Trends in research related to anxiety disorders on the autism spectrum: a bibliometric study

Yerco E. Uribe-Bahamonde[1], Anabel Fernandez-Blanco[2], Rosario Spencer-Contreras[2] and Osvaldo Hernández-González[1]

[1]Faculty of Psychology and Institute of Humanistic Studies Juan Ignacio Molina, Universidad de Talca, Talca, Chile; [2]Faculty of Psychology, Universidad de Talca, Talca, Chile

Anxiety disorder is listed as one of the most common diagnoses for people on the autism spectrum, however to date no bibliometric analysis has been conducted on this literature. This study aimed to analyze, from a bibliometric perspective, the production of scientific research published in Web of Science related to anxiety in the autism spectrum. Since 2013, research has grown exponentially and the most important field turned out to be developmental psychology. The main articles in the field address issues related to parenting, mental health and psychiatric comorbidity. Storch EA, USA, Kings College London (UK), *Journal of Autism and Developmental Disorders*, were respectively, the most productive author, country, institution and journal in the field. Keyword analysis revealed a close relationship between autism spectrum disorder, anxiety, and depression, making this a novel research field with interdisciplinary practical implications.

Keywords: anxiety; autism; ASD; mental health; neurodevelopmental disorders; comorbidity; bibliometric analysis; leading authors and journals

Introduction

Autism spectrum disorders (ASDs) represent a group of neurodevelopmental disorders that begins early in life and are characterized by qualitative difficulties in verbal and nonverbal communication, reciprocal social interactions, and restricted or repetitive behaviors (American Psychiatric Association [APA] 2022). The prevalence of ASD has grown exponentially in recent decades, with evidence indicating that one in fifty-nine children will be diagnosed with such condition (Baio et al. 2018). People with ASD experience higher psychiatric comorbidity relative to the general population (Fombonne et al. 2020). Among the most common comorbidities are anxiety disorders (Gordon-Lipkin et al. 2018, Wittkopf et al. 2021). Thus, understanding the clinical overlap of anxiety disorders in ASD has become a relevant research topic for the ASD community (Zaboski and Storch 2018).

In recent decades, multiple studies have been developed regarding the prevalence of anxiety disorders in children and young people diagnosed with ASD (Costello et al. 2005, Leyfer et al. 2006, Somers et al. 2006, Simonoff et al. 2008). Approximately 40% of children diagnosed with ASD have an anxiety disorder (van Steensel et al. 2011) and another 30–40% have levels of subclinical anxiety that also impact their social skills (Strang et al. 2012, Vasa et al. 2013). As the Autism Priority Setting Association mentions, the high prevalence of anxiety disorders in ASD requires urgent attention, since this clinical overlap has been reported to reduce quality of life and interfere with education and the ability to interact socially (South et al. 2017). Also, the behavioral problems of people with ASD may be aggravated due to the presence of anxiety comorbidity (Halim et al. 2018).

In the literature, it is possible to observe a wide range of hypotheses about the nature of the relationship between anxiety and ASD symptomatology. For example, it has been proposed that: (a) anxiety could be a consequence of stressful components related to ASD; (b) anxiety and core features of ASD merge and reinforce each other; (c) the stressful components associated with the ASD generate anxiety which, in turn, further exacerbates the core symptoms of the ASD; (d) anxiety may play a moderating role leading to increased severity of ASD disruptive behaviors and (e) anxiety could be at the core of ASD symptomatology (Wood and Gadow 2010). In light of these hypotheses, attempts have been made to explain 'typical' anxious

Correspondence to: Osvaldo Hernández-González, Faculty of Psychology and Institute of Humanistic Studies Juan Ignacio Molina, Universidad de Talca, Talca, Chile. Email: osvaldo.hernandez@utalca.cl

DOI 10.1080/20473869.2023.2283649

behaviors (anxiety symptoms common in people who are not marked by ASD) and 'atypical' (anxiety symptoms that are specifically related to ASD symptomatology) anxious behaviors (Kerns et al. 2014). However, the relationship of anxiety (clinical and subclinical) and ASD is very complex and still in progress to be better understood.

