, including “anxiety”, “inflammation”, “rheumatoid arthritis”, “fatigue”, “physical activity” and “fibromyalgia”. The cluster of anxiety contained depression, anxiety, pain, remission, validity, meta-analysis ([Figure 6B](#)). The cluster of inflammation comprised disease activity, inflammation, symptom and stress. The cluster of rheumatoid arthritis consists of rheumatoid arthritis, prevalence, validation and epidemiology. The cluster of fatigue consisted of fatigue, disease, comorbidity and criteria. The cluster of physical activity was composed of quality of life, health, ankylosing spondylitis, physical activity and adult. The cluster of fibromyalgia consisted of arthritis, fibromyalgia, osteoarthritis, and chronic pain.

## Discussion

Long-standing pain, functional impairment and prolonged inflammatory responses serve as risk determinants for the onset development of depression.<sup>14–17</sup> Therefore, diseases such as cancer, inflammatory bowel disease, and rheumatic autoimmune diseases often have a higher probability of being accompanied by depression.<sup>18–21</sup> RA typically exhibits

**Table 4** The Top 5 Institution with the Largest Number of Publishes and Highest Centrality

Rank	Institution	Centrality	Country	Rank	Institution	Frequency	Country
1	Univ Calif San Diego	0.28	USA	1	Kings Coll London	20	ENGLAND
2	Univ Montreal	0.20	CANADA	2	Univ Calgary	16	CANADA
3	McGill Univ	0.18	CANADA	3	Univ Manitoba	16	CANADA
4	Northwestern Univ	0.14	USA	4	Johns Hopkins Univ	15	USA
5	Aarhus Univ	0.14	DENMARK	5	Univ Penn	15	USA



**Figure 4** Co-occurrence map of authors publishing articles between rheumatoid arthritis and depression.

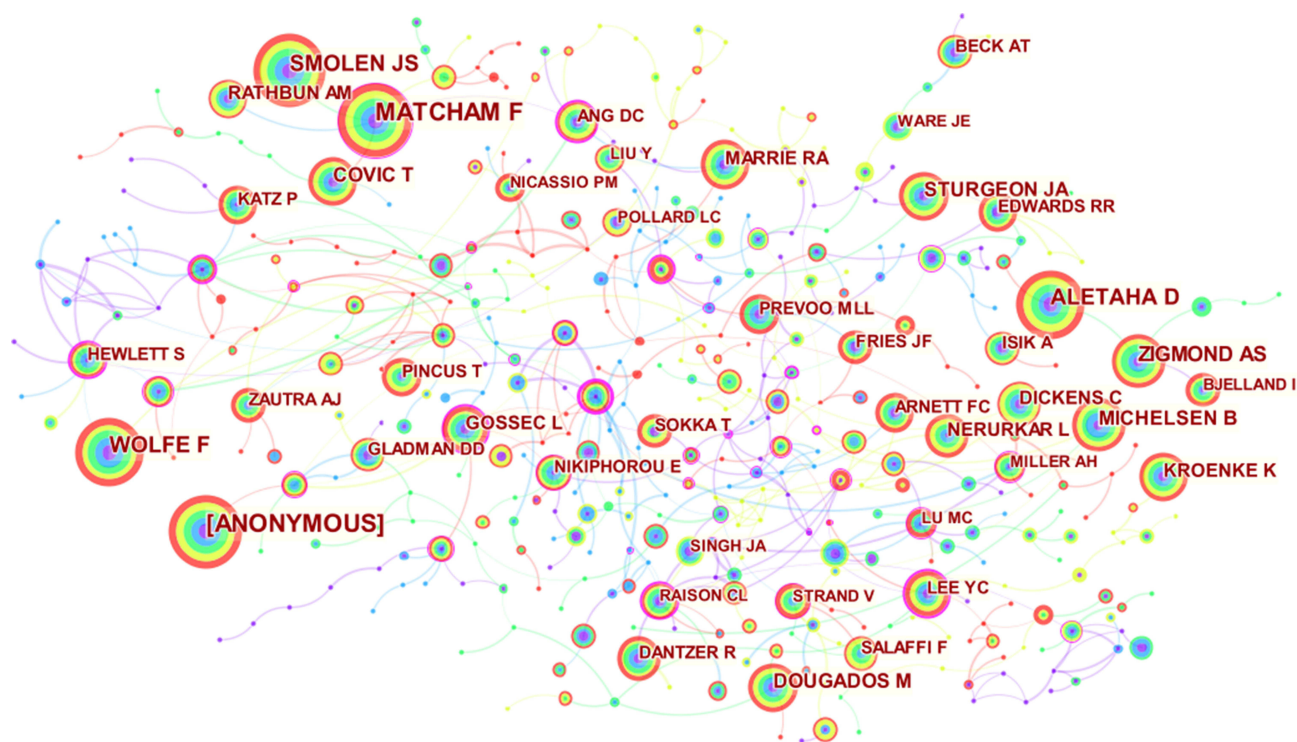
a high prevalence of depression, which is a critical factor in the poor prognosis of the disease.<sup>22</sup> Recent studies have shown a close association between the occurrence of depression and high disease activity of RA.<sup>23</sup>

