

Visual Analysis of Psychological Resilience Research Based on Web of Science Database

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Background: The importance of psychological resilience that people show in coping with stress and adversity is prominent, but few studies have used rigorous bibliometric tools to analyze the knowledge structure and distribution of psychological resilience research.

Objective: The purpose of this study was to sort out and summarize the previous studies on psychological resilience by using bibliometrics. Specifically, the time distribution of psychological resilience research was determined by publication trend, the power distribution was determined by the distribution of countries, authors, institutions and journals, the hot research spots were analyzed according to the results of keyword cluster analysis, and the research frontier was explored according to the results of burst keywords.

Methods: CiteSpace5.8.R3 was used to analyze the literatures on psychological resilience collected in Web of Science core Collection database from January 1, 2010, to June 16, 2022.

Results: A total of 8462 literatures were included after screening. Research on psychological resilience has been on the rise in recent years. The United States had made a high contribution in this field. Robert H Pietrzak, George A Bonanno, Connor KM and others were highly influential. *J Pers Soc Psychol* has the highest citation frequency and centrality. The research hot spots focus on five aspects: study on psychological resilience related to COVID-19 pandemic, influencing factors of psychological resilience, psychological resilience related to PTSD, study on psychological resilience of special population, and the molecular biology and genetic basis of psychological resilience. Psychological resilience related to COVID-19 pandemic was the most cutting-edge research aspect.

Conclusion: The current situation and trend of psychological resilience research were found in this study, which may be used to identify more hot issues and explore new research directions in this field.

Keywords: psychological resilience, CiteSpace, hot spots, visualization

Introduction

The study of psychological resilience began in the 1970s when Rutter studied the psychological adaptation of children after experiencing maternal deprivation. Rutter's research found that children who were able to grow up healthily in adverse environments had higher levels of psychological resilience, which can play a supportive and protective role.^{1,2} Since then, researchers have gradually carried out research on psychological resilience. After more than 30 years of development, psychological resilience has become a hot topic in the international psychology field, and it also has attracted great attention in psychology, pedagogy, medicine, and other disciplines. Many studies have proved that psychological resilience can help individuals maintain a relatively stable and healthy physiological level in traumatic or stressful environments, which is of great significance for individuals to cope with stress and improve their mental health.³⁻⁶

Psychological resilience represents a complex set of protective and pathogenic factors, as well as processes important to the understanding of health and disease and the process of treatment and recovery.⁷ It is a positive adaptation after a stressful situation. It represents the mechanism for coping and overcoming difficult experiences, namely one's ability to

successfully adapt to change, resist the negative effects of stressors, and avoid major dysfunction.⁸ It represents the ability to return to what was previously called a “normal” or healthy state after a trauma, accident, tragedy, or illness. In other words, psychological resilience is the ability to cope with difficult, stressful, and traumatic situations while maintaining or restoring normal function.^{9,10} The higher the level of psychological resilience, the lower the vulnerability and risk of disease.¹¹ People with high psychological resilience levels tend to be more optimistic, tend to see everything as a useful experience, focus on personal strengths and qualities, use constructive criticism, build close relationships with others, develop social skills, and have emotional awareness.¹² Good psychological resilience will prevent the onset of disease, provide good health, promote, and speed healing, and provide a productive life and sense of well-being in the context of chronic illness.

Up to now, the definition of psychological resilience in the sense of scientific research has not been unified. Based on the viewpoints of many researchers, the definition of psychological resilience can be divided into three types: the definition of consequentiality refers to a phenomenon in which an individual can adapt well or develop smoothly even under severe threat,¹³ the definition of competence refers to the ability of resilience to maintain healthy and orderly development in the face of various adverse factors,¹⁴ and the definition of process refers to the process of psychological resilience, in which an individual adapts actively and develops healthily under adverse and dangerous circumstances.¹⁵

Psychological resilience has been studied for decades, and many researchers have reviewed the literatures on psychological resilience to further sort out the research content and direction, however, there is still a lack of summary and evaluation on the literature features, research direction, research depth, hot topics and other aspects of psychological resilience research, and few researchers have made qualitative and quantitative visual analysis of the research on psychological resilience by using bibliometrics.

Bibliometrics is a branch of information science, which is the science of quantitative analysis and study of documents.¹⁶ Since the 21st century, bibliometrics has been widely used in assessing the research strength of institutions or individuals, understanding the countries or departments with strong research strength in various disciplines, and looking for possible partners, as well as unit evaluation and searching for talents. Quantitative analysis from the perspective of bibliometrics can summarize the development status of a research field more objectively.^{17,18}

This study intends to use bibliometrics method to analyze the status, hotspots, and trends of psychological resilience research, to help researchers to better grasp the research status and promote the development of psychological resilience research.

Methods

Data Collection

Bibliometric analysis relies on objective and comprehensive literature database. At present, widely used databases include Scopus, Web of Science, PubMed, Embase, Cochrane Library, etc. Among them, Web of Science database contains large multidisciplinary, high impact, international, comprehensive academic journals. Therefore, it is reasonable and effective to choose Web of Science database as our research data source.

The core collection database of Web of Science was used as the research platform because of the high quality of the Science Citation Index (SCI) literature and the high influence of the industry. All collected articles were written in English, and we used the following fields to retrieve the data:

1. Retrieval strategy was TS (topic): Psychological Resilience.
2. Since the purpose of this study is more inclined to look for the research hotspot of psychological resilience in recent years, rather than explore the knowledge development context, we set the retrieval time from January 1, 2010 to June 16, 2022.
3. Index: (Science Citation Index Expanded (SCI-EXPANDE), Social Sciences Citation Index (SSCI), Conference Proceedings Citation Index – Science (CPCI-S), Conference Proceedings Citation Index - Social Science & Humanities (CPCI-SSH), Book Citation Index – Science (BKCI-S), Book Citation Index - Social Sciences & Humanities (BKCI-SSH)).

4. Document type: Article OR Review.
5. Inclusion criteria: The topic of the literature is related to psychological resilience.
6. Exclusion criteria: animal literature, book chapters, book reviews, letters, conferences.
7. Quality Control: Two researchers screened the literatures respectively and cross-checked the results. They scanned the title and abstract of the article for screening. If they could not make it clear, they would consult the full text and decide.

Based on the search items listed above, 8471 articles were extracted from the Web of Science core collection database, and 8462 articles were finally included after the repeated articles were removed through CiteSpace.

Instrument

Scientific mapping is an important step of bibliometric analysis, which can objectively present the research status of one subject.¹⁹ There are many visualization software tools available to aid bibliometric analysis, such as CiteSpace, VOSviewer, etc. In addition to providing information about the main thematic focus areas, these tools can also be used to unravel the complex interrelationships among different potential components of a research field. There is evidence that Web of Science databases provide better knowledge mapping when CiteSpace is used for visual analysis,^{20,21} this further confirms our confidence in using CiteSpace to analyze the data in this study.

CiteSpace is a visual citation analysis software developed under the background of scientometrics and data visualization.²² As one of the popular knowledge mapping tools, CiteSpace focuses on analyzing, mining, and searching for research hotspots or development trends in a certain discipline and presents them in a visual way.²³

The full records and referenced references retrieved from the Web of Science core collection database were exported in plain text. In this study, CiteSpace (5.8.R3) was used to analyze the resulting data. CiteSpace settings were as follows: The time span was from January 1, 2010, to June 16, 2022, and the time slice was 1 year. The analysis node types included publication, country, author, institution, journal and keyword. Pruning the selected content is sliced through pathfinder and pruning sliced networks to get the corresponding knowledge maps. Some other details can be seen in the upper left corner of the knowledge map.

