Research article

The development and evolution of the research topic on the mental health of college students: A bibliometric review based on CiteSpace and VOSviewer

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ARTICLE INFO	ABSTRACT
	Background: With the advances in society and in response to changing times, college students have had to face multiple challenges. These challenges frequently affect the mental health of college students, leading to significant consequences for their social lives, personal well-being, and academic achievements, thereby attracting extensive societal attention. Therefore, examining the current status of research topics related to the mental health of college students can assist academia in dissecting the influencing factors and seeking solutions at their source or through early intervention. This can contribute to a better understanding of and effectively address this challenge. *Method:* CiteSpace and VOSviewer were used to conduct a bibliometric analysis of 1609 journal articles indexed in the Web of Science (WoS) database over the past two decades (2000–2022), which helped identify the current state of research and hot topics in the field based on development trends. Furthermore, this study analyzes and discusses the core authors, high-productivity countries and organizations, key journals, and keyword clustering in this field. This study clarifies the current research landscape, analyzes evolving trends based on developmental trajectories, and identifies forefront research hotspots. This study provides scholars with reference research directions and ideas for conducting subsequent studies. *Results:* Since the beginning of the 21st century, research on college students' mental health has increased, especially in the past three years, and due to the impact of the COVID-19 pandemic and online distance learning, the number of publications has increased rapidly. With the increase in attention and publication volume, the countries and organizations contributing papers as well as core journals have all started to take shape. Cluster and evolution analyses found that several stable research topics have been formed in this research field, and many new and diverse topics are continuously emerging with time. *Conclusion:* and prospect: The findings prove that the field of college students' mental health has begun to take shape, gradually shifting from conceptual research to the implementation of specific interventions. However, whether specific interventions are effective and how effective they are require further investigation.

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1. Introduction

Mental health is a ubiquitous concept comprised of multiple dimensions [1–3], and psychological well-being is a dynamic state of internal balance, which implies that individuals can use their abilities correctly and reasonably and have universal social values. Therefore, numerous specific elements contribute to achieving internal balance to different degrees, with physical and mental harmony being the most important aspects. Affected by drastic changes in social background, mental health problems are increasingly appearing in the lives of ordinary people, especially adolescents, and have attracted the attention of many scholars in recent years [4–6].

Many governments and international organizations have attempted to address college students' mental health issues. At the end of 2019, the National Health Commission of the People's Republic of China[1] issued the *Healthy China Action Plan for Children and Adolescents' Mental Health (2019–2022)* to guide subordinate institutions in promoting the mental health of children and adolescents. After the onset of the COVID-19 pandemic, the American College Health Association (ACHA) in conjunction with the Healthy Minds Network (HMN) investigated the impact of the pandemic on the mental health of American college students and found that the incidence of depression among college students increased from 35.7 % in autumn 2019 to 40.9 % in spring 2020. The increasing mental health problems of college students catalyzed by the COVID-19 pandemic have also attracted the attention of the World Health Organization (WHO), which found that college students have higher levels of anxiety and depressive symptoms than general workers against the backdrop of the pandemic [7]. Undoubtedly, this new era and social background bring new research value to college students' mental health problems.

Owing to the general attention of academic circles to the psychological problems of college students, current research on this issue has accumulated fruitful results thus far and has had corresponding research in different directions, including but not limited to psychological quality education [8], therapeutic intervention [9], and research on college students' mental health in the context of the pandemic [10–12]. Despite the academic community's recognition of the significance of college students' mental health, key issues, such as the focal points of existing research findings and the overall progress of this topic, remain unclear. Researchers may face challenges in effectively conducting studies on college students' mental health issues when they lack a clear understanding of the overview of the research, the current research status, and the evolving dynamics in this field. Therefore, this study adopts a bibliometric method to quantify the number of articles published in this field, key journals, and key organizations at home and abroad. Based on the data analysis, this study systematically sorts, compares, and analyzes related research on college students' mental health from 2000 to 2022, grasps the research status, evolution trend, and core issues in this field from a global perspective, and summarizes the existing problems in the current research. The research contributes outstandingly to this field by highlighting the development direction for future research, and consequently providing theoretical as well as practical guidance and support for intensifying the research on this topic, in addition to promoting the popularization and application of existing research results. In summary, this study addresses the following three issues:

1. Analyze the research status of college students' mental health from the perspectives of publication trends, journals, countries, organizations, etc., from 2000 to 2022.
2. Use cluster analysis and evolution analysis to analyze the core hotspots and development status of college students' mental health research from 2000 to 2022.
3. Discuss the development trends and possible future agendas on the topic of college students' mental health based on their comprehension of the current research and development process.

1.1. Literature review

Since 2000, college student populations worldwide have faced myriad challenges in response to changing times. The severity of mental health issues among college students has been on the rise, and help-seeking behaviors have also increased gradually [5,6, 13–16]. The importance of college students' mental health has been increasingly emphasized, drawing widespread societal attention. Some researchers have referred to this trend as a "mental health crisis" emerging in higher education [17,18]. With the emergence of this research trend, scholars have begun to recognize the commonalities and distinct characteristics of college student populations. These unique characteristics are the precise reason that the factors influencing mental health become more complex, outward behaviors exhibit greater diversity [19–22], and research encompasses a wide range of areas. Consequently, college students' mental health has become a field of high research value.

Once college students experience mental health issues, a cascade of related problems ensues, often accompanied by observable external behaviors. For instance, factors such as class attendance, participation, and homework completion tend to decrease [23,24]. Scholars such as Eisenberg have explicitly pointed out that college students' mental health problems can lead to lower GPAs, signifying academic struggles [25]. Furthermore, this can result in derivative issues such as insomnia [26–28] and Internet addiction [29,30]. Each of these derivative problems has prompted scholars to conduct a series of studies, with a focus on sleep quality as a representative

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[1] National Health Commission of the People's Republic of China. Notice on printing and distributing the healthy China action plan for children and adolescents' mental health (2019–2022). 2019 Dec 26 [cited 6 October 2022]. Available from:http://www.nhc.gov.cn/jkj/tggg1/201912/6c810a8141374adfb3a16a6d919c0dd7.shtml.

example and mainly focusing on three aspects: factors resulting in insomnia [26,27], the extent to which it affects mental health [28], and how it can be used as an intervention [24]. Such studies have demonstrated that sleep quality is strongly associated with mental health and could be improved through meditation [31,32], mindfulness [20], and other activities that could be used as intervention methods to help improve sleep quality and thus reduce students' psychological distress.

Although some scholars believe that higher education provides good opportunities and conditions for promoting mental health among young people (it provides a single integrated environment that includes academic, professional, social activities, health services, and other supporting services) [15,33]. However, most college students with mental health problems and low levels of well-being do not receive treatment during their higher education [6,34] and are influenced by various factors [35–37]; therefore, the implementation of college students receiving treatment or psychological counseling is not optimistic. Although studies have also revealed a gradual increase in the overall need and willingness of college students to seek mental health services [5], cultural differences, cognitive biases, and other factors have caused the development of mental health services to be restricted to a certain extent [38].

