INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 13, Issue 4, (2024) E-ISSN: 2226-6348

Research Trends on the Effects of Physical Activity on Bipolar Disorder from 2014 to 2024: A Bibliometric Analysis

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To Link this Article: http://dx.doi.org/10.6007/IJARPED/v13-i4/22868 DOI:10.6007/IJARPED/v13-i4/22868

Published Online: 09 October 2024

Abstracts

Background: Recent years. Bi-directional affective disorder and physical activity (PA) are being studied further. This area's research progress and future directions are undetermined. This study investigates hot research topics and emerging trends in this sector. The goal is to suggest future research and offer physicians references. Materials and Methods: Retrieve relevant literature from the Web of Science core ensemble database, import the downloaded files into CiteSpace6.2.R3 for visual analysis, generate the cooperative network diagram between authors, countries, institutions, cited journals, and co-occurring keywords, and identify research hotspots and trends through keyword clustering, timeline browsing, and keyword citations. outbreaks and other analysis to identify research centers and trends. Results：There were 723 research, and PA in bipolar illness is growing. The US (256), London University (64), and AM J PSYCHIAT (394) had the most articles. The keywords identified youth, quality of life, physical health, risk health, and coronary heart disease as groups of interest, observational indicators, and related illness categories. Conclusions: This study highlights ongoing research and developing trends and underscores the need for further research to widen the findings. Future collaborations between institutions and authors must be strengthened and explored to explore physical and mental exercise and its effects on bi-directional affective disorder, PA, and specific populations, as well as the physiological mechanisms of various exercises, and to validate current findings or hypotheses through longitudinal studies or randomi.

Keywords: Physical Activity, Bipolar Disorder, Bibliometric Analysis

Introduction

Bipolar disorder is a chronic disorder characterized by frequent episodes of mania and depression, often associated with functional impairment and poor quality of life. When people have bipolar disorder, they tend to have poor concentration, anxiety disorders, depression, work-learning differences, and co-morbid problems (Nabavi et al., 2015; Nelson & Liebel, 2018; Pedersen & Jodin, 2016).A diagnosis of bipolar disorder is also associated with

an increased risk of cardiovascular disease leading to premature mortality.Individuals with bipolar disorder may have poor relationships with others for reasons of trust and self-esteem, and in severe cases may not even be able to fit into groups. (Weiner & Weiner, 1997). The onset of bipolar disorder is increased when people are exposed to various stressors in addition to various environmental changes such as poor dietary habits, decreased physical activity, poor sleep habits and quality, alcoholism, etc (Ridner et al., 2016).

Thankfully, scholars are becoming aware of the importance of bi-directional affective disorder and more research is being conducted on it.Exercise may be an excellent candidate to meet this need. Previous research has shown that PA improves the quality of life and well-being in adolescents and adults with major clinical depression or bipolar disorder(Marquez et al., 2020). Physical activity is an adjunctive treatment modality that improves social functioning and coherence in patients with bipolar disorder (Khedr et al., 2024). Engaging in physical exercise may enhance the alleviation of dysphoria in individuals diagnosed with bipolar illness(Fernandes et al., 2011). Research has shown a connection between exercise and enhanced cognitive function as well as the release of brain-derived neurotrophic factors, especially in those diagnosed with bipolar illness(Bowen et al., 2013; Wright et al., 2012) (Wright et al., 2012; Bowen et al., 2013).

Bibliometrics is a widely used research approach that involves analyzing scientific literature to find study areas of high interest and rising trends (Chen et al., 2012). Bibliometric analysis has the benefit of encompassing a broad spectrum of investigations. The use of bibliometrics in visual presentations allows for a more intuitive, complete, and methodical understanding of the evolution of a certain topic. Hence, this study methodology has been extensively used across many disciplines (Cui et al., 2023; Dong et al., 2021; Zhang et al., 2024). The purpose of this study was to provide a bird's eye view of the last decade of research in the field through a bibliometric approach to expand the understanding of physical activity in the field of bi-directional affective disorder. To this end, several commonly used bibliometric indicators were used in this study to explore the trajectory of the field over the past decade based on trends in the number of publications over time; to explore the key players driving research on physical activity on bi-directional affective disorders and potential patterns of scientific collaboration in the field based on authors' and country's publication outputs and co-citation relationships; to explore the field's potential disciplinary foundation over the past decade through co-citation analyses of journals potential disciplinary underpinnings of the field over the past decade; and exploring recurring research themes and their trends over time through co-occurrence analysis of keywords. As far as we know, there has not been a thorough bibliometric study conducted on the present state and patterns of research on bi-directional affective illness. Hence, the objective of this study is to provide an overview of the existing research on physical activity (PA) with bipolar affective disorder. The study intends to identify the current research status, key areas of focus, and emerging trends in this field. The findings will serve as a theoretical foundation for future research directions and aid clinicians in enhancing their clinical practice.

Material & Methods

To understand the latest trends in the field, we chose to search the Web of Science Core Collection (WoSCC) for relevant literature from 2014 to 2024.The WoSCC search formula was set as follows: TI = [("bipolar disorder" OR "bipolar affective disorder" OR "bipolar depressive

disorder" OR "bipolar spectrum disorder" OR "biphasic disorder") AND ("exercise " OR "training" OR "dance" OR "aerobic" OR "fitness" OR "cardio" OR "physical activity" OR " resistance exercise" OR "weight training" OR "yoga" OR "taichi " OR "wuqinxi" OR "baduanjin" OR "yijinjing")].

Inclusion and Exclusion Criteria

The inclusion criteria for the bibliometric analysis were (1) peer-reviewed articles on physical activity and bi-directional affective disorder, including both basic and clinical studies; (2) physical activity included aerobic exercise, resistance exercise, weight training, dance, yoga, tai chi, wu ji chuan, ba duan jin, and yi jin jing; (3) the main types of literature selected for our study were articles and reviews; and (4) the language of the articles was limited to English. The exclusion criteria were (1) articles not related to the research topic, (2) articles not officially published, (3) conference abstracts and proceedings and errata papers, and (4) articles not in English.

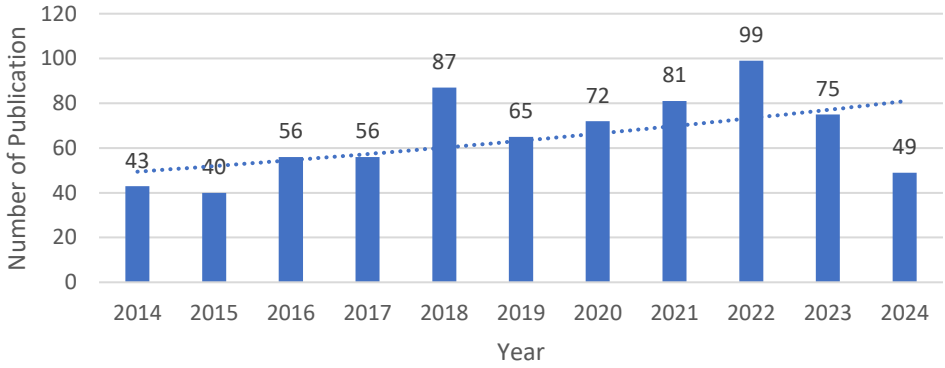
Bibliometrics and Visualization Analysis

CiteSpace 6.2.R3 is a data analysis and visualization software developed by Dr. Chao-Mei Chen, a professor at Drexel University in Philadelphia, USA (Zhang et al., 2022). Its main features include burst detection, mediated centrality, and heterogeneous networks, which aid in identifying the characteristics of research frontiers, keyword tagging, and detecting emerging trends and temporal changes(Chen, 2006). The analysis process includes time slicing, thresholding, modeling, pruning, merging, and mapping (Chen, 2004). The analysis of the collaborative network of authors, countries, and institutions, as well as cited journals, co-cited references, co-occurring keywords, cluster analysis, citation bursts of keywords, and timeline views of physical activity on bi-directional affective disorders was conducted using CiteSpace 6.2.R3. A multi-project mapping was created, consisting of nodes and connecting lines. The nodes represent the objects being analyzed, such as authors, countries, or keywords. The size of the nodes indicates the frequency or number of publications, and the color corresponds to the time of first appearance. Similarly, links indicate collaborations or co-citation relationships, and their colour indicates the year of first appearance (Zhou et al., 2022). Nodes with purple borders indicate high medio centricity, which is often a hotspot or turning point in a field.