In the generated knowledge map,²⁴ N represents the number of network nodes, E represents the number of connections, and Density represents the network density. Modularity is an evaluation index of network Modularity, a larger value of Modularity Q indicates a better clustering, a value of Modularity $Q > 0.3$ means that the resulting network structure is significant. The Silhouette value is an indicator used to measure network homogeneity, the closer the value is to 1, the higher the homogeneity of the network will be, the value above 0.5 indicates reasonable clustering results. The nodes represent citation rings, different colors and sizes of the rings represent different years and citation numbers, which represent the citation history of the literature since its publication. For the knowledge map of keyword distribution network, the distribution of keyword frequency can reflect the cited frequency or number of articles in a certain field, and the field with the highest number of articles or the most cited articles is often the hot spot of research. The larger the word frequency, the larger the node shown in the knowledge map. At the same time, co-occurrence times can be determined according to the thickness of the lines of link keywords, the affinity and disaffinity between them can be measured, and the time of word frequency occurrence can be judged by color. Cluster analysis refers to the analysis process of grouping a collection of physical or abstract objects into multiple classes composed of similar objects.²⁵ In this study, to summarize the research hotspots of disciplines or fields, cluster analysis will be used to show the relationship between high-frequency subject words. Burst means that the value of a variable changes greatly in a short period, keywords with strong burst indicates that researchers have discovered new research fields and perspectives in a certain period, thus showing the academic frontier in a certain period, which is often shown in red in the knowledge map.

Results

Analysis of Annual Publications

The number of annual publications can reveal the development trend of a certain research field. According to the line chart (Figure 1), studies on psychological resilience generally show an upward trend. The upward trend was relatively

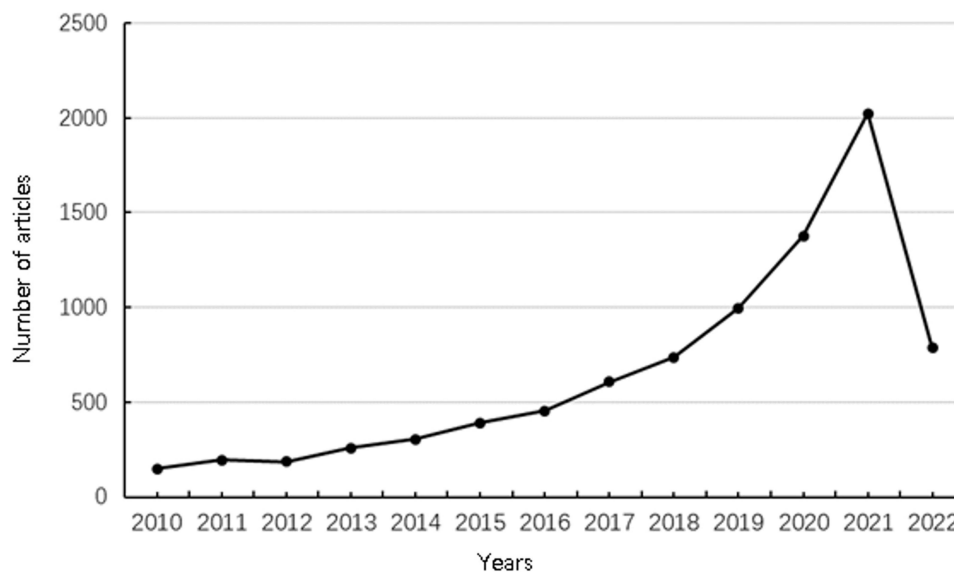


Figure 1 Analysis of annual publications.

gentle before 2019 but showed a rapid upward trend after 2019, with the largest literature volume in 2021. Due to the statistical deadline of June 16, 2022, the research results of 2022 were not complete, there were 93 fewer than the number of papers published in the same period last year.

Countries Distribution

There are 42 nodes and 147 lines in the knowledge map of national cooperation network (Figure 2), with a density of 0.1707. The connection in the knowledge map of national cooperation network is relatively close, indicating that cooperation among countries was relatively close. Table 1 lists the top 10 countries in terms of literature publication and centrality of psychological resilience research. Among them, the United States has the largest number of literatures and highest centrality, indicating that the United States had the closest academic research cooperation with other countries and had also played an important role in research innovation with far-reaching influence. In addition to the United States, other countries with high production and centrality include England, Australia, Italy, Canada, Spain, Germany, Netherlands, etc. The country with the second largest number of literatures was China, but its centrality is only 0.03, indicating that its influence in the field of psychological resilience was weak and its influence still needs to be improved.

Institutions Distribution

There are 76 nodes and 130 links in the knowledge map of institutional cooperation network (Figure 3), with a density of 0.0456. Table 2 lists the top 10 institutions in terms of publication, centrality, and burst. Harvard Med Sch, Univ Michigan and Columbia Univ were the top three institutions in terms of publication, their publications were 94, 90 and 88, respectively. Harvard Univ, Univ Washington and Yale Univ were the top three institutions in terms of centrality, their centrality were 0.21, 0.15 and 0.14, respectively. Burst is a variable that changes significantly in a short period of time, Harvard Med Sch, UCL and Univ Granada were the top three institutions in terms of burst, their burst value were 11.3, 10.23 and 9.94, respectively.

Authors Distribution

There are 560 nodes and 668 links in the knowledge map of author cooperation network (Figure 4), with a density of 0.0043. It is not difficult to analyze from Figure 4 that author cooperation network is generally dispersed, and only some important author cooperation networks are shown in Figure 4. Table 3 lists the top 10 authors in terms of publication,

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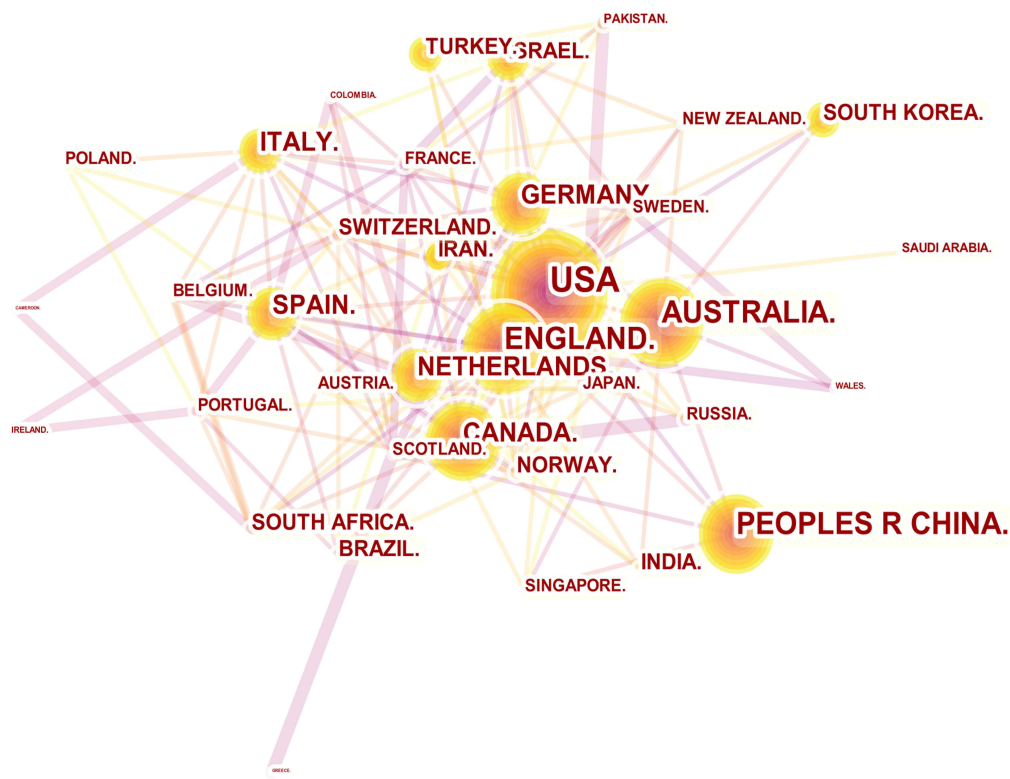