Meanwhile, the current development is accompanied by many challenges, such as the popularization of the Internet, the prosperity of smartphones, and the emergence of social software replacing sports activities, face-to-face communication, and social activities [37–39]. This change is also responsible for college students' proclivity to online gambling, all leading to Internet addiction among college students [29,30,40].

Additionally, the isolation resulting from the COVID-19 outbreak has exacerbated mental health issues among college students [41]. In response to the spread of the COVID-19 pandemic, many institutions have adopted major policies such as social distancing and movement restrictions, and all educational institutions have been closed for an extended period [42]. Moreover, the shift from offline learning to prolonged online learning brings in a lot of stress and anxiety, all of which have a serious impact on the mental health of college students. Through interviews and surveys, scholars found that college students, in the context of the COVID-19 pandemic, were experiencing psychological problems such as anxiety, depression, and fear [43]. This is exacerbated by the reported increase in stress and anxiety because of the COVID-19 outbreak in 71 % of the students [44], with their life satisfaction continuously declining [45]. They also displayed high tendencies toward drug abuse, self-harming behavior, and ideation [46]. With the arrival of the post-pandemic era, college students have returned to school, and their collective mental health has received attention from scholars. Xue et al. [47] found that college students returning to school had a sense of alienation regarding physical education, school happiness, and expectations of future healthy living.

In summary, college students' psychological health problems have become a high-profile, high-value research field, and the numerous influencing factors of college students' mental health cover a vast scope. Researchers or educators in colleges and universities need to be additionally careful and meticulous when treating this subject, as well as conducting research in actual scenes with targeted questions and specific objects. Conducting an analysis of the current status and evolving research trends on this topic serves several purposes. First, it will help to better understand and address this challenge at a time when college students' mental health has garnered widespread societal attention. Second, considering the sequential and extensive nature of the research on college students' mental health, this study provides scholars with valuable research directions and conceptual guidance for future studies. Third, this study can serve as a starting point for subsequent studies, bridging knowledge gaps for new researchers in this field. Based on the fact that this research field is constantly updated and iterated with the development of the times, this study needs to accurately grasp the development and evolution processes, as well as research hotspots, and predict future research through bibliometric methods under the current background.

2. Methodology and materials

2.1. Research method

A bibliometric method has been adopted in this paper. Literature research methods refer to the quantitative analysis of the measurement data in the literature [48] and can also produce qualitative statements about scientific activities [49]. As a major advantage of bibliometrics, such analyses also tend to apply statistical tools to evaluate the research results of individuals, organizations, and countries [50] to obtain information about the current state of research in a particular field; thus they can help researchers find and pursue new research directions swiftly, accurately, and effortlessly [51]. Therefore, the development of a field can be analyzed using bibliometric analysis [52]. The utilization of modern computer technology, graphics, and visual effects can complement literature analysis; for example, Ma and Xi [53] emphasized that the visualization method of co-citation analysis in bibliometrics was helpful for data interpretation and accordingly made the results more comprehensive. Furthermore, in the context of research related to "college students' mental health," visualizing additional information such as authors, keywords, institutions, and countries can help uncover and present the inherent connections between information, thereby gaining access to more potential insights.

2.2. Search strategies

The Web of Science Core Collection (WOSCC) dataset was chosen to use for the bibliometric analysis for several reasons. Firstly, WoSCC is a high-quality public digital literature resource database covering many different fields [54]. Meanwhile, college student mental health is a multidisciplinary field that includes several disciplines such as psychology, education, and medicine. Therefore, the use of comprehensive databases to ensure that thorough analyses are conducted is essential. Secondly, compared to other databases, WoSCC contains comprehensive literature information and provides more suitable data for VOSviewer and CiteSpace analyses [55,

56]. Because the dataset downloaded from the WOSCC database contains the cited references, while a citation report is provided as a validation tool to ensure the accuracy and credibility of the results obtained from the bibliometric analyses [57,58]. Third, the datasets obtained from WOSCC could be directly analyzed using mainstream bibliometric software without the need for format conversion [58]. This eliminated any potential issues related to data corruption or missing fields, thus ensuring the integrity of this analysis. Last, the WOSCC database encompassed the Science Citation Index Expanded (SCIE) flagship citation index, which guaranteed a high level of quality control for journals and related publications [58,59]. Therefore, using WoSCC as the data source for this study can ensure the quality of the analyzed literature [60,61] and facilitate research operations. To ensure comprehensive and accurate data retrieval, two indexes were selected: the Science Citation Index Expended (SCIE) and the Social Science Citation Index (SSCI). After confirming the sources of research data, specific retrieval strategies should be selected, which should balance the relationship between the breadth and accuracy of retrieval coverage; that is, covering all the literature on the research topic on the one hand and excluding as much literature unrelated to the research on the other. As the core theme of this study is the mental health of college students, the two core elements of "college students" and "mental health" need to be highlighted. After several attempts, the retrieval strategy in this paper was finally determined as TS = (("mental health" OR "psychological well-being") AND "college students"), with the time span from January 2000 to September 2022, the search time as of September 27, 2022, and the article type as "Articles." A total of 5582 journal articles were retrieved, and the retrieved articles were further screened (the screening process can be seen in the "Inclusion and Exclusion Criteria" section of this paper), and 1609 valid articles were finally obtained.