Results

Annual Publications

FIGURE 1
Annual trend chart of publication (2014-2024)



By looking at the changes in the number of papers published each year, it is possible to get a more intuitive picture of the research trends in the field. The search yielded 1,223 articles, and 723 articles were finally included. As seen in Figure 1 the number of relevant publications was found to be generally on the rise, but with some fluctuations, ranging from 44-99 articles. A small peak of growth was observed in 2014-2018, with the number of publications rising from 40 to 87. In 2019-2022 there is a steady increase in publications, peaking at 99 in 2022. What this shows. The field has continued to grow and receive increased attention over the last 10 years.

Co-author Analysis

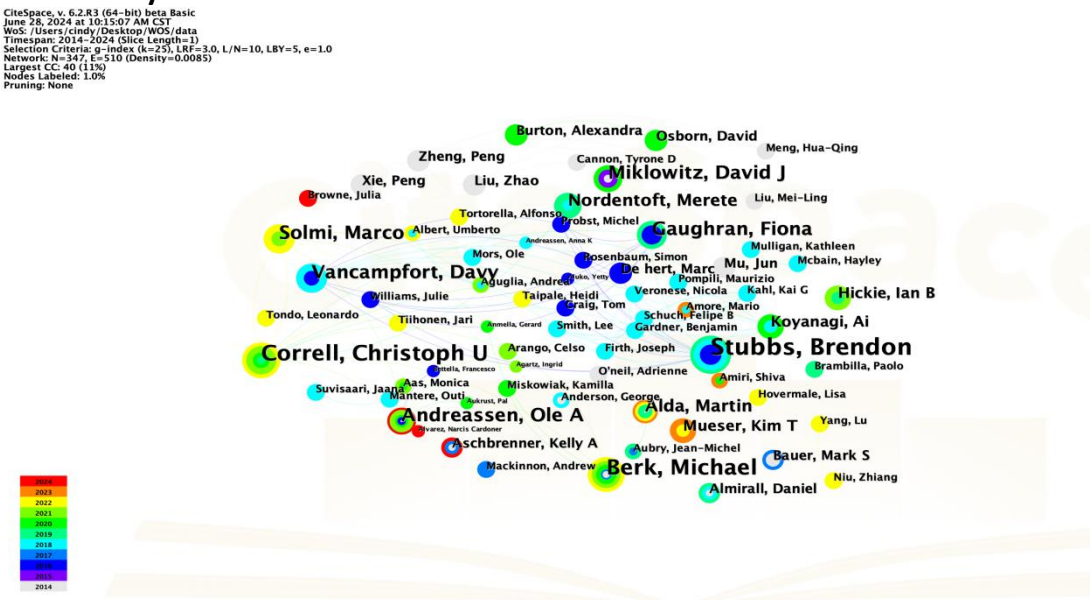


Figure 2 The Network Of Co-Authors

Table 1
Top Ten authors in the list by publication volume/centrality

No	Count	Centrality	Year	Authors
1	11	0.01	2016	Stubbs, Brendon
2	9	0	2014	Berk, Michael
3	9	0.02	2019	Correll, Christoph U
4	6	0	2016	Andreassen, Ole A
5	6	0	2014	Gaughan, Fiona
6	6	0	2021	Miklowitz, David J
7	6	0	2016	Solmi, Marco
8	6	0.01	2014	Vancampfort, Davy
9	5	0	2014	Alda, Martin
10	5	0	2018	Nordentoft, Merete

The author collaboration network was analysed using Citespace 6.2.R3 to identify authors with high publication volumes and collaborative groups between them, identifying authors with some influence in the field. From the Figure 2 it can be seen that there are 347 nodes, 510 links, and a number of collaborative groups. Larger nodes represent a higher number of published papers. The colours from cool to warm reflect the time from 2014 to 2024. As shown in Table 1, the first place in terms of the number of published papers is occupied by Stubbs Brendon, with 11 articles, or 1.5 per cent of the total number of published papers.Berk Michael is in second place, with 9 articles. Meanwhile, Correll Christoph U also published 9 articles with a centrality of 0.02, they researched the prevention of mental health problems in young people and the associated factors affecting people with mental disorders, giving a greater understanding of young people's health problems. Their most cited article describes the current status of mental disorders and bipolar disorder in young people and finds the effects of selective screening, psychological interventions and physical activity on people with different types of mental illness. The other top 10 authors had five or six publications. Although some stable collaborative networks have been formed between the top 10 authors, for example between Correll Christoph U and Berk Michael. there is also close collaboration between Stubbs Brendon, Gaughan Fiona and Vancampfort Davy.Nevertheless, the level of global cooperation remains insufficient, and we eagerly anticipate fostering encounters among experts hailing from other nations. In addition, it is noteworthy that none of the writers have a position of centrality, indicating the absence of any authoritative or important scientists in the area of studying the impact of physical exercise on bi-directional affective illness.

Country and Institution Analysis

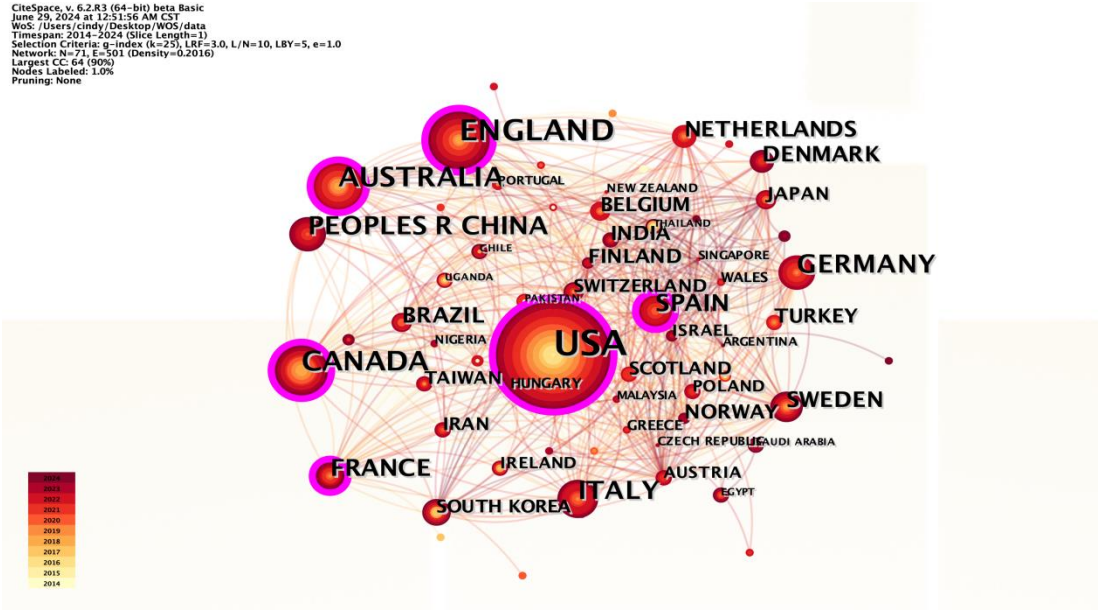


Figure 3 The network of countries

Table 2
Top five countries in the list by publication volume/centrality

Rank	Ranked by publication volume		Ranked by centrality	
	Country	Number	Country	Centrality
1	USA	256	ENGLAND	0.18
2	ENGLAND	124	USA	0.16
3	AUSTRALIA	79	AUSTRALIA	0.11
4	CANADA	78	CANADA	0.11
5	ITALY	49	ITALY	0.02

Analysis of national and institutional collaborative networks using Citespace 6.2.R3 Results of national collaborative network analysis are shown in Figure 3 and Table 2 are shown. Figure 3. in which the graph consists of 71 nodes and 501 links, with the United States having the largest node size, the largest number of publications, the thickest ENGLAND purple edges, and the highest degree of centrality.

The top five countries contributed a total of 586 (81.1%) papers, namely 256 (35.4%) from the United States, 124 (17.2%) from the United Kingdom, 79 (10.9%) from Australia, 78 (10.8%) from Canada, and 49 (6.8%) from Italy, indicating that each country has formed a close and stable collaborative network. In terms of centrality, the top five countries were the UK (0.18), the US (0.16), Australia (0.11), Canada (0.11), and Italy (0.02), suggesting that the UK's contribution was greater than that of the other countries, and that developed countries have had a greater impact in the areas of physical activity and bi-directional affective disorder.

Table 3
Top five Institutions in the list by publication volume/centrality

Rank	Ranked by publication volume		Ranked by centrality	
	Institution	**Number**	**Institution**	**Centrality**
1	University of London	64	Assistance Publique Hopitaux Paris (APHP)	0.13
2	King's College London	49	University of London	0.12
3	Harvard University	45	King's College London	0.09
4	University of California System	36	Baylor College of Medicine	0.08
5	University of Toronto	32	University of California System	0.07

Table 3 shows the top five institutions in terms of number of articles, all of which are universities. The top five institutions in terms of the number of articles are the University of London (64 articles, 8.85%), King's College London (49 articles, 6.78%), Harvard University (45 articles, 6.22%), University of California (36 articles, 4.98%) and University of Toronto (32 articles, 4.43%). The University of London is a significant contributor in this area, and as such it is at the top of the list in terms of number of articles and centrality. However, only the top two institutions have centrality > 0.1, which means that most institutions play a relatively small role in linking the entire network.