Figure 2 The knowledge map of national cooperation network.

burst, citation frequency and burst of citation, to analyze the key authors in the field of psychological resilience research. Robert H Pietrzak, George A Bonanno, Yohanan Eshel were the top three authors in terms of publication, George A Bonanno, Yohanan Eshel, Hadas Marciano were the top three authors in terms of burst, Connor KM, Bonanno GA, Masten AS were the top three authors in terms of citation frequency, World Health Organization, American Psychiatric Association, Smith BW were the top three authors in terms of burst of citation. The literatures published by the authors

Table I Psychological Resilience Research Distribution by Countries

Country	Count	Country	Centrality
USA	2712	USA	0.28
Peoples R China	790	England	0.18
England	736	Scotland	0.12
Australia	668	Italy	0.11
Canada	473	Switzerland	0.11
Spain	400	Australia	0.09
Germany	384	Canada	0.09
Italy	340	Germany	0.08
Netherlands	259	Netherlands	0.08
Israel	228	Spain	0.07

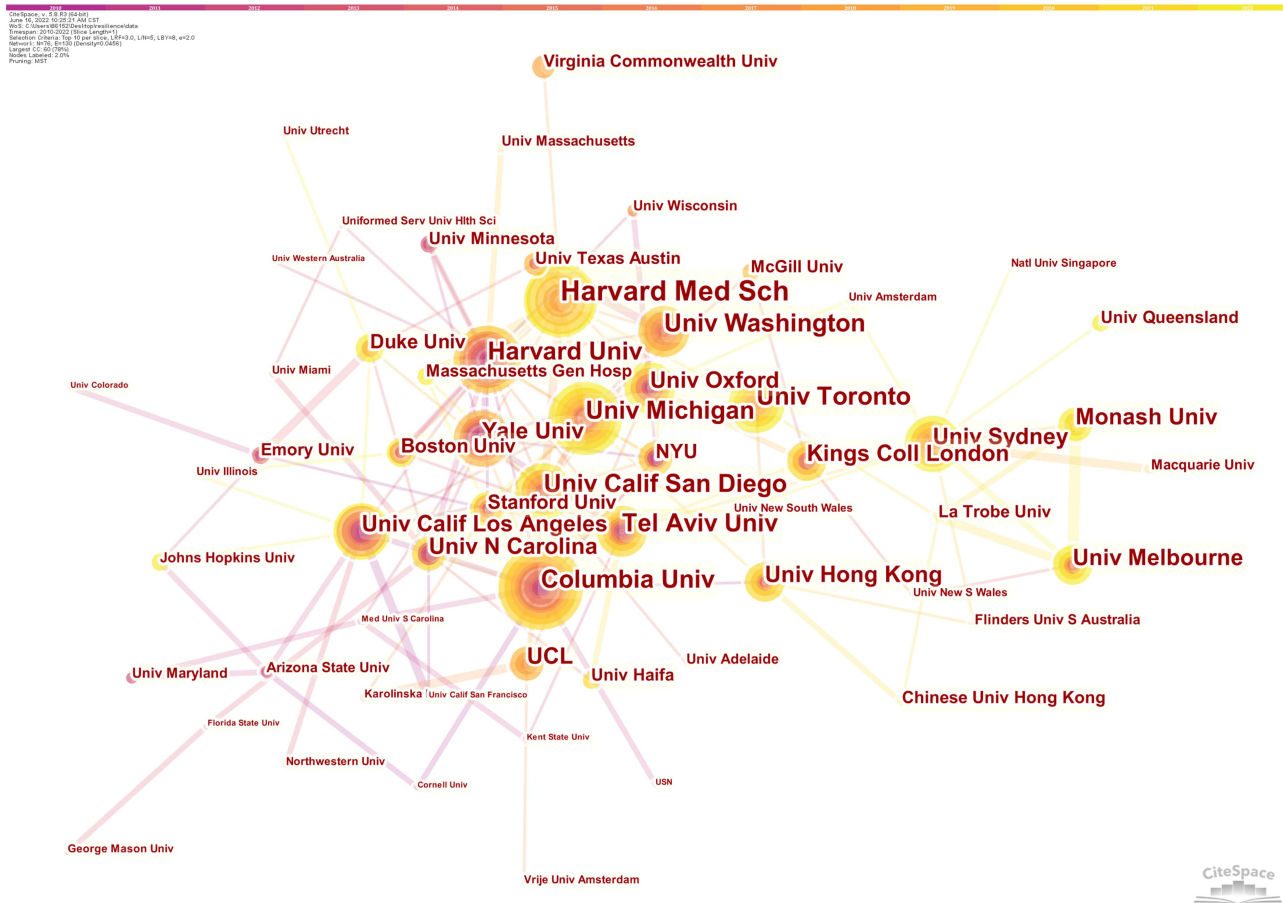


Figure 3 The knowledge map of institutional cooperation network.

above were foundational to a certain extent and play a key role or turning point in the field of psychological resilience. More information can be seen in Table 3.

Cited Journals Distribution

There are 43 nodes and 125 links in the knowledge map of cited journals network (Figure 5), with a density of 0.1384. Table 4 lists the top 10 journals in terms of citation frequency, centrality and burst. The most frequently cited journal was *J Pers Soc Psychol* with 2876 citations, followed by *Am Psychol* and *Psychol Bull* with 2588 citations and 2044 citations,

Table 2 Institutions Distribution by Count, Centrality and Burst

Institutions	Count	Institutions	Centrality	Institutions	Burst
Harvard Med Sch	94	Harvard Univ	0.21	Harvard Med Sch	11.3
Univ Michigan	90	Univ Washington	0.15	UCL	10.23
Columbia Univ	88	Yale Univ	0.14	Univ Granada	9.94
Univ Toronto	85	Columbia Univ	0.12	Virginia Commonwealth Univ	9.36
Univ Washington	78	Univ Toronto	0.12	Flinders Univ S Australia	7.75
Harvard Univ	78	Kings Coll London	0.12	Yale Univ	7.73
Yale Univ	67	Univ Michigan	0.11	Univ Adelaide	7.51
Univ Calif San Diego	63	Univ Sydney	0.1	Univ Hong Kong	7.05
Kings Coll London	57	Harvard Med Sch	0.09	China Med Univ	6.8
Tel Aviv Univ	55	Univ Calif San Diego	0.09	Univ Minnesota	6.61