2.3. Inclusion and Exclusion Criteria

Manual screening of the retrieved articles is important to ensure the reliability and validity of the research. In this study, data screening of the retrieved articles was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [62]. Following the four steps of "retrieval-preliminary screening-inclusion-synthesis," one repetitive article is
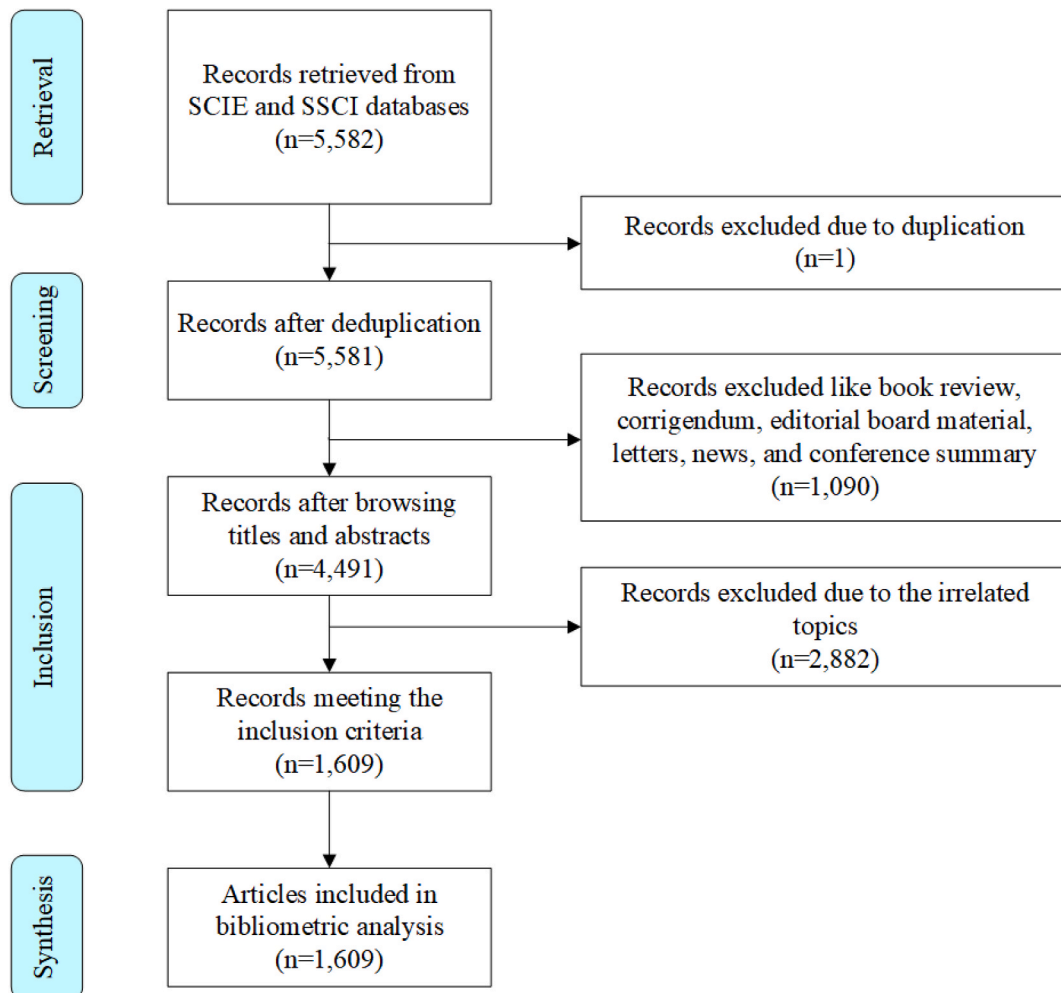

Fig. 1. PRISMA diagram.

deleted first, and 1090 articles belonging to literature types such as book review, correction, editorial board material, letters, news, conference summary, and review of literature are excluded. The remaining articles were browsed manually individually, and articles unrelated to this research topic were excluded to ensure that all the selected articles were centered on the mental health problems of college students.

Before the screening, to reduce the subjectivity of the screening process, three team members worked independently and voted to decide whether to include controversial articles after full consultation. In addition, the team also set standardized screening requirements: First, even if the term "college students" did not appear in the title of the articles, the specific research samples therein were college students, and in case undergraduates, postgraduates, international students, and freshmen appeared, which are all considered to belong to the category of college students [63], then those articles should be included in this paper. Second, terms such as teenagers and emerging adults, whose age span is large and cannot be clearly defined, should be distinguished by a clearly specified age, and the scope that can be included is 18–25 years old [64], while the rest should be excluded. Third, the inclusion criteria for mental health included mental health [65], mental illness [66], and physical and psychological well-being [67], while articles that did not explicitly mention mental health or were not specifically aimed at college students were excluded. After manual screening, 1609 articles were identified as the final research sample. The data filtering process is illustrated in Fig. 1.

3. Results and discussion

3.1. Publication trend

The number of published articles visually represents the development trends of a research topic. Fig. 2 presents the publication trends in college students' mental health research. Overall, the number of articles published on this topic displayed a rapid growth trend over time: from 2000 to 2006, the number of articles was in single digits and then increased to 18 articles in 2007 and 69 articles in 2015. Because of the COVID-19 pandemic, this topic has attracted much attention; therefore, a new growth point of the outbreak appeared in the number of articles published [68], and the annual growth rate was approximately 100 articles in the past three years. This indicates that international attention to the field of college students' mental health is increasing and has become a research hotspot.

3.2. Analysis of the authors

Authors with high yields and citations often represent core strengths in the research field. Fig. 3 presents the relevant information of the top ten authors with the number of articles published in the field of college students' mental health (11 authors are included in this paper because there are four authors with eight articles published). Over the past 22 years, Daniel Eisenberg has been the most influential author in this field, having published 34 articles, primarily on mental health services [35,69] and college students seeking mental health help [6,70] as the first author; however, when cooperating with others, he mainly focused on the influencing factors of college students' suicidal behaviors [71,72]. In addition, each of his articles has been cited 149.74 times on average, playing a foundational role in the early stages of college students' mental health research.
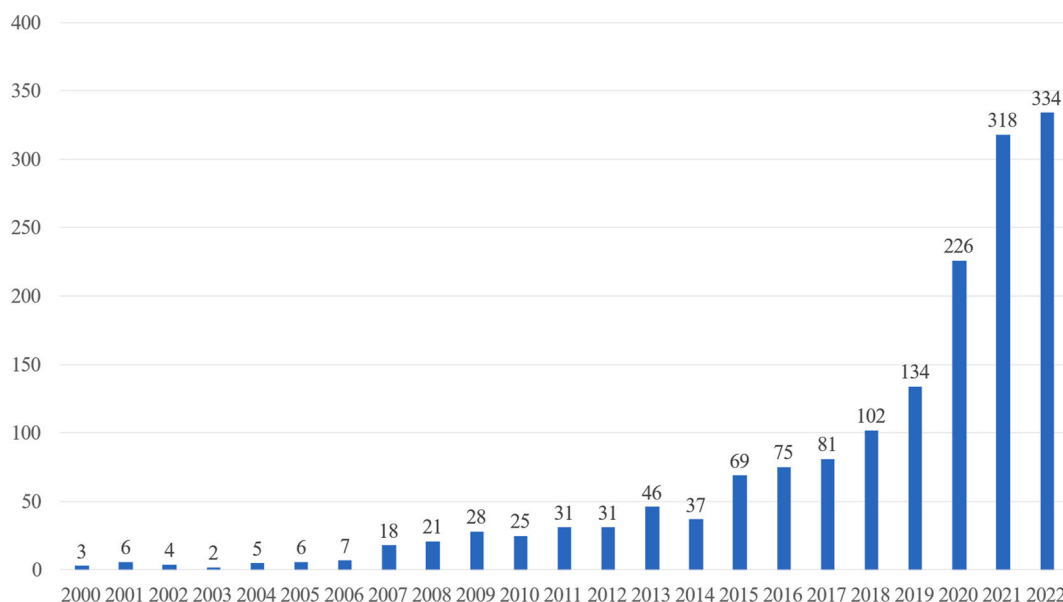

Fig. 2. Publication trend chart in the field of college students' mental health.