Analysis of cited journals

Table 4
Top five journals in the list by citation frequency/centrality

Rank	Ranked by cited frequency		Ranked by centrality	
	Journal	**Number**	**Journal**	**Centrality**
1	AM J PSYCHIAT	394	PROG NEURO-PSYCHOPH	0.05
2	BRIT J PSYCHIAT	372	ADDICTION	0.04
3	J AFFECT DISORDERS	360	AM J PREV MED	0.04
4	PSYCHIAT RES	319	BIOINFORMATICS	0.04
5	ARCH GEN PSYCHIAT	315	EARLY INTERV PSYCHIA	0.04

We used CiteSpace 6.2.R3 to conduct co-citation analysis on the journals, which measures the level of relevance of each publication to the field. Table 4 presents the top five journals that have been rated based on their citation frequency and centrality. Interestingly, they are quite different, with the highest cited frequency being the American journal AM J PSYCHIAT with 394 citations, followed by BRIT J PSYCHIAT (372) and J AFFECT DISORDERS (360). The journal with the greatest centrality was PROG NEURO-PSYCHOPH (0.05), whereas the other four journals all had a centrality of 0.04, tying for second place. The findings indicated that the research was published in reputable journals such as Psychiatry and Affective Disorders. Moreover, there was a substantial number of articles on the correlation between Physical Activity and Bi-directional Affective Disorders, albeit they were widely dispersed. The journal AM J PSYCHIAT has the highest number of citations, with an impact factor of 17.7 in 2022. It is situated in Region I of the Journal Citation Reports. American Journal Of Psychiatry (AM J PSYCHIAT) is an English-language scholarly journal focusing on the field of psychiatry and was

founded in 1921 by AMER PSYCHIATRIC PUBLISHING, INC. The journal's focus encompasses the area of psychiatry, with the goal of providing timely, precise, and thorough reports on the experiences, scientific research findings, technological innovations, and academic developments of psychiatrists both domestically and internationally in the realm of scientific research and related endeavors. The journal has been indexed in the SCI, SCIE, and SSCI databases, indicating its significant impact in this subject.

Analysis of Cited References

Table 5

Top 5 studies in the list by co-citation frequency

Rank	Author	Co-cited reference	Frequency
1	Vancampfort D	Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: a systematic review and meta-analysis	41
2	Vancampfort D	Sedentary behaviour and physical activity levels in people with schizophrenia, bipolar disorder and major depressive disorder: a global systematic review and meta-analysis review and meta-analysis	37
3	Correll CU	Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: a large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls	37
4	Vancampfort D	Diabetes mellitus in people with schizophrenia, bipolar disorder and major depressive disorder: a systematic review and large scale meta-analysis	30
5	Firth J	The Lancet Psychiatry Commission: a blueprint for protecting physical health in people with mental illness	25

Table 6
Top 5 studies in the list by co-citation centrality

Rank	Author	Co-cited reference	Centrality
1	Firth J	A meta-review of "lifestyle psychiatry": the role of exercise, smoking, diet and sleep in the prevention and treatment of The role of exercise, smoking, diet and sleep in the prevention and treatment of mental disorders	0.24
2	Vancampfort D	Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: a systematic review and meta-analysis	0.17
3	Correll CU	Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: a large-scale meta- analysis of 3,211,768 patients and 113,383,368 controls	0.15
4	Liu NH	Excess mortality in persons with severe mental disorders: a multilevel intervention framework and priorities for clinical practice, policy and research agendas	0.14
5	Walker ER	Mortality in Mental Disorders and Global Disease Burden Implications A Systematic Review and Meta-analysis	0.14

We analysed the cited literature using CiteSpace 6.2.R3. Tables 5 and 6 show the frequency and centrality of the top 5 cited literatures, respectively. The first literature by Vancampfort D explored the prevalence of metabolic syndrome and other components in patients with psychosis (schizophrenics, patients with bi-directional affective disorder, and patients with major depression and compared differences between patients in terms of demographic variables and psychotropic medication use, with a frequency of 37 citations and a centrality of 0.17.The second has the same authors as the first, but this one analyses the average time per day spent sedentary or physically active in patients with severe psychosis and analyses predictors of physical activity and sedentariness, comparing differences in physical activity and sedentary behaviours between patients with psychosis and healthy individuals, and has a citation frequency of 37.The third author is Correll CU, who examines the prevalence of cardiovascular disease in patients with severe psychosis, morbidity and mortality. The frequency of citations is 37 and the centrality is 0.15. The fourth author, Vancampfort D, writes about the prevalence of diabetes and other related issues in people with schizophrenia, bipolar disorder, or depression, with a frequency of 30.The fifth author, Firth J, focuses on the physical health of people with psychiatric illnesses, highlighting the multifactorial nature of physical health disparities and the existence of latent risks. The frequency is 25.According to Table 6 it can be seen that Firth examined the highest centrality (0.24) of the article on how physical activity, sleep, dietary patterns, and smoking affect risk and treatment outcomes in psychiatric disorders, indicating that the article has the most influence in the area of physical activity and bi-directional affective disorders. Table 5 , and these cited references listed in Table 6, we found that the majority of studies focused on the

characteristics of people with psychosis, people with bi-directional affective disorder, the relationship between prevalence and incidence and health-related behaviors, and differences in physical activity. In addition to this, high-quality guidelines and reviews have emerged.

Analysis of Co-Occurring Keywords

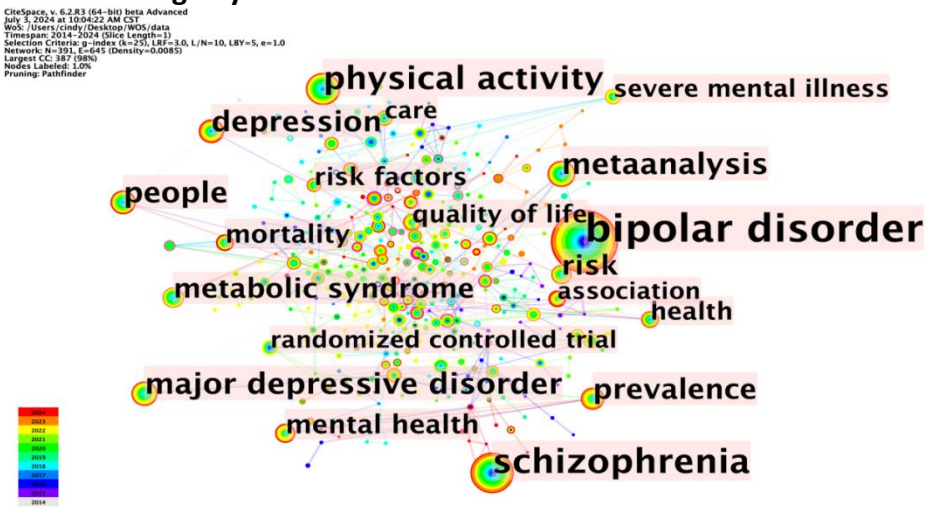


Figure 4 The Network Of Keywords

Table 7
Top 10 keywords in the list by co-citation frequency/centrality

Rank	Ranked by co-citation frequency		Ranked by centrality	
	Keyword	Number	Keyword	Centrality
1	bipolar disorder	473	Life	0.28
2	schizophrenia	212	Adolescents	0.18
3	physical activity	145	1st episode	0.15
4	major depressive disorder	94	community	0.15
5	Meta analysis	93	adhd	0.15
6	people	89	Cognitive remediation	0.14
7	depression	82	1st episode psychosis	0.14
8	prevalence	77	individuals	0.13
9	metabolic syndrome	66	smoking	0.13
10	risk	66	Executive function	0.13

We used CiteSpace 6.2.R3 for keyword co-occurrence analysis. In order to enhance the visual impact of the graph, we conducted pruning on the graph and produced a keyword network graph. This graph is composed of 391 Nodes and 2709 linkages, as seen in Figure 4 and detailed in Table 7. As the size of the Nodes increases, the frequency of the keywords also increases. The color purple signifies past events, whereas the color red represents more current occurrences. Keyword co-occurrence is the measure of how often two subject phrases appear together in an article and is used to demonstrate the relationship between two subjects. Keywords serve as a concise description of an article. High-frequency keywords are indicative of popular themes, while highly centered keywords suggest that the term has

significant prestige and influence in the respective sector. The most often occurring terms are bipolar disorder (frequency: 473), schizophrenia (frequency: 212), and physical activity (frequency: 145). The terms that have greater centrality include "life" with a centrality score of 0.28 and "adolescents" with a centrality score of 0.18. From the keywords, it can be seen that the characteristics of people's physical activity, the relationship between physical activity and health of psychiatric patients and bipolar disorder patients, and the relationship between bipolar disorder and lifestyle and bipolar disorder of adolescents have been paid attention by researchers, and different measurement methods were used to study the relationship between physical activity and health of adolescents. and different measures were used for the study.