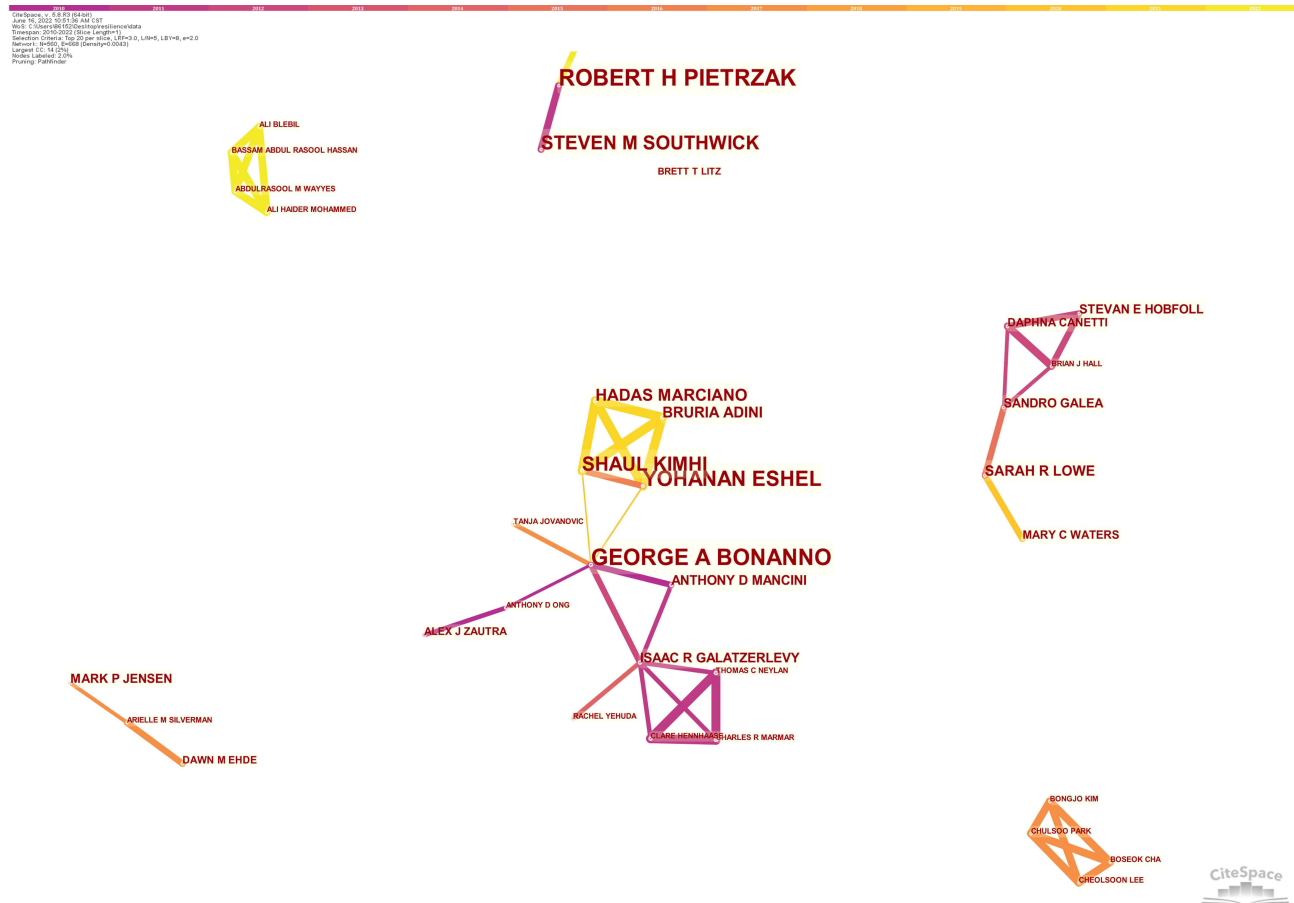


Figure 4 The knowledge map of author cooperation network.

respectively. *J Pers Soc Psychol* has the highest centrality with a value of 0.32, followed by *Am Psychol* and *PLoS One* with a value of 0.23 and 0.2, respectively. The top 10 journals are located at the center of the nodes in the cited journal network, and many branches are developed around them. *Int J Env Res Pub He* has the highest value of burst, which is

Table 3 Authors Distribution

Authors	Publications	Authors	Burst	Cited Authors	Cited Counts	Cited Authors	Burst
Robert H Pietrzak	28	George A Bonanno	6.12	Connor KM	1284	World Health Organization	90.7
George A Bonanno	26	Yohanah Eshel	5.66	Bonanno GA	1182	American Psychiatric Association	69.19
Yohanah Eshel	21	Hadas Marciano	5.24	Masten As	1060	Smith BW	65.59
Shaul Kimhi	18	Shaul Kimhi	5.18	Luthar SS	884	Wang CY	65.55
Steven M Southwick	16	Xiaoming Li	4.76	Rutter M	794	Southwick SM	54.12
Lie Wang	15	Bruria Adini	4.71	Kessler RC	671	Windle G	50.9
Dilip V Jeste	14	Lie Wang	4.36	Campbell-Sills L	610	Norris FH	44.98
Li Liu	13	Li Liu	3.87	Lazarus RS	604	Ong AD	43.39
Mustafa Sarkar	13	Fred Luthans	3.77	Cohen S	604	Scheier MF	42.32
Xiaoming Li	13	Anthony D Mancini	3.64	Diener E	561	Fletcher D	41.52