3.3. Quantitative analysis of countries and organizations

To identify countries with high contributions to the field of college student mental health, this study analyzed the number of published articles from 77 countries. Fig. 4 lists the top ten countries; accordingly, the United States emerges as the most influential country (1002 articles, 30,208 citations), accounting for 62.23 % of the total. China (489 articles) and South Korea (54 articles) ranked second and third. In addition, Fig. 4 highlights that all listed countries except China are developed countries, which reflects that this research topic is affected by the degree of economic development to a certain extent. Countries with relatively advanced economies would pay more attention to this topic.

To understand the main publishing organizations in the field of college students' mental health, this study lists the top ten publishing organizations. Fig. 5 reveals that the University of Michigan has the most scientific productivity in this field, with a total of 66 articles published, and the average citation rate of its articles is also among the top, reaching 89.32, far more than that of any other organization. In addition, the top 10 organizations are all based in the United States, indicating that American organizations lead the field.

3.4. KeywordsCo-occurrence network

Keywords represent the core and essence of an article. Keyword co-occurrence analysis can help to quickly and accurately discover research hotspots in a scientific field, and slice analysis of years can help understand the specific changes in research hotspots over time. In this study, VOSviewer 1.6.17 (developed by Van Eck and Waltman at the Centre for Science and Technology Studies) was used to draw a collinear network view of keywords from 1609 articles, and 100 emphasized keywords with frequencies greater than or equal to 27 were selected for visualization. The results are depicted in Fig. 6. In Fig. 6, the larger the circle node, the more times the keywords appear and the more they can represent research hotspots. The line of nodes represents the strength of the association; the thicker the line, the more times it appears together in the same article. Node colors represent different clusters, namely, research topics. Fig. 6 reveals the five research themes on the mental health of college students. The five clusters are analyzed one by one as follows:

The blue cluster extensively investigates mental health in higher education and the cognitive aspects of students concerning mental health issues. Within this cluster, research identifies the profound impact of interpersonal relationships and self-protection factors on the mental well-being of college students. It particularly delves into a spectrum of issues arising from the stigma associated with mental health problems. An illustrative study conducted in 2008 examined college students' attitudes toward and utilization of mental health services, revealing a low utilization of psychological counseling due to stereotyped perceptions of mental health [73,74]. However, it's crucial to note that this study primarily focused on surface-level behaviors of college students. Subsequent research delved deeper to uncover the underlying reasons behind these stereotyped cognitions. It was discovered that college students were more likely to harbor stigmatizing attitudes toward mental health issues, driven by feelings of shame, leading them to maintain social distance from individuals with mental illnesses [75,76]. This undesirable situation hampers college students from seeking necessary assistance for mental health issues [77]. Certainly, the challenges highlighted in this phenomenon warrant the attention of academia and relevant institutions. Assisting college students in establishing a correct understanding of mental health problems is an intricate and crucial task. The need to counteract stigmatization and promote a supportive environment for mental health within higher education is evident. Addressing these issues will not only contribute to the well-being of college students but also advance the broader discourse on mental health within academic and institutional contexts.
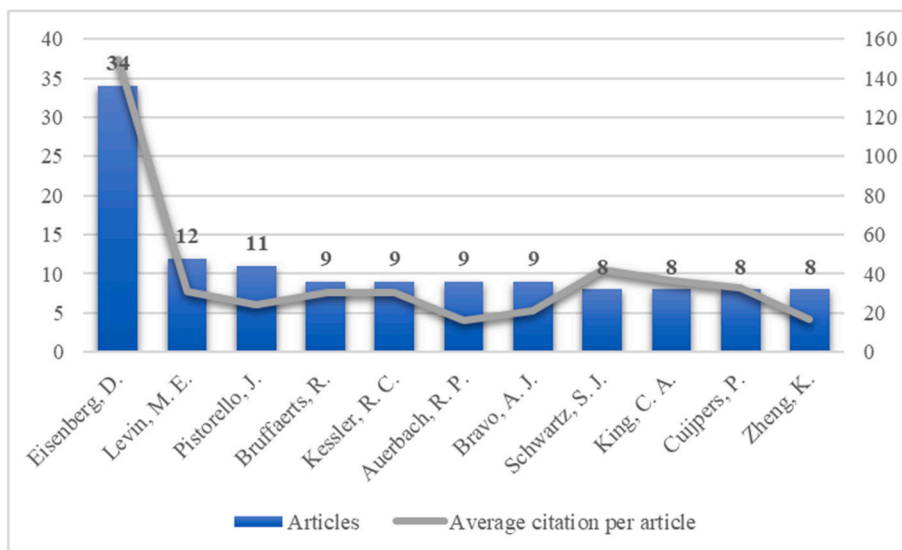

Fig. 3. Relevant quantitative information of core authors in the field of college students' mental health.
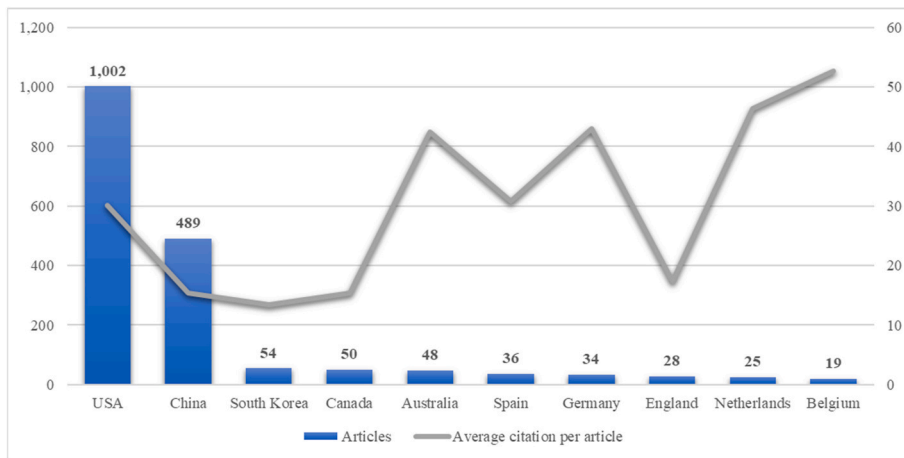
Fig. 4. Major countries with a large publication volume in the field of college students' mental health.
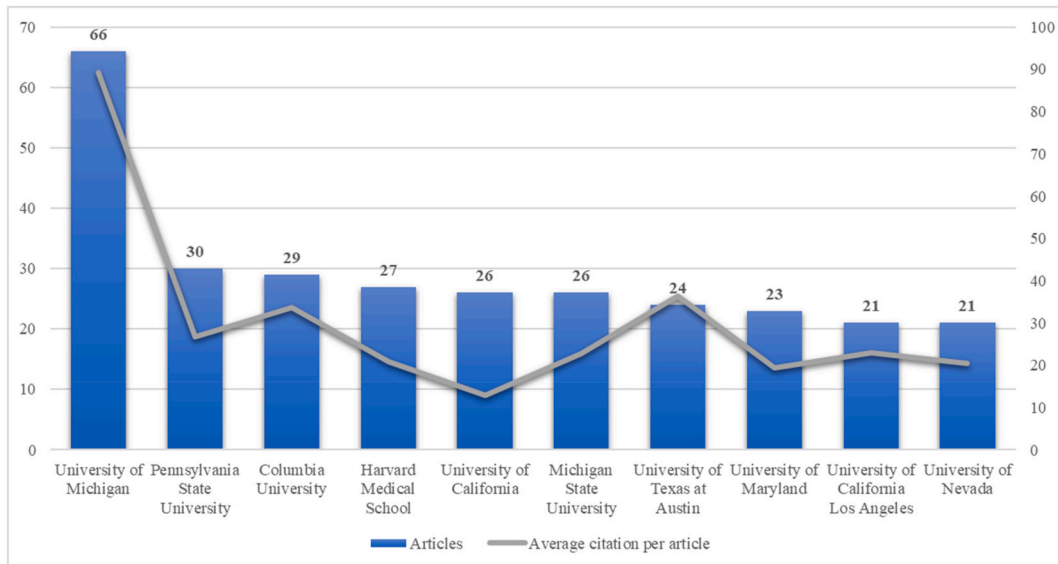