Analysis of Keyword Clusters

Figure 5 Cluster Analysis Of Keywords

Table 8
Top 10 largest clusters of keywords

Cluster	Cluster Label	Size	Silhouette	Year	Keywords
#0	Quality of life	33	0.875	2018	Quality of life; body mass index; individuals; motivation; metabolic syndrome
#1	Bipolar disorder	28	0.845	2016	Bipolar disorder; schizophrenia; stress; metabolic syndrome; cognitive remediation
#2	Cognitive remediation	26	0.884	2017	Cognitive remediation; negative symptoms; early intervention; employment; peripheral markers
#3	Coronary heart disease	26	0.881	2018	Coronary heart disease; guidelines; weight loss; prevalence; lifestyle intervention
#4	Mood disorder	25	0.882	2017	Mood disorders; major depressive disorder; mental disorder; perception; hippocampus
#5	Recovery	23	0.82	2017	Recovery ; outcm; peer support; remediation; covid-19
#6	Physical health	22	0.831	2016	Physical health; illness; people; mental health nursing; social media

#7	Risk factors	21	0.881	2016	Risk factor; bipolar disorder; order adults; birth cohort; inpatient care
#8	Youth	21	0.913	2016	Youth; mania; expressed emotion; therapy; rating scale
#9	Machine learning	21	0.875	2020	Machine learning; version; impact; medical education; parihs framework

Keyword clustering is performed by using keyword mapping (Figure 5) to determine the primary study topics within the area. Modularity Q and mean contour degree are used to assess the appropriateness of the clustering of the scientific atlas. Typically, a Q value over 0.3 indicates a strong clustering structure, while a S value above 0.7 implies a compelling clustering. The Q value and S value in this clustered knowledge network are 0.7341 and 0.8857, respectively. These values suggest that the clustering effect is satisfactory. The study focused on the top 10 keyword clustering labels, as shown in Table 8. These labels include #0 Quality of life, #2 Cognitive remediation, #5 Recovery, #6 Physical health, and #7 Risk factors, which pertain to several observable characteristics. Bipolar illness, coronary heart disease, and mood disorder are all types of diseases. Youth is a topic of study. Machine learning is a way of life.

Analysis of Timeline View

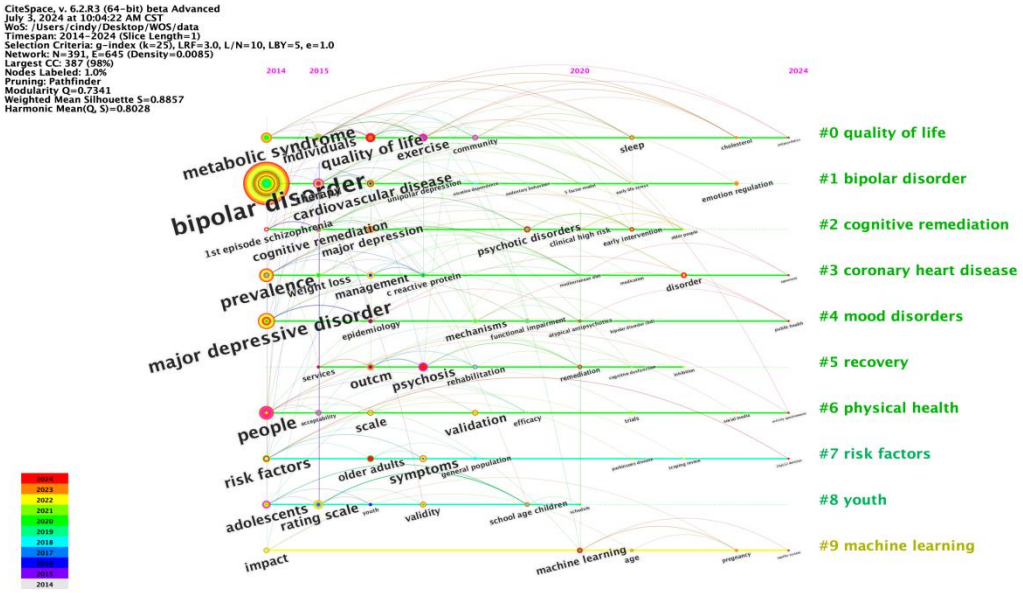


Figure 6 Timeline Graph Of Cluster Analysis

We used CiteSpace 6.2.R3 to create the timeline analysis. The timeline illustrates the correlation between the clusters and the progression of the grouped terms over time. Distinct hues correspond to distinct groupings. Figure 6 demonstrates a steady growth in the number of keywords over the last decade, suggesting that physical exercise and bi-directional affective illness are significant study topics that researchers are interested in. The frequency of terms in clusters 0, 1, and 2 has reached its peak in the current decade, suggesting that researchers are focused on the topic of bi-directional affective illness and its correlation with physical activity and lifestyle. In the timeline, we can find a large number of keywords in 2024 as well, such as PUBLIC HEALTH, MOOD INSTABILITY, and BURDEN. These are the research hotspots of physical activity and bi-directional affective disorder.

Keywords with Citation Burst

Top 20 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2014 - 2024
serious mental illness	2014	3.33	**2014**	2016	
children	2015	3.37	**2015**	2017	
older adults	2016	3.72	**2016**	2018	
diabetes mellitus	2016	3.24	**2016**	2019	
cardiovascular disease	2016	2.58	**2016**	2020	
self management	2016	2.48	**2016**	2018	
c reactive protein	2017	3.41	**2017**	2018	
cognitive behavioral therapy	2017	2.98	**2017**	2019	
mobile phone	2017	2.92	**2017**	2018	
symptoms	2017	2.53	**2017**	2018	
mental illness	2015	2.46	**2017**	2018	
major depression	2016	3.67	**2019**	2020	
school age children	2019	2.94	**2019**	2020	
reliability	2019	2.91	**2019**	2022	
sedentary behavior	2018	2.81	**2019**	2020	
psychotic disorders	2019	2.77	**2019**	2021	
depressive symptoms	2020	3.28	**2020**	2021	
association	2019	4.68	**2021**	2024	
exercise	2017	2.78	**2021**	2024	
disorder	2022	3.09	**2022**	2024	

We used CiteSpace 6.2.R3 to generate visual representations of keyword citation bursts. Outburst detection utilizes the Kleinberg algorithm, a method that extracts significant patterns from a continuous flow of documents and identifies keywords that experience changes over time(Kleinberg, 2003). Keyword citation bursts provide insights on the temporal distribution and dynamic patterns of keywords at a certain moment, enabling us to get a deeper understanding of historical and current focal points. Figure 7 displays the 20 most powerful citation bursts. The blue line represents the time interval, whereas the red line represents the occurrence of keyword citation bursts(Chen et al., 2014). Hotspots can be described as three phases. It is known that from 2014 to 2016, research focused on severe mental illness in older adults or children and the relationship between diabetes and cardiovascular disease. From 2017 to 2019, the effectiveness of multiple cognitive-behavioural therapies for psychiatric disorders was studied mainly as a hotspot for this period. Showcasing the latest research hotspots from 2020 to 2024, ASSOCIATION (early intervention), depressive symptoms, and exercise have become current hot topics in physical activity and bi-directional affective disorder.

Discussion

The study of physical activity and bi-directional affective disorder has received increasing attention over the last decade, which may be related to the increased economic burden associated with the rising incidence of bi-directional affective disorder, and the trend towards a younger population with the condition. The USA and the UK have become prominent nations in this domain, with the UK having the most intimate and pivotal partnerships with other countries, while the USA leads in terms of the biggest number of research papers and corresponding authors. The output institutions mostly consist of the University of London and King's College London in the United Kingdom, Harvard and the University of California in the United States, and the University of Toronto in Canada. The top five universities together contributed to 31.26% of the total number of published articles, suggesting their significant

academic achievements and substantial influence. Nevertheless, the level of cooperation among these institutions is not as apparent as the collaboration seen among nations. Collaboration facilitates the flow of ideas and resources among researchers studying physical exercise and bipolar illness, which is crucial for advancing research. Therefore, stronger collaborations between researchers, countries and institutions should be established.