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 Silhouette S=0.9716
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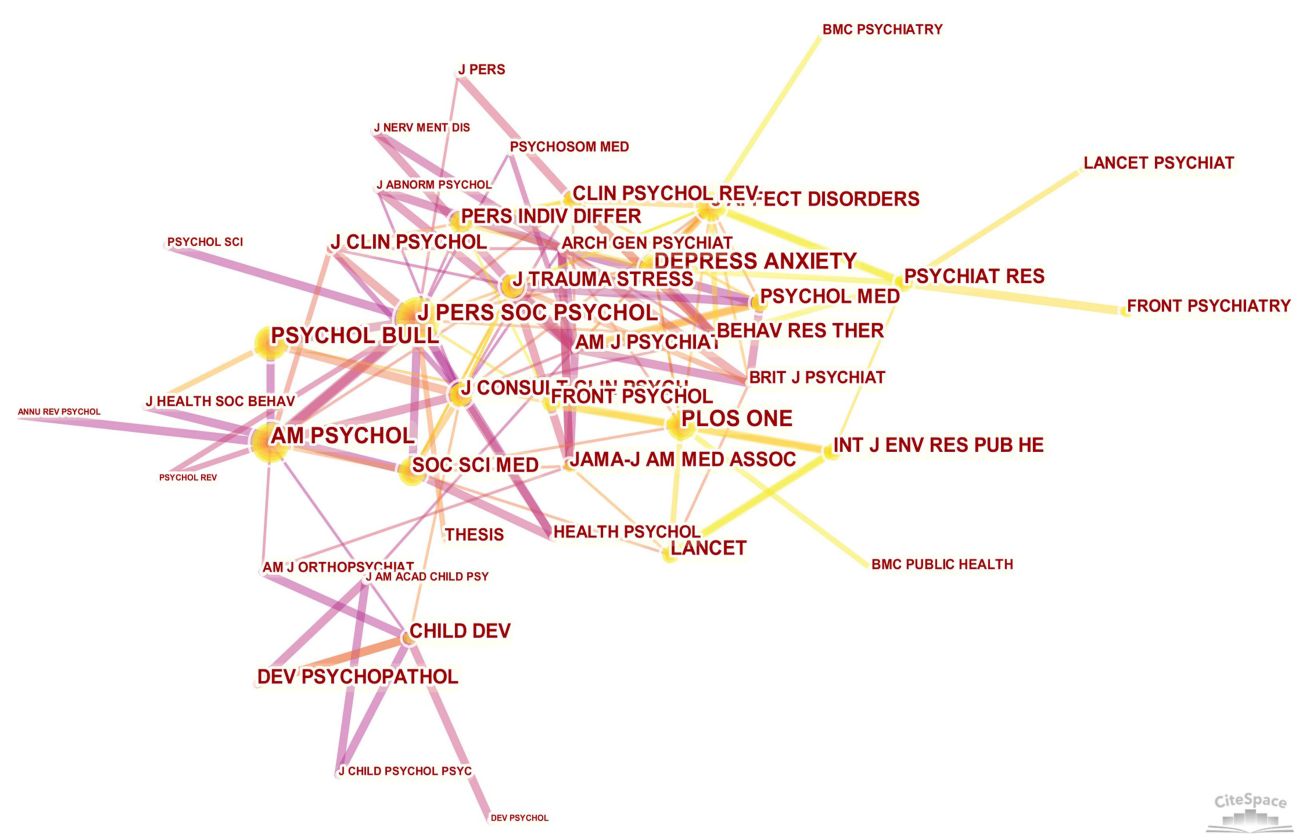


Figure 5 The knowledge map of cited journals network.

222.15, followed by *Psychiat Res* and *Thesis*, which are 207.52 and 141.55, respectively. The journals with high citation frequency and high centrality were *J Pers Soc Psychol* and *Am Psychol*.

Research Trends of Psychological Resilience

Analysis of Important Keywords

Keywords are the concentration of the topic of one paper, and the frequency of their occurrence in a certain field can reflect the hot spots.²⁶ Figure 6 shows the knowledge map of keyword distribution network, with 113 nodes, 119 lines

Table 4 Cited Journals Distribution

Journals	Count	Journals	Centrality	Journals	Burst
<i>J Pers Soc Psychol</i>	2876	<i>J Pers Soc Psychol</i>	0.32	<i>Int J Env Res Pub He</i>	222.15
<i>Am Psychol</i>	2588	<i>Am Psychol</i>	0.23	<i>Psychiat Res</i>	207.52
<i>Psychol Bull</i>	2044	<i>PLos One</i>	0.2	<i>Thesis</i>	141.55
<i>PLos One</i>	1983	<i>J Affect Disorders</i>	0.14	<i>Arch Gen Psychiat</i>	141.48
<i>Depress Anxiety</i>	1677	<i>Psychol Bull</i>	0.11	<i>Lancet</i>	102.56
<i>J Affect Disorders</i>	1430	<i>J Consult Clin Psych</i>	0.1	<i>Health Psychol</i>	84.38
<i>Pers Indiv Differ</i>	1364	<i>J Trauma Stress</i>	0.06	<i>Am J Psychiat</i>	76.68
<i>J Trauma Stress</i>	1207	<i>Am J Psychiat</i>	0.05	<i>Dev Psychopathol</i>	65.48
<i>Soc Sci Med</i>	1171	<i>Soc Sci Med</i>	0.04	<i>Psychosom Med</i>	61.53
<i>J Consult Clin Psych</i>	1103	<i>Psychol Med</i>	0.04	<i>Brit J Psychiat</i>	54.69

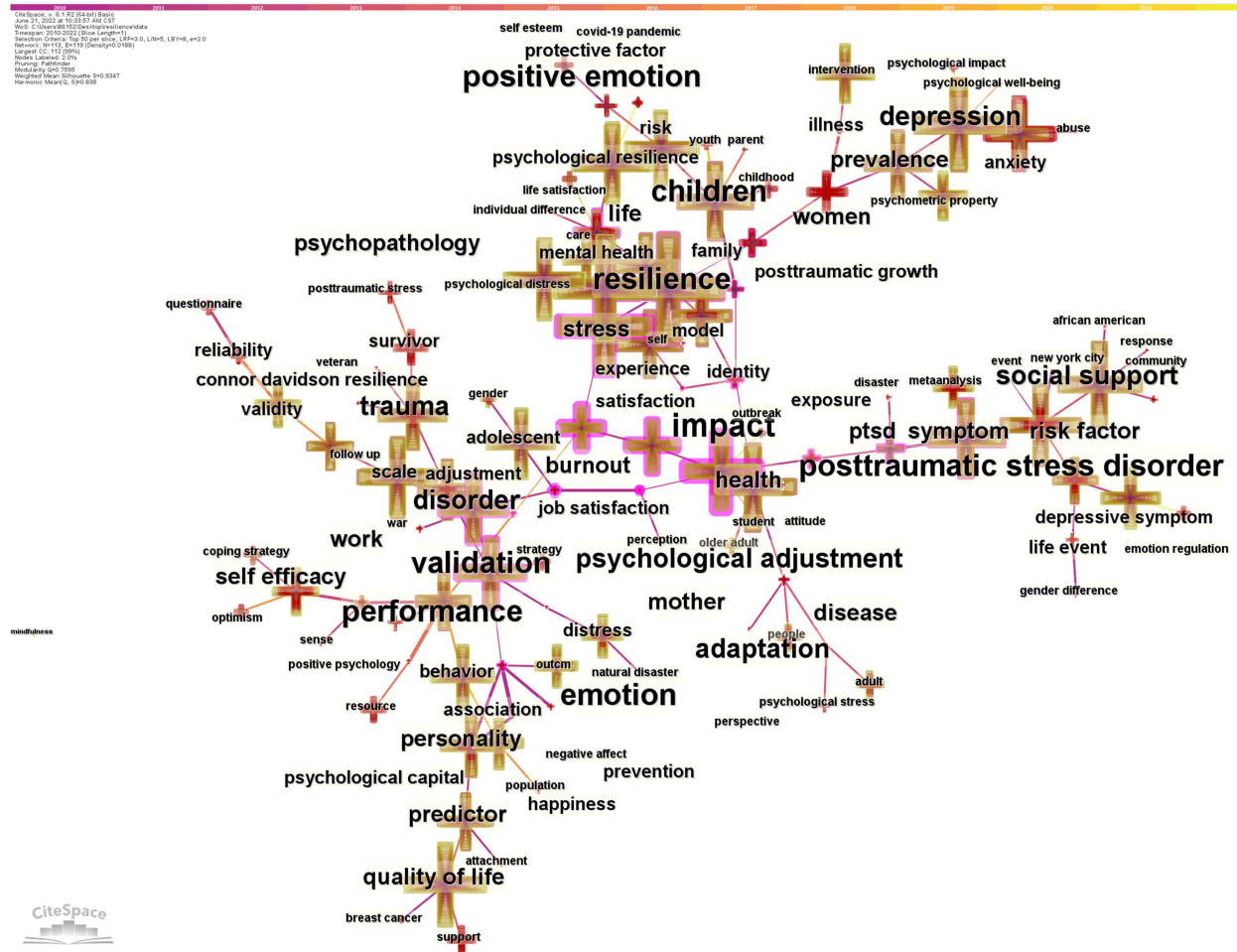


Figure 6 The knowledge map of keyword distribution network.

and a density of 0.0188. Table 5 lists the top 10 keywords in terms of frequency and centrality. The top three keywords in terms of frequency are resilience, mental health, and depression, with frequency of 1925, 1631 and 1180, respectively. The top three keywords in terms of centrality are impact, burnout, and satisfaction, with centrality of 1.22, 1.17 and 0.99, respectively.