The guidelines provided in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) on anxiety disorders and ASD have prompted a new and necessary update on the diagnostic and research trajectory in both disorders (APA 2022). In relation to ASD, the clustering of the subgroups of ASD and Asperger syndrome in a broader and more open diagnostic category (Autism Spectrum Disorder) provides a more comprehensive and realistic view of the disorder. The organization and clarity of the chapters on anxiety disorders have been revised. As a result, the subtypes of anxiety, such as obsessive-compulsive disorder, acute stress, and post-traumatic stress, have been removed. On the other hand, separation anxiety disorders and selective mutism have been added (APA 2022). These changes have prompted a significant increase in research and clinical practice addressing both categories and especially their concurrence (Kupfer 2015).

After the publication of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), systematic reviews and meta-analyses have been carried out. Spain et al. (2018) conducted a systematic review of 24 studies, concluding that the comorbidity of social anxiety and ASD is associated with poorer social skills, competence, and social motivation. Van Steensel and Heeman (2017) conducted a meta-analysis of 83 articles in which it was demonstrated that children with ASD had higher levels of anxiety compared to children with neurotypical development and this difference increased with IQ. In addition, regarding the treatment, Ung et al. (2015) carried out a meta-analysis of 14 studies where they concluded that Cognitive Behavioral Therapy reduces anxiety symptoms in young people with high-functioning ASD. However, to our knowledge, none of these reviews has analyzed how the literature related to anxiety in the autism spectrum has evolved from a bibliometric perspective. Due to the need to bring new evidence to the research related to anxiety in ASD from a more in-depth perspective, this study complements the previous literature with a bibliometric review of the research carried out since the publication of the DSM-5. This is the first study that aims to analyze, from a bibliometric perspective, the production of scientific research published in Web of Science (WoS) related to anxiety in the autism spectrum. The contribution of this study lies in the orientation of the researchers by proposing an ordered and updated base on the literature related to anxiety in ASD; since a bibliometric analysis allows researchers to acquire more knowledge about research trends, information about the contribution of a particular country, institution or journal to a given topic and at the same time, sheds lighter on co-authorship and collaboration.

Method

The analysis used in this paper is descriptive, cross-sectional, and retrospective. By conducting a study for all documents, which generates both a categorization and a subsequent systematic description of indicators to evaluate and measure each of the questions posed (Table 1), presenting the information from the general to particular.

The search as well as the exclusion and inclusion criteria for selected documents were developed based on the PRISMA methodology (Moher et al. 2009) (see Figure 1). The process of data collection for this research centered around the use of the term 'Anxiety', which was systematically introduced into the WoS search system. The objective was to draw upon a wide range of academic literature pertaining to various manifestations of anxiety disorders and their intersection with autism. To perform a meticulous and in-depth exploration of the available resources, we employed a specific search strategy targeting several subcategories of anxiety. Each of these categories was searched in conjunction with 'autism'. These categories were: Anxiety disorder, Social anxiety disorder, Agoraphobia, Panic disorder, Selective mutism, Specific phobia disorder, Generalized anxiety disorder, Separation anxiety disorder. For each category, the search was formulated as: 'TS = autism and TS ="[specific anxiety disorder]"'. This search strategy was refined further by including only document types like 'Article' and 'reviews' and explicitly excluding documents published in the year 2022. The chosen databases for this search strategy were SCI-EXPANDED, SSCI, A&HCI, and ESCI, which encompass a comprehensive spectrum of academic disciplines.

This focused approach was used to ensure that only original articles, which often serve as primary information sources and reflect the current research in each country, were included in the study. Furthermore, these articles are likely to have been subjected to rigorous academic scrutiny and may have benefited from funding through national or international agencies, thus reinforcing their credibility and reliability.

The inclusion of original articles in our search is crucial, as these contributions offer robust and updated insights into the problem, which can be instrumental in informing decisions at local, national, or global levels. These decisions may be related to developing therapeutic interventions, informing public policy, or shaping future research directions in the realm of autism and anxiety disorders.

Table 1. Specific questions, relevance, and methods used in the study.