Articles on physical activity and bipolar disorder research were published in 523 different academic journals. Among the top 5 journals with an impact factor > 10 (AM J PSYCHIAT with an impact factor of 17.7 and BRIT J PSYCHIAT with an impact factor of 10.671, PSYCHIAT RES with an impact factor of 11.3, and ARCH GEN PSYCHIAT with an impact factor of 14.273), there is only one journal J AFFECT DISORDERS has an impact factor of 6.6. Thus, this topic has a high interest among high impact factor journals.

Data on key authors can help researchers identify potential partners. A comprehensive analysis of the number of publications and co-citations identified authors Vancampfort D, Correll CU, and Firth J as the most prolific and influential authors in the field of physical activity and bi-directional affective disorders.Vancampfort D has investigated the relationship between schizophrenia, bi-directional affective disorders, and depression, primarily through systematic reviews and meta-analyses. The relationship between lifestyle, physical activity levels and metabolic syndrome, diabetes, etc. in patients.Correll CU et al. reviewed and made recommendations on the prevalence, morbidity and mortality of cardiovascular disease in patients with bi-directional affective disorder.Firth J focused on the impact of lifestyle, such as physical activity, sleep, and diet, on patients with bi-directional affective disorder and the possible risks they may be exposed to.

Our analysis of co-occurring keywords showed that the four most commonly used keywords were Bipolar disorder, Schizophrenia, physical activity, and major depressive disorder.

Physical Activity Affects People with Schizophrenia

According to Ferrari (2022), schizophrenia, a kind of persistent psychotic disease, has the greatest rates of impairment among all mental disorders. Prior studies have established that exercise is a crucial approach to tackle physical health issues and premature death in individuals with schizophrenia. Numerous global guidelines advocate for the encouragement and incorporation of exercise in regular psychiatric care(Calder et al., 2022; Firth et al., 2019; Stubbs et al., 2018). Exercise therapies may provide several advantages for mental health and physical well-being, which is a distinct characteristic not present in current psychosocial treatments for schizophrenia. Exercise has been shown to have many good effects on individuals with schizophrenia, including enhancing mood, cognition, and both positive and negative symptoms of the condition(Dauwan et al., 2016; Firth, Torous, et al., 2017; Sabe et al., 2020).In their study, Shimada (2022), shown a substantial improvement in general cognition, attention/vigilance, working memory, and language learning among individuals diagnosed with schizophrenia as a result of engaging in aerobic exercise. Findings from a meta-analysis of five prospective studies indicate that increased levels of physical exercise are linked to a reduced likelihood of developing psychosis or schizophrenia(Brokmeier et al., 2020).

Physical Activity Effects on People with Bipolar Disorder

Bipolar disorder is a debilitating and persistent mental condition marked by recurring periods of depressed, manic, and hypomanic states. The available research regarding the preventive benefits of physical exercise in bipolar illness and schizophrenia is weak and contradictory. A prospective research conducted by Strohle(2007) discovered that those with higher levels of physical activity had an increased probability of acquiring bipolar disorder throughout the follow-up period. A Mendelian randomisation research conducted by Sun(2020) revealed that physical exercise had a causal protective effect on bipolar illness, with an odds ratio of 0.49 and a 95% confidence interval of 0.31-0.76. Additional study is anticipated to provide novel perspectives on this subject. Sá Filho(2020)reported similar effects of medication and aerobic exercise in reducing symptoms of mood disorders, suggesting the potential of exercise in controlling and stabilising mood. Thus, there are many reasons to believe that improving cardiorespiratory fitness (VO 2max) could be an important means of protecting against physical and mental impairment in patients with bipolar disorder (BD) and reducing the likelihood of such impairment

The Effect of Physical Activity on People with Major Depressive Disorder

According to meta-analyses conducted by Schuch(2016), exercise has been shown to be helpful in decreasing depressive symptoms in individuals with depression, including those with subclinical symptoms or a diagnosis of major depression. For those with major depression, the effect was larger compared to controls who lacked physical activity (SMD = 1.13, 95% CI = 0.46-1.81).According to some investigations, the positive benefits of exercise treatments on depression may decrease as the duration of exercise increases(Kvam et al., 2016).Nevertheless, persons who consistently participate in physical activities of moderate intensity have a reduced likelihood of experiencing depression(Mammen & Faulkner, 2013; Schuch et al., 2018).

A keyword clustering diagram was created using the findings of the research, focusing on the impact of physical activity on the quality of life in individuals with bipolar disorder. Cluster #0 represents this relationship. The findings of the research examining the relationship between physical activity and quality of life in individuals with bipolar disease suggest that there is a need to enhance the level of physical activity among bipolar disorder patients. Moreover, it has been shown that there is a positive correlation between the level of physical activity and the psychological well-being of patients.

Physical activity (PA) has been shown to decrease depression symptoms and enhance the quality of life in individuals diagnosed with bipolar illness, as shown by studies conducted by Marquez (2020), and D'Angelantonio (2022). Research conducted by Bauer et al (2016), has shown that health promotion interventions, such as engaging in physical activity and adopting a healthy diet, can enhance the quality of life and facilitate weight loss in individuals diagnosed with bipolar disorder. The study specifically examined the correlation between physical activity levels and quality of life in individuals with bipolar disorder who were monitored at the CMHC. Engaging in more physical exercise was linked to improvements in both persons' mental health and overall quality of life. The results of our study align with the existing body of research. In a study conducted by Vancampfort and his colleagues (2017), it was shown that engaging in 150 minutes of physical exercise per week has a beneficial effect on the overall quality of life, including physical, psychological, social, and environmental aspects, for

those diagnosed with bipolar illness. Individuals diagnosed with bipolar illness who engaged in physical exercise had reduced depression symptoms and improved overall quality of life (Ashton et al., 2020).

Cluster #8 Youth highlights the field's significant concern on the prevalence of bipolar illness in young individuals. Bipolar disorder (BPSD) is a chronic and recurring mental disorder that encompasses various types, including bipolar disorder type 1 (BD1), bipolar disorder type 2 (BD2), cyclothymic affective disorder (CYC), and other specified bipolar and related disorders (OSBARD) (Brickman & Fristad, 2022). This condition can significantly impair one's quality of life and is associated with increased rates of hospitalization and suicide. When bipolar disorder occurs in young people, a number of terms have been used to describe it, including prepubertal, adolescent, childhood, or juvenile bipolar disorder (Comsa et al., 2022). Bipolar disorder in adolescents is more likely to exhibit rapid cycling and mixed states, and the intensity and duration of symptoms are more likely to fluctuate, making an accurate diagnosis less likely than in adults.BPSD was once thought to be primarily an adult disorder, but it is now recognised that BPSD occurs not only in adults, but in adolescents as well. While the average prevalence of BD1 or classic BD in adolescents is only 0.6%, considering all BPSD subtypes, the international prevalence increases to approximately 3.9% (Van Meter & Cosgrove, 2019). The presence of OSBARD (the predominant subtype among adolescents) in the study is noteworthy due to the comparable levels of impairment observed in these adolescents compared to those with BD1. Additionally, there is a relatively high probability (approximately 30-50%) of these individuals transitioning to either BD1 or BD2 within a span of 5-8 years(Axelson et al., 2011; Birmaher et al., 2018). Although BPSD is known to have significant morbidity and fatality rates, almost 50% of afflicted adolescents do not get treatment (Khazanov et al., 2015; Merikangas et al., 2011).

Clusters number 1, number 3, and number 4 Classification of diseases linked to bipolar illness. Individuals with bipolar disorder have a higher prevalence of general diseases compared to individuals of the same age in the general community. Patients with bipolar illness have a cardiovascular risk that is about two times higher than that of the general population. Accurate evaluation of diabetes and lipid problems, which often coexist with bipolar illness(Marzani & Price Neff, 2021). A prior research showed that the incidence of co-morbidity between BD and other medical disorders was roughly 96.3 percent(Sinha et al., 2018). A separate research revealed that over 60% of individuals diagnosed with BD had comorbidity with various medical problems(Yatham et al., 2018). Furthermore, Jolfaei (2019) discovered that the incidence of BD was significantly greater in patients with medical disorders compared to the whole population. BD is linked to several systemic disorders, and individuals with BD often have various medical issues (Wang et al., 2022). Presently, the co-morbidities of BD that have been documented in both research and clinical practice include brain disorders, cardiovascular diseases, respiratory diseases, genitourinary diseases, endocrine diseases, haematological diseases, infectious diseases, and other systemic diseases.The relationship between BD and co-morbidities of medical conditions seems to be reciprocal (SayuriYamagata et al., 2017).