Analysis of Research Topic

To further understand the theme of psychological resilience research in recent years, clustering analysis of keywords can be carried out based on the knowledge map of keyword distribution network to obtain the knowledge map of keyword

Table 5 Keywords Distribution

Keywords	Count	Keywords	Centrality
Resilience	1925	Impact	1.22
Mental health	1631	Burnout	1.17
Depression	1180	Satisfaction	0.99
Stress	1154	Stress	0.97
Health	974	Mother	0.82
Psychological resilience	782	Psychopathology	0.8
Social support	740	Disorder	0.77
Scale	737	Resilience	0.69
Quality of life	737	Validation	0.63
Impact	686	Psychological adjustment	0.51

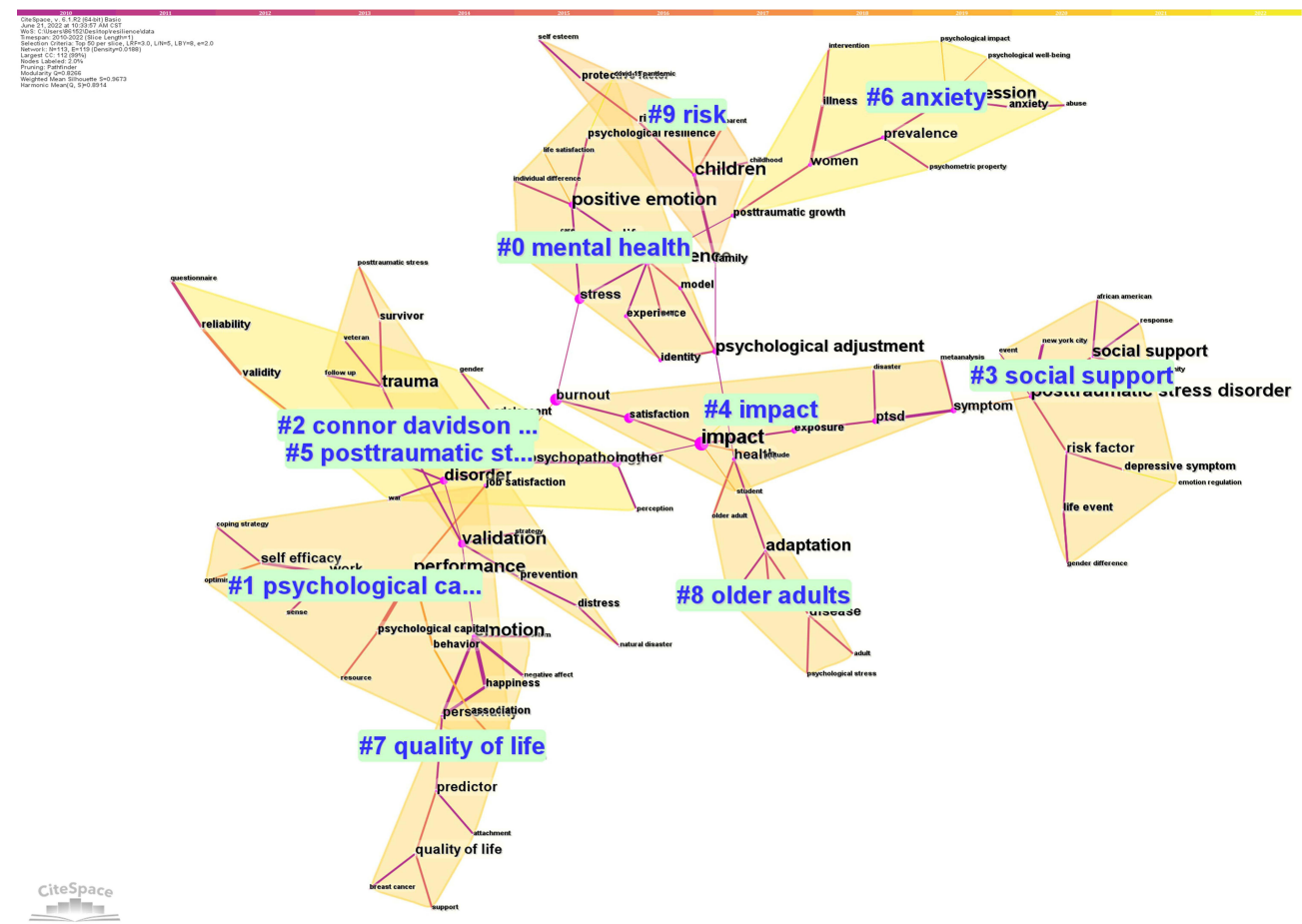


Figure 7 The knowledge map of keyword clustering.

cluster. As shown in Figure 7, the Modularity (Q value) of keyword clustering knowledge map is 0.8266 and Mean Silhouette (S value) is 0.9673, indicating that the cluster has a good effect and can provide a reliable reference for the study of psychological resilience.²⁷ The results show that there are 10 key word clusters, the top three cluster labels are mental Health (Cluster 0), Psychological Capital (Cluster 1), Connor Davidson Resilience (Cluster 2), specific cluster information can be seen in Table 6.

Table 6 Keywords Cluster Information

Cluster ID	Size	Silhouette	Mean(Year)	Label (LLR)
0	16	0.918	2011	Mental health; psychological distress; psychological resilience; experience; transgender
1	13	1	2012	Psychological capital; self-efficacy; motivation; organizational resilience
2	12	1	2011	Connor davidson resilience; scale; young adults; disorder; sense of danger
3	12	1	2011	Social support; posttraumatic stress disorder; risk factors; veterans; risk factor
4	11	0.896	2013	Impact; meta-analysis; satisfaction; psychological capital; symptom
5	11	0.967	2010	Posttraumatic stress; trauma; meaning-making; distress; nepal
6	11	0.938	2012	Anxiety; depression; covid-19; child sexual abuse; people
7	10	0.983	2010	Quality of life; personality; psychological functioning; breast cancer; covid-19
8	8	1	2012	Older adults; health; older adult; mental health; dementia
9	8	1	2011	Risk; children; adolescence; protective factors; family