Fig. 5. Major organizations with a large publication volume in the field of college students' mental health.

The red cluster is dedicated to thoroughly investigating the risk factors and distinct manifestations of group mental distress prevalent among college students, a phenomenon that is steadily gaining attention. This distress is frequently associated with severe outcomes such as suicide, depression, mental illness, and various other forms of psychological challenges. Researchers within this cluster have initiated a comprehensive exploration into the intricate dynamics influencing mental health, shedding light on relatively subtle elements that play a significant role. A notable area of focus within the red cluster's research is the examination of academic achievement [35] and its impact on mental health. Scholars are delving into how the pressure and expectations associated with academic performance can contribute to mental distress among college students. Understanding these academic-related stressors is crucial for developing effective interventions and support systems. Furthermore, the red cluster is actively investigating the mental health challenges faced by cisgender sexual minorities in terms of their sexual orientation [4]. By recognizing and addressing the specific stressors and discrimination faced by this demographic, researchers aim to contribute to creating a more inclusive and supportive environment on college campuses. Additionally, the cluster examines the impact of helicopter parenting [78–80] on college students' mental well-being, scrutinizing its potential role in dependency. Understanding the interplay between parenting styles and mental health is vital for targeted interventions. Religiousness [81,82] is another intriguing element under investigation within the red cluster. Scholars are exploring how religious beliefs and practices can both positively and negatively influence the mental health of college students. This holistic approach takes into account the diverse range of factors that contribute to mental distress, allowing for a more nuanced understanding of the complexities involved. In summary, the red cluster is at the forefront of research, examining a diverse array of factors contributing to group mental distress among college students. By delving into academic, sexual orientation,

Fig. 6. Keywords co-occurrence network.

parenting, and religious dimensions, scholars within this cluster aim to provide comprehensive insights that can inform effective interventions and support strategies for the well-being of college students.

The green cluster is dedicated to 'intervention research,' focusing on identifying intervention methods from various perspectives, such as social support, self-efficacy, and resilience. The goal is to reduce the occurrence of mental health problems among college students. Some scholars within this cluster have discovered that metrics like college belonging and social support indirectly forecast mental health status [83–85]. Moreover, the green cluster extensively utilizes concepts such as the need to belong [86,87], self-determination theory [88–90], and other theories as research frameworks [91,92]. These frameworks systematically explore how to foster a sense of belonging among college students to mitigate mental health problems.

In contrast, the yellow cluster revolves around the prevalence of mental stress induced by epidemics, such as COVID-19, and its impact on college students. Drawing from previous reports on SARS outbreaks, it is evident that communicable diseases' outbreaks can have adverse effects on students' mental health [93,94]. COVID-19 is no exception, exerting a global impact on student mental health [95,96]. Within the yellow cluster, there is a detailed discussion of the primary symptoms experienced by college students influenced by the contemporary backdrop, namely depression and anxiety [41,97].

In alignment with the valuable feedback received, we commit to thoroughly enhance the content within both the green and yellow clusters. We will provide a more nuanced analysis, delving into the intricacies of the findings and establishing a robust scholarly discourse. Additionally, we will expand our references to incorporate a diverse range of sources, thereby reinforcing the academic rigor and depth of these sections.

The light-purple cluster, as depicted in Fig. 6, exhibits a scattered distribution. The majority of relevant studies within this cluster focus on correlation factors and intervention methods for addressing mental health issues among college students, with a predominant emphasis on meta-analyses. Delving into specific associated factors and intervention methods, the light-purple cluster centers its attention on four key categories: assessment methods, sleep quality, physical exercise, and activity [98,99]. Noteworthy is the extensive exploration of sleep quality within this cluster. Research on sleep quality and insomnia has unequivocally established the significance of sleep in maintaining the mental health of college students [100,101]. Furthermore, upon detailed analysis of the articles, it becomes evident that research on physical activity has evolved from a broad generalization to more intricate and specific studies. These include investigations into the impact of specific activities such as Baduanjin exercise [102–104], Tai Chi [67,105], and other targeted physical exercises on mental health. The shift towards detailed examinations of specific interventions indicates a departure from mere conceptual discussions. Scholars are now actively seeking concrete and feasible solutions to address the mental health challenges faced by college students. The proposal of such measures reflects a commitment to practical problem-solving,

marking a positive trend within the scholarly discourse on college students' mental health.

3.5. Temporal keyword analysis: Thematic evolution

Because the research topics of college students' mental health are greatly affected by time and there have been many growth points, accurately grasping the research hotspots only by keyword co-occurrence is difficult. To further understand the development and changing trends of research hotspots, a more detailed analysis of keyword evolution in different years of the same interval was conducted in this study.

The transmutation of research topics is a dynamic evolutionary process. To understand the changes in research topics in different periods, this study divided the time span into three periods (2000–2007, 2008–2015, and 2016–2022), and the keyword networks of the three periods were analyzed to understand the evolutionary trajectory of the research topics of college students' mental health over time.

From 2000 to 2007, the body of literature addressing the mental health of college students was relatively modest, signifying the nascent stage of research during this period. The primary focus was on elucidating the relationship between college students and mental health, as depicted in Fig. 7. The key topics encompassed depression [106], college students' attitudes towards mental health problems [107], and strategies for mental health problem adjustment [108]. As the years progressed, there was a discernible shift from mere representation to a more profound exploration and analysis of the internal mechanisms underlying mental health issues. However, it is important to note that the keywords during this period were somewhat limited. This limitation can be attributed to the relatively shallow depth of research and a narrow thematic focus, where numerous aspects of mental health were not comprehensively considered by scholars. The keyword network illustrated in Fig. 7 substantiates this observation. Future research should aim to broaden its scope and delve into previously overlooked facets of college students' mental health. By expanding the thematic spectrum and increasing the depth of investigation, scholars can contribute to a more comprehensive understanding of the complexities involved in mental health issues among college students. This enhanced exploration will not only enrich the scholarly discourse but also pave the way for more nuanced interventions and support systems for this demographic.