The second kind of interventions is cognitive interventions. Initial findings indicate that engaging in aerobic exercise may augment the efficacy of cognitive remediation in improving cognitive functioning among patients with severe mental illness (Quigley et al., 2020). There

is a notion suggesting that the enhanced cognitive performance linked to higher levels of physical activity is influenced by an elevation in brain-derived neurotrophic factor (BDNF) (Nuechterlein et al., 2023). Physical exercise is considered a promising non-pharmacological treatment approach to enhance clinical symptoms and cognitive impairments in individuals diagnosed with schizophrenia (Chang et al., 2024). Studies have shown that physical activity helps alleviate symptoms of despair and anxiety in individuals diagnosed with schizophrenia (Schuch et al., 2016). Dauwan (2016) conducted a study that examined the impact of exercise on clinical symptoms and functioning. They employed several forms of exercise and compared them to both active and passive control conditions. Their research substantiated that physical activity had substantial advantages on positive, negative, and clinical symptoms, depressive symptoms, quality of life, and overall functioning in individuals diagnosed with schizophrenia. In their study, Sabe (2020), performed a meta-analysis of 17 research and determined that aerobic exercise is more effective than other forms of exercise in enhancing negative symptoms in individuals with schizophrenia. Furthermore, physical activity triggers alterations in the brain structure of individuals diagnosed with schizophrenia and has an impact on their cognitive abilities. Individuals diagnosed with schizophrenia observe a rise in the size and blood circulation of the hippocampus following engagement in exercise training(Pajonk et al., 2010). Additionally, there is an elevation in the levels of brain-derived neurotrophic factor (BDNF)(Ahmed et al., 2015), as well as an enhancement in neuroplasticity(Kimhy et al., 2014). Exercise enhances cognitive abilities such as attention, processing speed, memory, working memory, and executive functioning in individuals diagnosed with schizophrenia (Firth, Stubbs, et al., 2017; Kimhy et al., 2014; Pajonk et al., 2010)

The length and frequency of exercise may have an impact on the advantages it provides for clinical symptoms, neurocognitive functioning, and everyday functioning in people with schizophrenia (Firth et al., 2015). In their study, Firth et al (2017), investigated the impact of aerobic exercise on cognitive functioning in individuals diagnosed with schizophrenia. Their findings highlighted a notable and favorable relationship between the quantity of exercise and improvements in cognitive abilities. In this study, Girdler et al (2018), examined how aerobic exercise impacts cognitive functioning in individuals with schizophrenia. this findings reinforce a strong and favorable relationship between the level of exercise and improvements in cognitive abilities. The study conducted in 2019 emphasized the notable impact of organized exercise treatments and emphasized that prescribing exercise is a crucial element in altering the clinical symptoms of individuals with schizophrenia. There is no text provided.

Citation explosiveness of keywords is a bellwether of research frontiers. Through a comprehensive analysis of the latest keyword bursts, we identified two emerging trends in the field of physical activity and bipolar disorder research: association (correlation, causation, correlates of BP episodes and relapses) and disorder (diabetes and heart disease).

Within the examination of keyword explosiveness, the terms with the highest level of explosiveness were very effective in spotting emerging trends and variations. Anxiety, addiction, and social support exhibited the most pronounced surges, all surpassing a value of 3, which might be used as a forefront and aligns with the current areas of intense investigation in phase III. Here, we outline three upcoming areas of research: Firstly, it is important to incorporate the intricate connections between sleep and substance addiction, mental health, and diet quality, including their potential roles in mediating or moderating these relationships.

Secondly, researchers should undertake longitudinal studies or randomized controlled trials to determine the factors that influence sleep and the negative consequences it may have, as well as to discover effective interventions for sleep issues, particularly in diverse populations. Lastly, additional research should be conducted to enhance the reliability of findings by utilizing objective assessment tools like polysomnography or activity loggers.

Conclusions

To summarize, this study has examined and analyzed the relevant literature in the area of physical exercise and bi-directional affective disorder, highlighting the key areas of research focus and cutting-edge advancements. The current areas of focus in study include investigating the frequency of bipolar illness in various communities and exploring the intricate connection between physical exercise, bipolar disorder, and other medical conditions. Conducting longitudinal investigations and randomised controlled trials is essential in order to expand upon the present study results. This study offers researchers guidelines and references to help them consider and establish the trajectory of their research, so minimizing the need to extensively examine the limits of the topic. By tailoring treatments and behaviors, educators and clinicians may enhance the physical and emotional well-being of individuals with bipolar illness. Furthermore, it is essential to foster increased cooperation among nations, organizations, and scholars in order to carry out more comprehensive investigations. The primary objective of all research endeavors is to maintain the well-being of individuals and provide a superior standard of living.

References

Ahmed, A. O., Mantini, A. M., Fridberg, D. J., & Buckley, P. F. (2015). Brain-derived neurotrophic factor (BDNF) and neurocognitive deficits in people with schizophrenia: a meta-analysis. *Psychiatry Res*, *226*(1), 1-13. https://doi.org/10.1016/j.psychres.2014.12.069

AS, S. F., Cheniaux, E., Paula, C. C., Murillo-Rodriguez, E., Teixeira, D., Monteiro, D., Cid, L., Yamamoto, T., Telles-Correia, D., Imperatori, C., Budde, H., & Machado, S. (2020). Exercise is medicine: a new perspective for health promotion in bipolar disorder. *Expert Rev Neurother*, *20*(11), 1099-1107. https://doi.org/10.1080/14737175.2020.1807329

Ashton, M. M., Mohebbi, M., Turner, A., Marx, W., Berk, M., Malhi, G. S., Ng, C. H., Cotton, S. M., Dodd, S., Sarris, J., Hopwood, M., Stubbs, B., & Dean, O. M. (2020). Physical Activity as a Predictor of Clinical Trial Outcomes in Bipolar Depression: A Subanalysis of a Mitochondrial-Enhancing Nutraceutical Randomized Controlled Trial. *Can J Psychiatry*, *65*(5), 306-318. https://doi.org/10.1177/0706743719889547

Axelson, D. A., Birmaher, B., Strober, M. A., Goldstein, B. I., Ha, W., Gill, M. K., Goldstein, T. R., Yen, S., Hower, H., Hunt, J. I., Liao, F., Iyengar, S., Dickstein, D., Kim, E., Ryan, N. D., Frankel, E., & Keller, M. B. (2011). Course of subthreshold bipolar disorder in youth: diagnostic progression from bipolar disorder not otherwise specified. *J Am Acad Child Adolesc Psychiatry*, *50*(10), 1001-1016.e1003. https://doi.org/10.1016/j.jaac.2011.07.005

Bauer, I. E., Gálvez, J. F., Hamilton, J. E., Balanzá-Martínez, V., Zunta-Soares, G. B., Soares, J. C., & Meyer, T. D. (2016). Lifestyle interventions targeting dietary habits and exercise in bipolar disorder: A systematic review. *J Psychiatr Res*, *74*, 1-7. https://doi.org/10.1016/j.jpsychires.2015.12.006

Birmaher, B., Merranko, J. A., Goldstein, T. R., Gill, M. K., Goldstein, B. I., Hower, H., Yen, S., Hafeman, D., Strober, M., Diler, R. S., Axelson, D., Ryan, N. D., & Keller, M. B. (2018). A Risk Calculator to Predict the Individual Risk of Conversion From Subthreshold Bipolar Symptoms to Bipolar Disorder I or II in Youth. *J Am Acad Child Adolesc Psychiatry*, *57*(10), 755-763.e754. https://doi.org/10.1016/j.jaac.2018.05.023

Bowen, R., Balbuena, L., Baetz, M., & Schwartz, L. (2013). Maintaining sleep and physical activity alleviate mood instability. *Prev Med*, *57*(5), 461-465. https://doi.org/10.1016/j.ypmed.2013.06.025

Brickman, H. M., & Fristad, M. A. (2022). Psychosocial Treatments for Bipolar Disorder in Children and Adolescents. *Annu Rev Clin Psychol*, *18*, 291-327. https://doi.org/10.1146/annurev-clinpsy-072220-021237

Brokmeier, L. L., Firth, J., Vancampfort, D., Smith, L., Deenik, J., Rosenbaum, S., Stubbs, B., & Schuch, F. B. (2020). Does physical activity reduce the risk of psychosis? A systematic review and meta-analysis of prospective studies. *Psychiatry Res*, *284*, 112675. https://doi.org/10.1016/j.psychres.2019.112675