Top 30 Keywords with the Strongest Citation Bursts

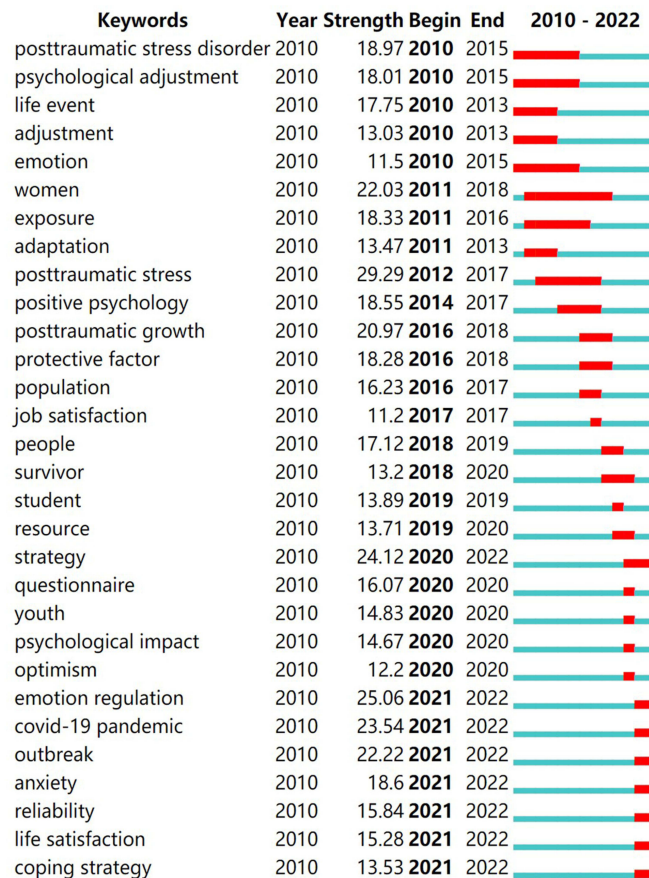


Figure 8 The keywords with the strongest citation burst.

Analysis of Research Frontier

Frontier exploration is helpful for researchers to grasp the development trend and research direction of a certain field more accurately, while burst keywords have their own year attribute can clearly present the frontier hot spots of academic research in corresponding years.²⁷ The burst keywords can be obtained by using the burst word analysis function of CiteSpace. Through analysis, a total of 30 burst keywords were obtained, and the specific results can be seen in [Figure 8](#).

Discussion

Research Trend and Contribution Distribution

The research on psychological resilience had attracted more and more attention, especially since 2019. The reason may be that the outbreak of COVID-19 at the end of 2019 had brought a huge psychological impact on the whole social group.^{28–30} Psychological resilience, as a protective factor of individual physical and mental health, has important research value.^{31–34}

Developed countries in Europe and America had published most of the studies on psychological resilience, which has a high centrality and an important influence. Among them, the United States was the most prominent, especially Harvard Univ, Univ Washington, Yale Univ, Univ Michigan and other institutions in the United States. Some developing countries, such as China and Israel, had also published many literatures, but their centrality was low. In addition, in the lists of the top 10 institutions, there were no institutions belonging to them, this indicated that their international influence was low and still needs to be improved.

Cooperation Analysis of Country, Institution and Author

The results show that the cooperation among countries and institutions were relatively close, but the density of author's cooperation network was low, in addition, there was no large-scale and closely linked cooperative group in the network, which indicating that the cooperation among authors was relatively weak. By careful observation, we found an relatively obvious author cooperation group in the network, this group was composed of George A Bonanno from Columbia University, Yohanan Eshel from University of Haifa in Israel, and Shaul Kimhi from Tel Hai Tel Hai College in Israel, etc, the research topics of this cooperative group mainly focus on stress, trauma, and the application of psychological resilience during the COVID-19 pandemic.^{32,35-37} In the future, more cross-institutional and interdisciplinary author collaborations are needed to further promote the development of psychological resilience research.

Analysis of Key Researchers

The most prolific authors was Robert H Pietrzak from the Department of Veterans Affairs National Center for PTSD, most of his psychological resilience-related studies were related to PTSD in veterans.^{38,39} Through further analysis of the top 10 authors in terms of publication, we found that their research objects related to psychological resilience were mostly veterans, sports athletes, military personnel, medical personnel, the elderly and other special groups, and their research content were mostly about the role of psychological resilience in coping with adversity, difficulties, and trauma.⁴⁰⁻⁴³

The most frequently cited author was Connor KM from Duke University, who compiled the Connor-Davidson resilience scale (CD-RISC).⁴⁴ This scale can be used as a measure to evaluate individual resilience and had been widely used by researchers around the world. Bonanno GA from Columbia University took the second place. His research fully explained the relationship between psychological resilience and potential traumatic events, studied the formation mechanism, individual differences, and influencing factors of psychological resilience.⁴⁵⁻⁴⁸ Masten AS from the University of Minnesota also played an important role. His research mainly focused on the development of psychological resilience in children and adolescents with special experiences such AS abuse, disaster, war, and terrorism.⁴⁹⁻⁵² Their research results have been widely used for reference by foreign researchers around the world, which has provided great impetus for the development of psychological resilience research.

Analysis of Important Journals

Journal of Personality and Social Psychology is a professional journal of psychology; it had published many highly cited articles on psychological resilience, which have an important influence in this field. In 2002, Bonanno GA from Columbia University published an article entitled "Resilience to Loss and Chronic grief: a prospective study from preloss to 18-months postloss" in this journal had been cited more than 120 times.⁵³ In 2006, Anthony D Ong from the University of Notre Dame published an article entitled "Psychological resilience, positive emotions, and successful adaptation to stress in later life" in this journal had been cited more than 210 times.⁵⁴ Michele M Tugade from Boston College published an article entitled 'Resilient individuals use positive emotions to bounce back from negative emotional experiences' in this journal had been cited more than 360 times.⁵⁵ *Am Psychol* was also an influential journal in the field of psychological resilience, A S Masten from University of Minnesota published an article entitled 'Ordinary magic. Resilience processes in development' in this journal had been cited more than 680 times,⁵⁶ so far, the journal had published many highly cited articles on psychological resilience.^{57,58} Other important journals can be found in [Table 4](#) or [Figure 5](#), the larger the nodes of the journals in [Figure 5](#) are, the greater their influence will be. Subsequent studies can refer to the psychological resilience-related articles published by these journals.

Distribution of Keywords

It is not difficult to conclude from the knowledge map of keyword distribution network that the network is generally centralized, but there are also many branches, which indicating that the research on psychological resilience had extended many sub-directions. Among them, the main research areas include mental health, depression, stress, health, social support, scale, quality of life, impact, etc. In the visualization network map, the larger nodes are the keywords that occur more frequently, such as resilience, mental health, depression, etc, while the purple nodes around the nodes are the

keywords with high centrality, such as impact, burnout, satisfaction, etc. To some extent, these keywords of high frequency or centrality represent the hot issues in the field of psychological resilience from 2010 to 2022, but what research hotspots and frontiers they can represent still need to be further demonstrated.

Analysis of Research Hotspots

Through the analysis, we concluded five hot research directions of psychological resilience in recent years:

1. Study on psychological resilience related to COVID-19 pandemic.
2. Influencing factors of psychological resilience.
3. Psychological resilience related to PTSD.
4. Study on psychological resilience of special population.
5. Molecular biology and genetic basis of psychological resilience.