Since 2008, there has been a notable increase in the number of keywords, signaling a significant expansion in the scope of articles on college students' mental health. The emergence of new keywords such as scale, anxiety, and seeking mental health help indicates a transition to a new stage in the development of this research area. During this period, the majority of articles concentrated on specific manifestations of mental health problems among college students, as depicted in Fig. 8. This included exploration into depression, anxiety [109], suicide [72], and Internet addiction [29]. In addition to examining external behavioral manifestations, there has been a considerable growth in the exploration of internal influencing factors [110], future intervention methods [72], and other aspects related to mental health. Research conducted by Oswalt et al. [5] substantiates the observation that the severity of mental health problems among college students during this period exhibited a continuous upward trend. Furthermore, there was an increasing willingness among students to seek mental health help and counseling services. These findings suggest a robust momentum in the research on college students' mental health, with emerging themes continually surfacing. This dynamic environment has significantly propelled the development of this field, showcasing an ongoing commitment to understanding and addressing the multifaceted dimensions of mental health issues faced by college students.

Since 2016, there has been a remarkable surge in the number of keywords, as illustrated in Fig. 9. This surge not only signifies the culmination of interest in the topic but also underscores the expanded scope of research content. The landscape of related fields has been covered, and with the increasing number of articles, the research focus has become more diverse and pronounced. Firstly, anxiety and help-seeking have maintained their status as primary research focal points for scholars. Secondly, the examination of information technology characteristics has become increasingly prevalent. Factors such as Internet addiction [30] and smartphone use [39] stand
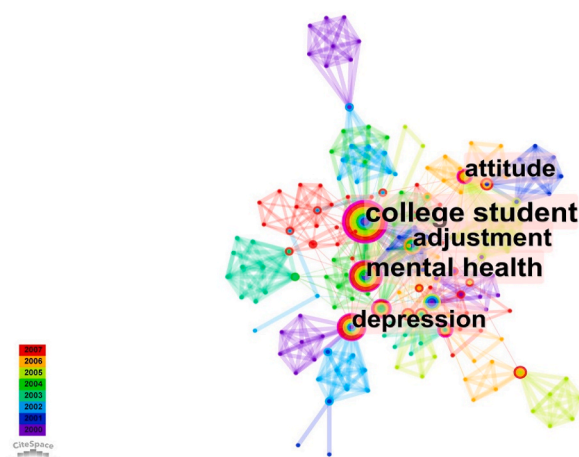

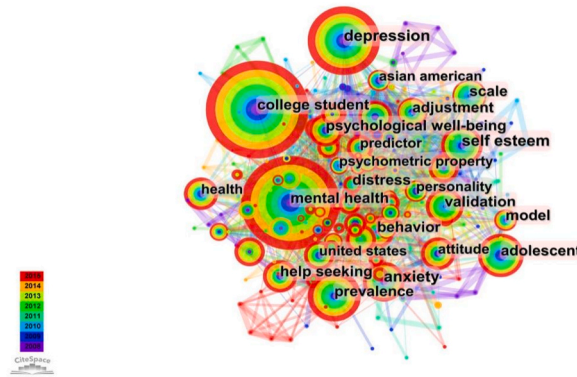**Fig. 7.** Thematic development from 2000 to 2007.

Fig. 8. Thematic development from 2008 to 2015.

out as noteworthy influences on mental health. Concurrently, the impact of informatization extends beyond its effect on college students; it also provides technical support for scholars engaged in research on interventions. Wei and Yan [111], for instance, constructed an evaluation model using big data. Yang et al. [112] combined data analysis with positive psychology, utilizing virtual reality as a method to enhance the mental health of college students. The results indicated a significantly higher happiness index in the treatment group, suggesting the potential of this approach as a novel method for early prevention and intervention of psychological disorders in colleges.

Moreover, the advent of the COVID-19 pandemic has served as a pivotal turning point, ushering in a new era where the factors influencing college students' mental health and the outward behavioral manifestations of psychological issues have become more concrete and complex. Notably, factors influencing mental health have expanded to include crucial aspects such as self-esteem [19], mindfulness [20], and satisfaction [21]. This marks a shift towards a more comprehensive understanding of the multifaceted determinants of mental well-being.

Simultaneously, research on the outward behavioral aspects of psychological issues has become more nuanced and detailed. Scholars are increasingly delving into social perspectives, exploring dimensions such as ethnic identity [22], service utilization [6], community [113], and social support [19]. This expanded scope of inquiry reflects a recognition of the interconnected nature of mental health, extending beyond individual factors to encompass broader social and environmental contexts. The evolving landscape of research post-COVID-19 underscores the necessity of a holistic approach in comprehending and addressing the intricate dynamics of college students' mental health.

3.6. Journals, citation and Co-citation analysis

3.6.1. Journals and citation analysis

Journal articles are the main carriers of literature, and the statistics of journals in this field are carried out in this study. The 1609 articles analyzed in this study are published in 429 journals. Table 1 depicts the top ten journals in terms of the number of articles, indicating that most of the publications are from journals in the field of psychology since the 20th century. As observed in Table 1, the
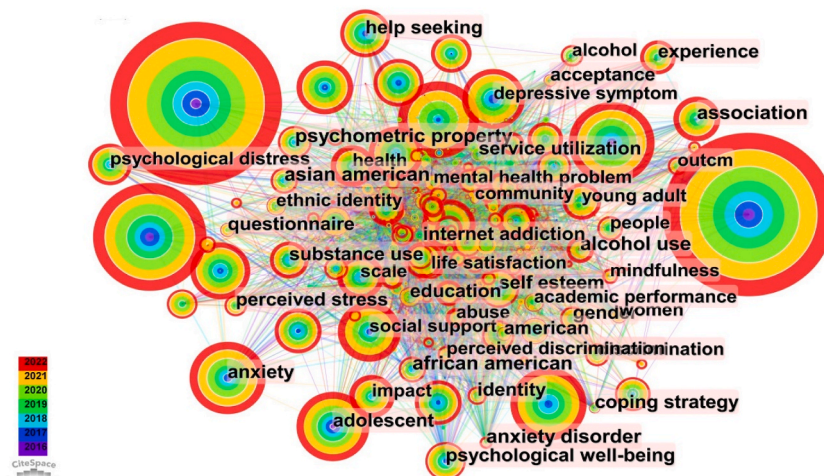

Fig. 9. Thematic development from 2016 to 2022.