Questions	Relevance	Method
Q1- What is the trend of publications related to Autism/Anxiety after the DSM-5 Publication?	The number progress of publications and their citations are useful for the researcher to know the evolution of the field, supplying information that helps to interpret other analyses aimed at predicting future research topics.	Production count (Waltman and van Eck 2015).
Q2- What are the publications about Autism/Anxiety with the greatest impact after the DSM-5 Publication?	Citation numbers provide researchers with the most influential documents within a field, thus supplying argumentative and theoretical pillars on the subject.	Citation analysis (Lawani 2012).
Q3- Which countries/institutions have contributed to Autism/Anxiety after the DSM-5 Publication?	Finding the countries, institutions, and research centers with the most contributions and citations, along with the degree of international collaboration, helps researchers to make strategic decisions for future international project proposals, both educational and research.	Production count, citation analysis and collaboration indicators.
Q4-, Which are the most relevant scientific journals, related to Autism/Anxiety after the DSM-5 Publication?	Knowing the journals that concentrate the most information on the subject and receive the most citations help the researcher to organize knowledge and find the best evaluation groups for their research.	Production count, citation analysis (Quevedo-Blasco et al. 2021).
Q5- Who are the most important authors in Autism/Anxiety research after the DSM-5 Publication?	Knowing the most relevant and cited authors on the subject helps researchers find the authors to follow and establish thematic axes according to their path.	Production count, citation analysis.
Q6- What are the collaborative structures of leading authors on Autism/Anxiety after the DSM-5 Publication?	The diverse structures of collaboration by the most relevant authors make visible the groups of studies that help the construction of knowledge and thus broaden the spectrum of relevant authors for research collaboration.	Co-authorship network.
Q7- What are the topics and how has their research focused on Autism/Anxiety after the DSM-5 Publication?	Knowing both the conceptual structure of knowledge of the topic provides researchers with the main research topics worked on, in addition to being able to find knowledge gaps that would provide future development opportunities.	Joint word or co-word analysis, elaborated on research (Batagelj and Mrvar 1999, Van Eck and Waltman 2010).

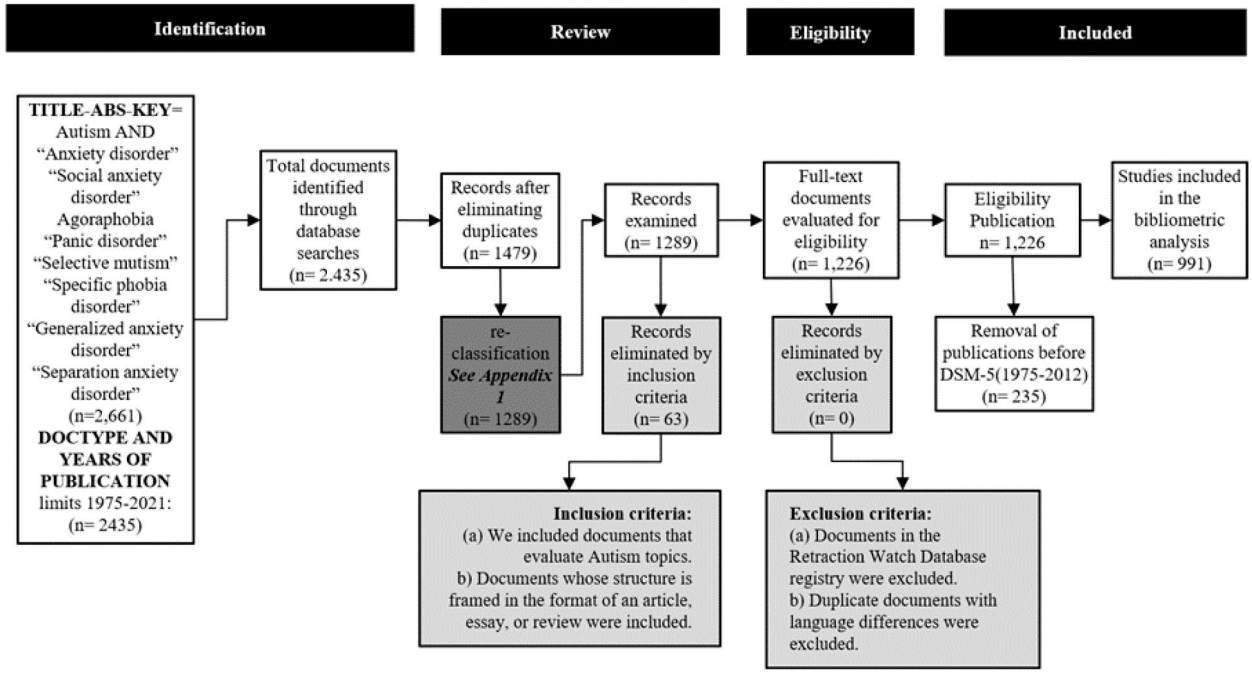

Figure 1. Flowchart showing the process of selection and filtering of documentation in the Web of Science.