Although the underlying mechanisms remain unclear, several factors could shed light on the intricate mechanisms. Firstly, RA is accompanied by the activation of systemic inflammatory responses, leading to a plethora of pro-inflammatory cytokines, such as Tumor Necrosis Factor- $\alpha$  (TNF- $\alpha$ ) and Interleukin-6 (IL-6).<sup>24</sup> Pro-inflammatory cytokines are able to stimulate microglia within the central nervous system, releasing a substantial amount of inflammatory factors and causing neurological impairment, ultimately culminating in the onset of depression.<sup>25,26</sup> Secondly, RA may trigger ongoing persistent chronic pain, which acts as a stressor, stimulating the nervous system and causing alterations in synaptic plasticity, ultimately contributing to depression.<sup>27-29</sup> Lastly, joint deformities in rheumatoid arthritis can profoundly hinder patients' daily and social functioning, thereby exacerbating the likelihood of developing depressive symptoms to some extent.<sup>30</sup>

A bibliometric analysis of articles on RA and depression can offer valuable insights into the current state of research, identify emerging hotspots, and guide future study designs. Through bibliometric analysis on the number of publications, it has been observed that over 165 articles are published annually on the topic, with a noticeable upward trend which indicates sustained research interest in this area. An examination of the volume of publications across different countries reveals that the United States, the United Kingdom, and China are always the top three contributors, reflecting ongoing engagement from researchers in these nations. Notably, in the past two years, China's publication output has surpassed that of the United Kingdom, signaling its growing potential in this research field. Additionally, there is stronger

**Table 5** The Top 5 Authors with the Largest Number of Publishes

Rank	Author	Frequency	Country
1	CHARLES N BERNSTEIN	14	CANADA
2	RUTH ANN MARRIE	13	CANADA
3	JOHN D FISK	12	CANADA
4	CAROL A HITCHON	12	CANADA
5	SCOTT B PATTEN	12	CANADA



**Figure 5** Co-occurrence map of cited authors publishing articles between rheumatoid arthritis and depression.

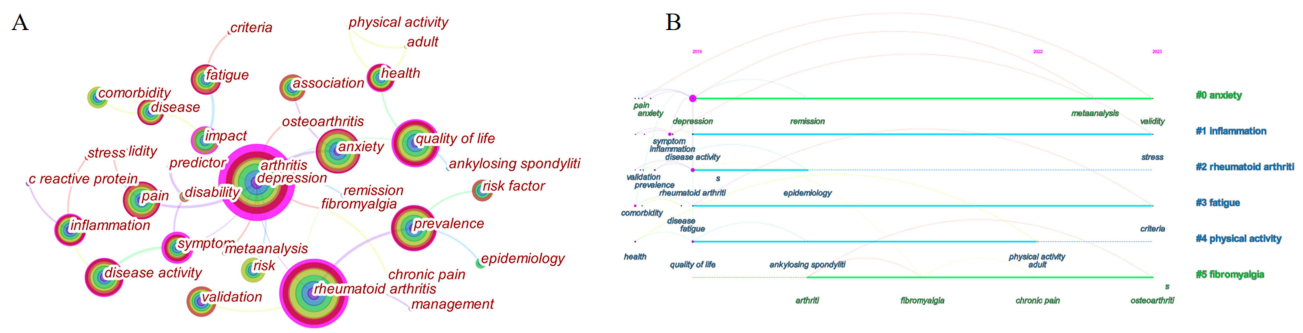
collaboration between researchers from the USA and the UK, while Chinese researchers engage in relatively fewer international efforts. This highlights the need for Chinese researchers to enhance global collaboration to avoid potential misinterpretations due to cultural differences.