Journal of American College Health has a significantly higher publication volume of 211 papers than the other journals. However, considering the variations in publication volume and relevance among different journals, a specific analysis should be conducted in conjunction with the "Average citation per paper." Table 1 reveals that *Psychiatry Research, Journal of Counseling Psychology*, and *Journal of Affective Disorders* all had citation counts exceeding 50, indicating a concentrated focus on college students' mental health research in these three journals. Additionally, the journal *Psychiatry Research* leads with a citation count of 156.69, underscoring its substantial impact and tendency to publish research on college students' mental health issues, such as Internet addiction. This indirectly reflects the severity of college students' mental health problems, which have often been studied in the field of psychiatry.

Meanwhile, the journal with the highest publication volume, the *Journal of American College Health*, mostly focuses on empirical studies on the actual situation of college students [114], and most articles in the past three years have focused on the impact of the COVID-19 pandemic on college students' mental health [115–117]. Nevertheless, for *Frontiers in Psychiatry* (74 articles, cited 598 times), journals on this topic were generally in the field of psychology, focusing on the specific impact of different factors on college students' mental health and exploring new educational strategies suitable for college students' mental health education [118]. Moreover, as the journal is fully open source, it helps in reducing the dissemination cost of the research results, ensuring more scholars and the public pay attention to this field, thereby further promoting the development of research.

This study then conducted a quantitative analysis of the articles therein, and three obvious characteristics were observed. First, the COVID-19 pandemic has gradually become a common research hotspot, and the number of research articles has surged over the past three years. Second, against the backdrop of the pandemic, research on depression and anxiety accounts for the highest proportion, which not only reflects the focus of the journal but also reflects the research heat on depression and anxiety in recent years. Third, journals closely related to "college students' mental health" (*Journal of American College Health*) exist among international journals, indicating that this research topic has gradually become mature and attracted the attention of many more scholars, evolving into a mature discipline in the world.

3.7. Co-citation analysis

Co-citation analysis can help understand the disciplines behind the field and provide other information. In this study, VOSviewer was used to draw the co-citation map of journals first, and the threshold value of the minimum number of co-citations was set to 200, leaving 52 journals for the co-citation analysis, as depicted in Fig. 10.

It can be seen from Fig. 10 that the co-citation network of the journals is mainly composed of four clusters, corresponding to the four colors in the figure, and the top four journals in terms of the number of citations are the *Journal of American College Health* (1405 citations), *Journal of Counseling Psychology* (1259 citations), *Journal of Personality and Social Psychology* (1093 citations), and *Journal of Affective Disorders* (1034 citations), which are affiliated to four clusters.

Among these four clusters, the journals in the red cluster focused on the health relevance of college students [21,87]. The purpose of citing these journals is mainly because the research objects belong to the same group, and the correlation is strong. By analyzing and reviewing existing studies and the characteristics of college students, the authors can provide empirical support for their own research. While the other three clusters are all in the field of psychology, the journals in the yellow cluster mainly focus on emotional disorders, that is, psychological diseases, including but not limited to the psychological status of college students [119] and the persistence of mental health problems and needs [120]. The journals in the blue cluster mainly focused on general social phenomena [121]. Examples include religious orientation [122], public health [123], and social relationships [124]. The journals in the green cluster focused on psychological counseling, including psychological counseling services [125], college students' attitudes toward psychological counseling [126], and mental health help-seeking behavior [127]. These journals often contain specific professional knowledge in the field of psychology, and the purpose of quoting these journals is mainly to provide support and testimony on the level of professional psychological knowledge for research, including but not limited to citing relevant theories, models [128], scales [104], etc.

To further carry out a co-citation analysis of articles, VOSviewer was used to draw a co-citation map of the references. The threshold value of the minimum number was set to 50, and 30 articles were filtered out for the co-citation analysis of co-cited articles. A co-citation relationship map is shown in Fig. 11.

By analyzing Fig. 11, it can be found that the co-citation network of highly-cited articles can be divided into three clusters, among

Table 1
Major journals in the field of college students' mental health research.

| Rank	Sourced journals	Articles	Citations	Average citation per article
1	Journal of American College Health	211	3053	14.47
2	Frontiers in Psychiatry	74	598	8.08
3	International Journal of Environmental Research and Public Health	42	696	16.57
4	Journal of Affective Disorders	37	1879	50.78
5	Frontiers in Psychology	32	139	4.34
6	Current Psychology	30	90	3
7	Journal of College Student Development	23	725	31.52
8	Journal of Counseling Psychology	21	1627	77.48
9	Cultural Diversity & Ethnic Minority Psychology	17	814	47.88
10	Psychiatry Research	16	2507	156.69
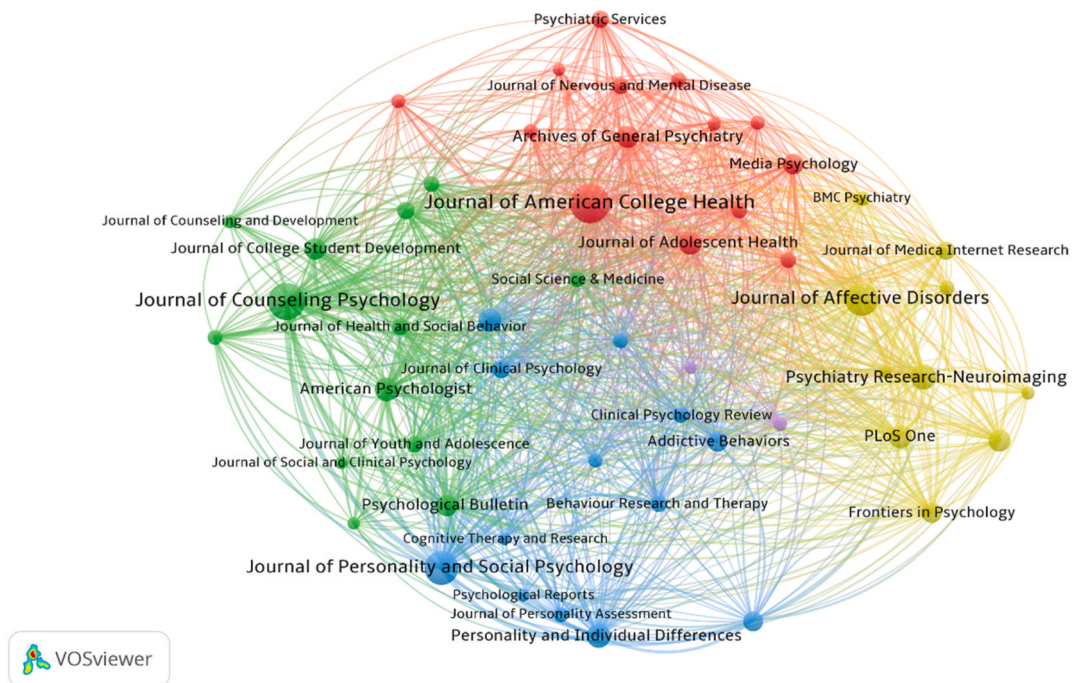
Fig. 10. The co-citation network of journals.

which the blue cluster mainly focuses on the influence of specific elements such as social support [129] and perceived stress [130] on mental health. The red cluster focuses on changes in the mental health status of college students in the background of the times [43, 44], while the green cluster is more inclined to study external manifestations or specific behavioral aspects [114,120].