Calder, R. V., Dunbar, J. A., & de Courten, M. P. (2022). The Being Equally Well national policy roadmap: providing better physical health care and supporting longer lives for people living with serious mental illness. *Med J Aust*, *217 Suppl 7*(Suppl 7), S3-s6. https://doi.org/10.5694/mja2.51717

Chang, K. T., Goh, K. K., Latthirun, K., & Yang, C. T. (2024). The effect of exercise on cognition and clinical symptoms of patients with schizophrenia: A systematic review of randomized controlled trial. *Prog Brain Res*, *283*, 255-304. https://doi.org/10.1016/bs.pbr.2024.01.002

Chen, C. (2004). Searching for intellectual turning points: progressive knowledge domain visualization. *Proc Natl Acad Sci U S A*, *101 Suppl 1*(Suppl 1), 5303-5310. https://doi.org/10.1073/pnas.0307513100

Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology*, *57*, 359-377. https://doi.org/10.1002/asi.20317

Chen, C., Dubin, R., & Kim, M. C. (2014). Emerging trends and new developments in regenerative medicine: a scientometric update (2000 - 2014). *Expert Opin Biol Ther*, *14*(9), 1295-1317. https://doi.org/10.1517/14712598.2014.920813

Chen, H., Zhao, G., & Xu, N. (2012). *The Analysis of Research Hotspots and Fronts of Knowledge Visualization Based on CiteSpace II*. https://doi.org/10.1007/978-3-642-32018-7_6

Comsa, M., Anderson, K. N., Sharma, A., Yadav, V. C., & Watson, S. (2022). The relationship between sleep and depression and bipolar disorder in children and young people. *BJPsych Open*, *8*(1), e27. https://doi.org/10.1192/bjo.2021.1076

Cui, L., Tang, W., Deng, X., & Jiang, B. (2023). Farm Animal Welfare Is a Field of Interest in China: A Bibliometric Analysis Based on CiteSpace. *Animals (Basel)*, *13*(19). https://doi.org/10.3390/ani13193143

D'Angelantonio, M., Collins, J. L., Manchia, M., Baldessarini, R. J., & Tondo, L. (2022). Physical exercise, depression, and anxiety in 2190 affective disorder subjects. *J Affect Disord*, *309*, 172-177. https://doi.org/10.1016/j.jad.2022.04.079

Dauwan, M., Begemann, M. J., Heringa, S. M., & Sommer, I. E. (2016). Exercise Improves Clinical Symptoms, Quality of Life, Global Functioning, and Depression in Schizophrenia: A Systematic Review and Meta-analysis. *Schizophr Bull*, *42*(3), 588-599. https://doi.org/10.1093/schbul/sbv164

Dong, Q., Liang, Q., Chen, Y., Li, J., Lu, L., Huang, X., & Zhou, Q. (2021). Bibliometric and Visual Analysis of Vascular Calcification Research. *Front Pharmacol*, *12*, 690392. https://doi.org/10.3389/fphar.2021.690392

Fernandes, B. S., Gama, C. S., Ceresér, K. M., Yatham, L. N., Fries, G. R., Colpo, G., de Lucena, D., Kunz, M., Gomes, F. A., & Kapczinski, F. (2011). Brain-derived neurotrophic factor as a state-marker of mood episodes in bipolar disorders: a systematic review and meta-regression analysis. *J Psychiatr Res*, *45*(8), 995-1004. https://doi.org/10.1016/j.jpsychires.2011.03.002

Firth, J., Siddiqi, N., Koyanagi, A., Siskind, D., Rosenbaum, S., Galletly, C., Allan, S., Caneo, C., Carney, R., Carvalho, A. F., Chatterton, M. L., Correll, C. U., Curtis, J., Gaughran, F., Heald, A., Hoare, E., Jackson, S. E., Kisely, S., Lovell, K.,…Stubbs, B. (2019). The Lancet Psychiatry Commission: a blueprint for protecting physical health in people with mental illness. *Lancet Psychiatry*, *6*(8), 675-712. https://doi.org/10.1016/s2215-0366(19)30132-4

Firth, J., Stubbs, B., Rosenbaum, S., Vancampfort, D., Malchow, B., Schuch, F., Elliott, R., Nuechterlein, K. H., & Yung, A. R. (2017). Aerobic Exercise Improves Cognitive Functioning in People With Schizophrenia: A Systematic Review and Meta-Analysis. *Schizophr Bull*, *43*(3), 546-556. https://doi.org/10.1093/schbul/sbw115

Firth, J., Torous, J., Nicholas, J., Carney, R., Pratap, A., Rosenbaum, S., & Sarris, J. (2017). The efficacy of smartphone-based mental health interventions for depressive symptoms: a meta-analysis of randomized controlled trials. *World Psychiatry*, *16*(3), 287-298. https://doi.org/10.1002/wps.20472

Jolfaei, A., Ataei, S., Ghayoomi, R., & Shabani, A. (2019). High Frequency of Bipolar Disorder Comorbidity in Medical Inpatients. *Iran J Psychiatry*, *14*(1), 60-66.

Khazanov, G. K., Cui, L., Merikangas, K. R., & Angst, J. (2015). Treatment patterns of youth with bipolar disorder: results from the National Comorbidity Survey-Adolescent Supplement (NCS-A). *J Abnorm Child Psychol*, *43*(2), 391-400. https://doi.org/10.1007/s10802-014-9885-6

Khedr, M. A., El-Ashry, A. M., El-Sayed, M. M., Elkot, M. A., & Hussein, R. M. (2024). The effect of physical exercises program on social functioning, alexithymia, and sense of coherence among patients with bipolar disorders: A randomized control trial. *Arch Psychiatr Nurs*, *49*, 83-92. https://doi.org/10.1016/j.apnu.2024.02.002

Kimhy, D., Vakhrusheva, J., Bartels, M. N., Armstrong, H. F., Ballon, J. S., Khan, S., Chang, R. W., Hansen, M. C., Ayanruoh, L., Smith, E. E., & Sloan, R. P. (2014). Aerobic fitness and body mass index in individuals with schizophrenia: Implications for neurocognition and daily functioning. *Psychiatry Res*, *220*(3), 784-791. https://doi.org/10.1016/j.psychres.2014.08.052

Kleinberg, J. (2003). Bursty and Hierarchical Structure in Streams. *Data Mining and Knowledge Discovery*, *7*(4), 373-397. https://doi.org/10.1023/A:1024940629314

Kvam, S., Kleppe, C. L., Nordhus, I. H., & Hovland, A. (2016). Exercise as a treatment for depression: A meta-analysis. *J Affect Disord*, *202*, 67-86. https://doi.org/10.1016/j.jad.2016.03.063

Mammen, G., & Faulkner, G. (2013). Physical activity and the prevention of depression: a systematic review of prospective studies. *Am J Prev Med*, *45*(5), 649-657. https://doi.org/10.1016/j.amepre.2013.08.001

Marquez, D. X., Aguiñaga, S., Vásquez, P. M., Conroy, D. E., Erickson, K. I., Hillman, C., Stillman, C. M., Ballard, R. M., Sheppard, B. B., Petruzzello, S. J., King, A. C., & Powell, K. E. (2020).

A systematic review of physical activity and quality of life and well-being. *Transl Behav Med*, *10*(5), 1098-1109. https://doi.org/10.1093/tbm/ibz198

Marzani, G., & Price Neff, A. (2021). Bipolar Disorders: Evaluation and Treatment. *Am Fam Physician*, *103*(4), 227-239.