Further analysis of the journals publishing relevant literature reveals that the majority of publications appear in journals such as RHEUMATOLOGY, ARTHRITIS CARE & RESEARCH, CLINICAL RHEUMATOLOGY, INTERNATIONAL JOURNAL OF RHEUMATIC DISEASES, CLINICAL AND EXPERIMENTAL RHEUMATOLOGY and CURRENT OPINION IN RHEUMATOLOGY. In contrast, there are comparatively fewer contributions in psychiatric journals. This suggests that the majority of these studies are conducted from a rheumatological perspective, with limited involvement from psychiatrists. Interestingly, despite publishing only one relevant article, LANCET PSYCHIATRY has garnered more citations than all the other journals, which suggests that, although psychiatric involvement in this research area is limited, it has a significant impact.

Further analysis of the relevant keywords reveals that research focuses on symptoms and comorbidities (such as symptom, fibromyalgia, pain, fatigue, anxiety, disease), studies related to quality of life (including quality of life, disability, health), epidemiological research (prevalence), and rheumatoid arthritis itself (disease activity, inflammation).

**Table 6** The Top 5 Cited Authors with the Largest Number of Publishes and Highest Centrality

Rank	Cited Author	Centrality	Rank	Cited Author	Frequency
1	OGDIE A	0.44	1	MATCHAM F	200
2	LEE YC	0.32	2	ANONYMOUS	187
3	RAISON CL	0.29	3	SMOLEN JS	130
4	ANG DC	0.24	4	WOLFE F	122
5	NIKOLAUS S	0.24	5	ALETAHA D	119



**Figure 6** (A) Co-occurrence map of keywords in articles between rheumatoid arthritis and depression. (B) Timeline map of keywords in articles between rheumatoid arthritis and depression.

A subsequent cluster analysis shows that the anxiety cluster consists of depression, anxiety, pain, remission, validity, and meta-analysis, primarily involving comorbidities and related symptoms. The inflammation, comprising disease activity, inflammation, symptom, and stress, highlights its relevance to the occurrence of rheumatoid arthritis disease activity and depression. The cluster of rheumatoid arthritis, which includes rheumatoid arthritis, prevalence, validation, and epidemiology, demonstrates a close relationship with epidemiology.

Through keyword analysis, it is evident that recent researchers have focused on cross-sectional studies to acquire information on relevant comorbidities and prevalence rates. These studies are easy to perform but tend to lack depth. However, there is a notable gap in research addressing clinical concerns, such as which Disease-modifying anti-rheumatic drugs (DMARDs) and bDMARDs medications should be used in the clinical treatment of rheumatoid arthritis to maximize benefits for patients with comorbid depression. Moreover, some reports indicate that, RA patients with comorbid depression respond less effectively to antidepressant treatments compared to those without RA, suggesting that RA-related depression may involve unique mechanisms. This underscores the demand for collaborative efforts between rheumatology and psychiatry researchers to address the above issue through a series of clinical and mechanistic studies.

**Table 7** The Keywords with Centrality Greater Than 0.1

Rank	Keyword	Centrality
1	Depression	1.69
2	Rheumatoid arthritis	0.9
3	Symptom	0.63
4	Quality of life	0.44
5	Impact	0.44
6	Fibromyalgia	0.34
7	Disease activity	0.33
8	Prevalence	0.23
9	Inflammation	0.23
10	Health	0.23
11	Anxiety	0.12
12	Pain	0.12
13	Fatigue	0.12
14	Disease	0.12
15	Arthritis	0.12
16	Disability	0.12



## Conclusion

Related research between rheumatoid arthritis and depression was a persistent hotspot, but there is still a lack of international collaboration and in-depth mechanistic studies. Simultaneously, psychiatrists should further engage in clinical research about rheumatoid arthritis and depression, delving into deeper explorations of relevant clinical issues.

## Ethics Declarations

This study does not require ethics clearance, as we are taking only secondary data from the available literature.

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## Disclosure

All authors declare no conflicts of interest.

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