According to the analysis of the publication years of the highly cited articles, the blue cluster was published first, followed by the green cluster, and the red cluster was published relatively later. Highly cited articles emerged one after another, indicating that the development trend is good, with new research hotspots and high-quality studies arising constantly.

4. Conclusions, implications and prospects

4.1. Conclusions and implications

As a social science, the field of college students' mental health is highly responsive to social changes, with its subject, college students, characterized by unique attributes. Consequently, it is significantly influenced by the zeitgeist, undergoing constant iterations and renewals. Leveraging VOSviewer and CiteSpace (version: 6.1. R3, developed by Chen C. at Drexel University) software, this study conducted a comprehensive analysis of relevant research in the field of college students' mental health from 2000 to 2022. It systematically reviewed the developmental trends, explored the evolution process, and traced the origins of specific aspects within the field. Additionally, the study discussed and analyzed core authors, high-productivity countries and organizations, key journals, and keyword clustering in this dynamic domain. Through bibliometric analysis, this study addressed three main research questions, leading to the following conclusions:

1. The analysis of the research status from 2000 to 2022 unveiled the evolving landscape of college students' mental health. The field has been progressively developing and maturing, currently experiencing a phase of rapid growth. Core journals, including the *Journal of American College Health* and *Psychiatry Research,* and influential author Eisenberg Daniel, have played crucial roles in shaping the field. Developed countries, particularly the United States, have demonstrated a higher interest in this research area compared to developing countries. This analysis provides scholars with a clear framework for existing research and deep insights into the field's development process.
2. Cluster and evolutionary analyses identified core hotspots and development trends in college students' mental health research. Stable research topics, such as the behavior of college student populations and specific factors influencing mental health, have been established through co-occurrence and cluster analyses. However, with changing societal contexts, numerous new and diverse topics continue to emerge. A co-citation analysis of highly cited literature provides insights into the changing trends of research hotspots in the field.
3. The study explored development trends and potential future agendas in the evolving landscape of college students' mental health. This research area holds significant potential for further development, strongly influenced by the era. After 2016, particularly in
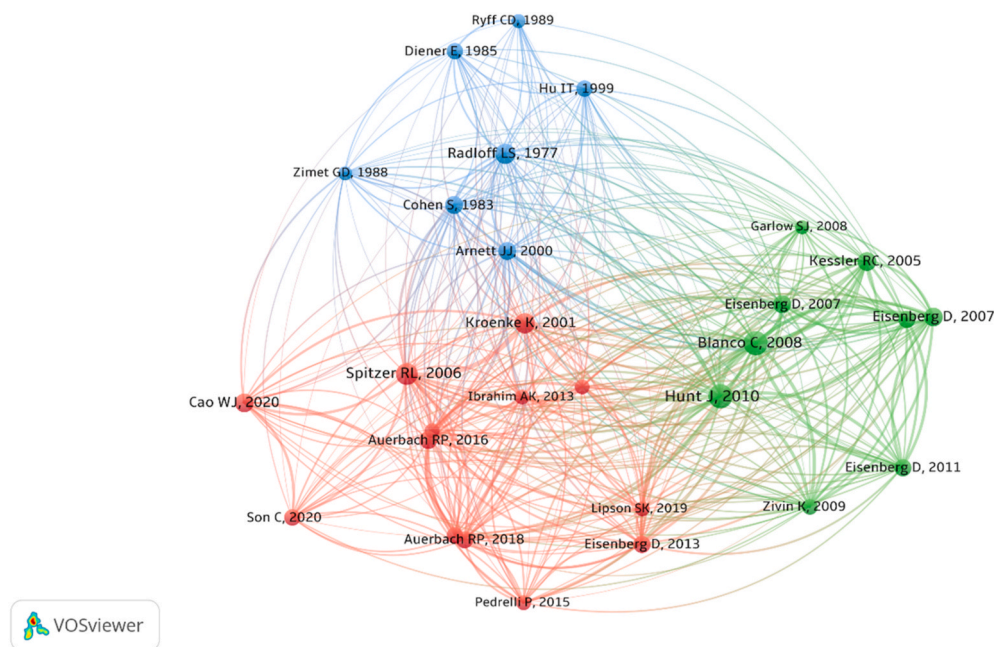
Fig. 11. The co-cited articles.

2019 during the pandemic's impact, there was a surge in publications, accompanied by the emergence of new and diverse topics. The study emphasizes the need for further comprehensive research and ongoing tracking of evolving trends to determine whether these emerging topics are transient or will become new research hotspots. The field is moving towards greater concreteness and complexity, and as the world enters the post-pandemic era, the future direction of development in this field warrants further investigation. College students' mental health issues should receive ample attention, and relevant stakeholders at the school, family, and societal levels should consider the conclusions drawn from academic research. Early prevention and intervention, as indicated by this study, could effectively improve the mental well-being of college students.

4.2. Limitations and future research

This study had several limitations. First, the articles analyzed were solely sourced from the Web of Science database, which limited the research sample. Subsequent studies should conduct searches in commonly used databases such as Scopus and Google Scholar to ensure a more comprehensive review. Second, only journal articles were retrieved for the analysis, excluding other relevant publication types in the field, such as reviews, book chapters, and conference proceedings. Simultaneously, owing to the limited number of samples and the subjectivity of artificial screening, the final research results have certain limitations. However, we believe that the bibliometric method used in this study provides new insights into the development and current situation of this field, as well as some challenges for future progress, and therefore has a certain reference value.

Future research could optimize the results, make the review studies more comprehensive, and make the conclusions more reliable and valuable by combining analyses using multiple databases and using more accurate and comprehensive search strategies. Qualitative research methods, such as field surveys and interviews, can be employed to investigate college students' campus lives more clearly, analyze their mental health status, and provide more feasible, scientific, and targeted recommendations based on empirical research.

In summary, future research in this field holds immense potential. This study aimed to provide a solid foundation for future research and in-depth exploration. We also hope that the relevant school administrators, families, and society as a whole will consider the conclusions drawn from academia, collaborate from various perspectives, and effectively improve college students' mental well-being.

Data availability statement

The datasets analyzed during the current study are available in the Dataverse repository: https://doi.org/10.7910/DVN/GNDM75.

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CRediT authorship contribution statement

Jingying Chen: Writing – review & editing, Writing – original draft, Supervision, Project administration, Funding acquisition, Conceptualization. **Yidan Liu:** Writing – original draft, Visualization, Software, Methodology, Conceptualization. **Keke Zhu:** Writing – review & editing, Visualization, Methodology. **Jian Dai:** Writing – review & editing, Software, Methodology. **Chengliang Wang:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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