Merikangas, K. R., Jin, R., He, J. P., Kessler, R. C., Lee, S., Sampson, N. A., Viana, M. C., Andrade, L. H., Hu, C., Karam, E. G., Ladea, M., Medina-Mora, M. E., Ono, Y., Posada-Villa, J., Sagar, R., Wells, J. E., & Zarkov, Z. (2011). Prevalence and correlates of bipolar spectrum disorder in the world mental health survey initiative. *Arch Gen Psychiatry*, *68*(3), 241-251. https://doi.org/10.1001/archgenpsychiatry.2011.12

Nabavi, B., Mitchell, A. J., & Nutt, D. (2015). A Lifetime Prevalence of Comorbidity Between Bipolar Affective Disorder and Anxiety Disorders: A Meta-analysis of 52 Interview-based Studies of Psychiatric Population. *EBioMedicine*, *2*(10), 1405-1419. https://doi.org/10.1016/j.ebiom.2015.09.006

Nelson, J. M., & Liebel, S. W. (2018). Anxiety and depression among college students with attention-deficit/hyperactivity disorder (ADHD): Cross-informant, sex, and subtype differences. *J Am Coll Health*, *66*(2), 123-132. https://doi.org/10.1080/07448481.2017.1382499

Nuechterlein, K. H., McEwen, S. C., Ventura, J., Subotnik, K. L., Turner, L. R., Boucher, M., Casaus, L. R., Distler, M. G., & Hayata, J. N. (2023). Aerobic exercise enhances cognitive training effects in first-episode schizophrenia: randomized clinical trial demonstrates cognitive and functional gains. *Psychol Med*, *53*(10), 4751-4761. https://doi.org/10.1017/s0033291722001696

Pajonk, F. G., Wobrock, T., Gruber, O., Scherk, H., Berner, D., Kaizl, I., Kierer, A., Müller, S., Oest, M., Meyer, T., Backens, M., Schneider-Axmann, T., Thornton, A. E., Honer, W. G., & Falkai, P. (2010). Hippocampal plasticity in response to exercise in schizophrenia. *Arch Gen Psychiatry*, *67*(2), 133-143. https://doi.org/10.1001/archgenpsychiatry.2009.193

Pedersen, D. E., & Jodin, V. (2016). Stressors associated with the school spillover of college undergraduates. *The Social Science Journal*, *53*(1), 40-48. https://doi.org/10.1016/j.soscij.2014.12.008

Quigley, A., MacKay-Lyons, M., & Eskes, G. (2020). Effects of Exercise on Cognitive Performance in Older Adults: A Narrative Review of the Evidence, Possible Biological Mechanisms, and Recommendations for Exercise Prescription. *J Aging Res*, *2020*, 1407896. https://doi.org/10.1155/2020/1407896

Ridner, S. L., Newton, K. S., Staten, R. R., Crawford, T. N., & Hall, L. A. (2016). Predictors of well-being among college students. *J Am Coll Health*, *64*(2), 116-124. https://doi.org/10.1080/07448481.2015.1085057

Sabe, M., Kaiser, S., & Sentissi, O. (2020). Physical exercise for negative symptoms of schizophrenia: Systematic review of randomized controlled trials and meta-analysis. *Gen Hosp Psychiatry*, *62*, 13-20. https://doi.org/10.1016/j.genhosppsych.2019.11.002

SayuriYamagata, A., Brietzke, E., Rosenblat, J. D., Kakar, R., & McIntyre, R. S. (2017). Medical comorbidity in bipolar disorder: The link with metabolic-inflammatory systems. *Journal of Affective Disorders*, *211*, 99-106. https://doi.org/10.1016/j.jad.2016.12.059

Schuch, F. B., Vancampfort, D., Firth, J., Rosenbaum, S., Ward, P. B., Silva, E. S., Hallgren, M., Ponce De Leon, A., Dunn, A. L., Deslandes, A. C., Fleck, M. P., Carvalho, A. F., & Stubbs, B. (2018). Physical Activity and Incident Depression: A Meta-Analysis of Prospective

Cohort Studies. *Am J Psychiatry*, *175*(7), 631-648. https://doi.org/10.1176/appi.ajp.2018.17111194

Schuch, F. B., Vancampfort, D., Richards, J., Rosenbaum, S., Ward, P. B., & Stubbs, B. (2016). Exercise as a treatment for depression: A meta-analysis adjusting for publication bias. *J Psychiatr Res*, *77*, 42-51. https://doi.org/10.1016/j.jpsychires.2016.02.023

Shimada, T., Ito, S., Makabe, A., Yamanushi, A., Takenaka, A., Kawano, K., & Kobayashi, M. (2022). Aerobic exercise and cognitive functioning in schizophrenia: An updated systematic review and meta-analysis. *Psychiatry Res*, *314*, 114656. https://doi.org/10.1016/j.psychres.2022.114656

Sinha, A., Shariq, A., Said, K., Sharma, A., Jeffrey Newport, D., & Salloum, I. M. (2018). Medical Comorbidities in Bipolar Disorder. *Curr Psychiatry Rep*, *20*(5), 36. https://doi.org/10.1007/s11920-018-0897-8

Ströhle, A., Höfler, M., Pfister, H., Müller, A. G., Hoyer, J., Wittchen, H. U., & Lieb, R. (2007). Physical activity and prevalence and incidence of mental disorders in adolescents and young adults. *Psychol Med*, *37*(11), 1657-1666. https://doi.org/10.1017/s003329170700089x

Stubbs, B., Vancampfort, D., Hallgren, M., Firth, J., Veronese, N., Solmi, M., Brand, S., Cordes, J., Malchow, B., Gerber, M., Schmitt, A., Correll, C. U., De Hert, M., Gaughran, F., Schneider, F., Kinnafick, F., Falkai, P., Möller, H. J., & Kahl, K. G. (2018). EPA guidance on physical activity as a treatment for severe mental illness: a meta-review of the evidence and Position Statement from the European Psychiatric Association (EPA), supported by the International Organization of Physical Therapists in Mental Health (IOPTMH). *Eur Psychiatry*, *54*, 124-144. https://doi.org/10.1016/j.eurpsy.2018.07.004

Sun, H., Gao, X., Que, X., Liu, L., Ma, J., He, S., Gao, Q., & Wang, T. (2020). The causal relationships of device-measured physical activity with bipolar disorder and schizophrenia in adults: A 2-Sample mendelian randomization study. *J Affect Disord*, *263*, 598-604. https://doi.org/10.1016/j.jad.2019.11.034

Van Meter, A., & Cosgrove, V. E. (2019). Overhauling technology-based interventions for young people with bipolar disorder: Lessons learned from adults. *Bipolar Disord*, *21*(1), 86-87. https://doi.org/10.1111/bdi.12716

Vancampfort, D., Firth, J., Schuch, F. B., Rosenbaum, S., Mugisha, J., Hallgren, M., Probst, M., Ward, P. B., Gaughran, F., De Hert, M., Carvalho, A. F., & Stubbs, B. (2017). Sedentary behavior and physical activity levels in people with schizophrenia, bipolar disorder and major depressive disorder: a global systematic review and meta-analysis. *World Psychiatry*, *16*(3), 308-315. https://doi.org/10.1002/wps.20458

Wang, Z., Li, T., Li, S., Li, K., Jiang, X., Wei, C., Yang, L., Cao, H., Li, S., & Li, J. (2022). The prevalence and clinical correlates of medical disorders comorbidities in patients with bipolar disorder. *BMC Psychiatry*, *22*(1), 176. https://doi.org/10.1186/s12888-022-03819-0

Weiner, E., & Weiner, J. (1997). University students with psychiatric illness: Factors involved in the decision to withdraw from their studies. *Psychiatric Rehabilitation Journal*, *20*(4), 88-91. <Go to ISI>://WOS:A1997XN58300014

Wright, K., Armstrong, T., Taylor, A., & Dean, S. (2012). 'It's a double edged sword': a qualitative analysis of the experiences of exercise amongst people with Bipolar Disorder. *J Affect Disord*, *136*(3), 634-642. https://doi.org/10.1016/j.jad.2011.10.017

Yatham, L. N., Kennedy, S. H., Parikh, S. V., Schaffer, A., Bond, D. J., Frey, B. N., Sharma, V., Goldstein, B. I., Rej, S., Beaulieu, S., Alda, M., MacQueen, G., Milev, R. V., Ravindran,

A., O'Donovan, C., McIntosh, D., Lam, R. W., Vazquez, G., Kapczinski, F.,…Berk, M. (2018). Canadian Network for Mood and Anxiety Treatments (CANMAT) and International Society for Bipolar Disorders (ISBD) 2018 guidelines for the management of patients with bipolar disorder. *Bipolar Disorders*, *20*(2), 97-170. https://doi.org/10.1111/bdi.12609

Zhang, X. Y., Ye, F., Yin, Z. H., Li, Y. Q., Bao, Q. N., Xia, M. Z., Chen, Z. H., Zhong, W. Q., Wu, K. X., Yao, J., & Liang, F. R. (2024). Research status and trends of physical activity on depression or anxiety: a bibliometric analysis. *Front Neurosci*, *18*, 1337739. https://doi.org/10.3389/fnins.2024.1337739

Zhang, Z., Zhu, Y., Wang, Q., Chang, T., Liu, C., Zhu, Y., Wang, X., & Cao, X. (2022). Global Trends and Research Hotspots of Exercise for Intervening Diabetes: A Bibliometric Analysis. *Front Public Health*, *10*, 902825. https://doi.org/10.3389/fpubh.2022.902825

Zhou, J., Qu, J., Ji, S., Bu, Y., Hu, Y., Sun, H., Xue, M., Zhou, T., Qu, J., & Liu, Y. (2022). Research trends in college students' sleep from 2012 to 2021: A bibliometric analysis. *Front Psychiatry*, *13*, 1005459. https://doi.org/10.3389/fpsyt.2022.1005459