Study on Psychological Resilience Related to COVID-19 Pandemic

The global public health crisis caused by COVID-19 had lasted longer than many of us expected, the COVID-19 pandemic was a direct threat to global mental health, both through disruption of social living environments and the neuropsychiatric sequelae of SARS-CoV-2 infection.⁵⁹ Psychological resilience is an individual's ability to cope with life adversity, trauma, tragedy, threat or other major life stress, it can play an important role in mitigating the impact of the COVID-19 pandemic on people's mental health; therefore, more and more researchers introduced COVID-19 into the study of psychological resilience.⁶⁰ Some vulnerable groups, such as people with mental illness, people diagnosed with COVID-19, health care workers, children and adolescents, pregnant women and the elderly were the main subjects of research by psychological resilience researchers.^{61,62} With the continuation of the COVID-19 pandemic, more and more research on psychological resilience will be carried out gradually, and the research in this area will continue for a long time.

Influencing Factors of Psychological Resilience

In recent years, the influencing factors of psychological resilience studied by researchers mainly include self-efficacy, psychological distress, stress, depression, anxiety, emotion regulation, etc, and more and more factors have been proved to be closely related to psychological resilience. Through the investigation of 223 AIDS patients, Wen et al found that improving self-esteem, self-efficacy and social support can enhance the psychological resilience of patients.⁶³ Zaman et al conducted a survey of 160 burn survivors aged 18–78 years and found a significant negative relationship between psychological resilience and stress.⁶⁴ A study conducted by Poole et al on people with adverse childhood experiences (ACE) showed that psychological resilience moderated the association between ACE and depression, and the association between ACE and depression was stronger in individuals with low levels of psychological resilience than in those with high levels of psychological resilience.⁶⁵ This kind of research can further enrich the foundation of psychological resilience and pave the way for the applied research of psychological resilience.

Psychological Resilience Related to Post-Traumatic Stress Disorder (PTSD)

PTSD had always been one of the hot spots in the field of psychological resilience research. Previous studies mostly focused on the post-disaster or post-war population. Due to the COVID-19 pandemic, the role of psychological resilience in coping with PTSD caused by the COVID-19 pandemic was a new research direction. Since health care workers are more likely to suffer from depression, anxiety and PTSD during the COVID-19 pandemic, they have become the main subjects of study in this research topic.⁶⁶ According to Hines SE's research, focusing on improving workplace support and reducing workplace stress may protect medical staff from adverse emotional effects, thereby reducing the occurrence of PTSD.⁶⁷ Carmassi et al found that factors such as reduced exposure levels, years of work experience, social and job support can enhance psychological resilience and reduce the risk of adverse mental health outcomes among healthcare workers facing the current COVID-19 pandemic.⁶⁸ Weiner et al pointed out that the COVID-19 epidemic had a serious impact on the mental health of health care workers, and online cognitive behavioral therapy (CBT) could effectively treat

and prevent stress-related disorders in health care workers.⁶⁹ As the COVID-19 epidemic continues, the research on psychological resilience in this field will be gradually in-depth in the future.

Study on Psychological Resilience of Special Population

In recent years, the population of psychological resilience research mainly includes medical staff, adolescents, military personnel, and patients with special diseases, such as trauma, multiple sclerosis, depression, oral cancer and so on. Most of the important literatures had pointed out the importance of psychological resilience, which is a positive psychological quality that individuals need to cope with stress and improve their mental health. Chinawa et al's study shown that the COVID-19 pandemic had caused a heavy burden of psychological pressure on adolescents, social support and psychological resilience can help reduce the level of anxiety and depression symptoms.⁷⁰ A study of 230 oral cancer patients organized by Gao et al found that higher levels of hope, optimism and education may improve the psychological resilience of oral cancer patients, which in turn may help relieve anxiety symptoms of patients.⁷¹ Thompson et al emphasized that psychological resilience training for active-duty soldiers was a convincing and necessary approach to help prevent the harmful effects of trauma on mental health.⁷²

Molecular Biology and Genetic Basis of Psychological Resilience

With the continuous expansion of the psychological resilience research, more and more researchers have tried to study psychological resilience from the perspective of molecular biology and genetics, to find the biological basis that may be related to psychological resilience. Hormones, neuropeptides, neurotransmitters and neural circuits are all important directions of psychological resilience research.⁷³ Through a study of 28 post-traumatic patients, van Rooij et al found that bilateral hippocampal region of interest (ROI) activation was positively correlated with psychological resilience, and hippocampal-dependent situational processing could be used as a mechanism of psychological resilience to cope with PTSD risk.⁷⁴ Vlasova et al analyzed the diffusion-weighted magnetic resonance imaging data of 70 elderly people with major depression and found that the structural integrity of a major white matter pathway involved in cognitive control and emotion regulation, namely connecting the prefrontal cortex, is associated with psychological resilience.⁷⁵ Fischer AS's study found that adolescents with high levels of psychological resilience showed a greater degree of activation in the middle frontal gyrus.⁷⁶ In the future, as the biological basis of psychological resilience gradually identified, research on the corresponding biological treatment of psychological resilience may be gradually carried out.⁷⁷

Analysis of Research Frontier

The analysis results of burst keywords show that keywords with strong burst from 2019 to 2022 mainly include emotion regulation, COVID-19 pandemic, outbreak, anxiety, reliability, life satisfaction, coping strategy, student, resource, strategy, questionnaire, psychological impact, and optimism. These keywords represent important research frontiers in psychological resilience research between 2019 and 2022. Burst keywords with longer duration of emergence include women, posttraumatic stress disorder, psychological adjustment, emotion, exposure, posttraumatic stress, life event and so on. These burst keywords represent the research frontier of psychological resilience in recent years.

We also tried to discuss the research frontier, but after reading a lot of literature, we found that these new research directions were relatively loose, the research on a certain keyword may involve different backgrounds and populations, and there is no relatively concentrated research topic and classic papers. Even so, researchers can still combine their research directions and choose the direction that may be suitable for them to carry out research.

Limitation

We used data from Web of Science for bibliometric analysis, and there are other publicly and commercially available bibliometric databases such as Scopus, Medline, and PubMed. However, this database was chosen for a number of reasons, for example, PubMed records do not include information on cited literature, so it is not possible to use PubMed for citation analysis. In addition, this study only uses one econometric analysis tool, and future studies can use different analysis tools to analyze more data.

Conclusion

Through bibliometric analysis of the research on psychological resilience, this study objectively understood the core research strength in the field of psychological resilience through the analysis of big data, which provided a basis for seeking better cooperation among authors in the future. In addition, this study also captured the research trends and hot spots of psychological resilience in recent years, which may point out the direction for subsequent relevant research. This study shows that the research on psychological resilience is very popular, and there are many high-impact researchers, institutions or journals, but the cooperation among researchers in this field still needs to be further improved. In addition, the hot research topics include five aspects: study on psychological resilience related to COVID-19 pandemic, influencing factors of psychological resilience, psychological resilience related to PTSD, study on psychological resilience of special population, and the molecular biology and genetic basis of psychological resilience. Future research can combine the above hotspots and the results of burst keywords analysis to carry out more meaningful research directions. For example, in the context of the current COVID-19 epidemic, more basic research related to psychological resilience should be carried out, such as the update of evaluation scale and intervention measure.

Data Sharing Statement

All data generated or analyzed during this study are included in this published article.

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Disclosure

The authors report no conflicts of interest in this work.

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