The database was corrected and standardized to eliminate transcription errors, duplication of documents, check the atomicity of the information and discard missing data or undeclared identifications (Kent 1983). The sample of scientific and relational production indicators, as well as tables and graphs, were elaborated and calculated in *Microsoft Excel,* then contrasted with *R* and *biblioShiny bibliophilycs package* (Aria and Cuccurullo 2017) and VOSviewer—Visualizing scientific landscapes. Finally, all graphics were standardized in *Adobe Illustrator 2021*. All the processed data were obtained from the databases where each of the documents is indexed.

Results

The following results consider three essential axes: document productivity, authors, and affiliations, as well as their relational and thematic evolution. Therefore, bibliometric, citation, collaboration, and relational indicators will be presented.

The existing relationships in the documentations regarding anxiety disorders show strong associations between developmental psychology and the following areas: special education, psychiatry, and rehabilitation (Figure 2). These categories are well-established in the registry, and their strength of association may be attributed to the broad production and thematic subdivision of the categories, rather than direct content association. Despite the overlap between categories, these associations are significant, with links of over 40% in both the overall sum and individual sum of categories.

Papers in the field of study

WoS contains documentation from 1975 to the present date. After applying the inclusion and exclusion criteria, a total of 1226 articles were obtained from the timeframe of 1994 to 2021 (Figure 3). An analysis of scientific productivity and impact (citations) over time reveals a significant increase in production starting from 2004, with accelerated growth after 2013. It is worth noting the potential impact of the publication of DSM-5 in the same year (APA 2013).

In Figure 4, we have implemented a reclassification system for the documents, grouping them into five primary categories, each representing a distinct aspect of research on the connection between anxiety disorders and autism. The creation of these categories was guided by the overall scope and specific focus of the document, as well as their relevance and contribution to the broader understanding of the interplay between autism and anxiety disorders.

'Study including Anxiety + Autism': This category includes research studies that primarily focus on the co-occurrence or interrelation of anxiety disorders and autism. Such documents could encompass both empirical studies and reviews that examine the prevalence, manifestation, or management of anxiety within the autistic population.

'Anxiety Disorder': The second category is dedicated to documents that primarily focus on anxiety disorders, contributing indirectly to our understanding of anxiety in individuals with autism. This category, with 196 documents, covers a broad spectrum of research on anxiety disorders and their various forms, symptomatology, causes, or treatment.

'Contributing indirectly to the understanding of Anxiety in Autism': This category comprises 176 documents that, while not directly focusing on the co-occurrence of anxiety and autism, provide valuable insights that contribute to a fuller understanding of how anxiety manifests in autistic individuals.

'Animal models of ASD with anxiety recording': This category, with 146 documents, captures studies using animal models to understand autism and comorbid anxiety. This includes research using mice, rats, or other animals to explore the neurobiology, genetics, or behavioral aspects of anxiety in autism.

'Anxiety in relatives of individuals with ASD': This category, encompassing 115 documents, includes studies that explore the experience of anxiety in family members of individuals with autism, recognizing the potential psychosocial impacts and the implications for familial mental health.

We developed the timeframe for the analysis by examining research created since the publication of the DSM-5 and applying the inclusion and exclusion criteria according to the PRISMA methodology. The resulting timeframe encompasses 2013 to 2021 (2022–current is not included as it was in progress at the time of analysis). Our bibliometric analysis yielded insightful observations regarding the scope, authorship trends, collaboration patterns, and impact within the body of literature focusing on Autism/Anxiety. Table 2 provides a detailed summary of these findings. 'Scope of the Literature': The analysis incorporated 991 documents, published across 337 different journals between 2013 and 2021. The depth and breadth of research are signified by a wide array of keywords, with 1967 unprocessed keywords and an additional 2174 'keywords Plus' employed across these documents, illustrating the extensive range of research topics within this sphere. 'Authorship Trends': The selected corpus was authored by 3706 unique authors, highlighting the large pool of researchers contributing to this domain. The data reveals that single-authorship is relatively rare, with only 24 authors publishing single-authored documents, while the majority (3686 authors) engage in multi-authored works. 'Collaboration Patterns': The data uncovers high levels of collaboration in this research field. The mean number of authors per document is 3.74, while the average number of co-authors per document stands at 5.13. Furthermore, the collaboration index is 3.82,

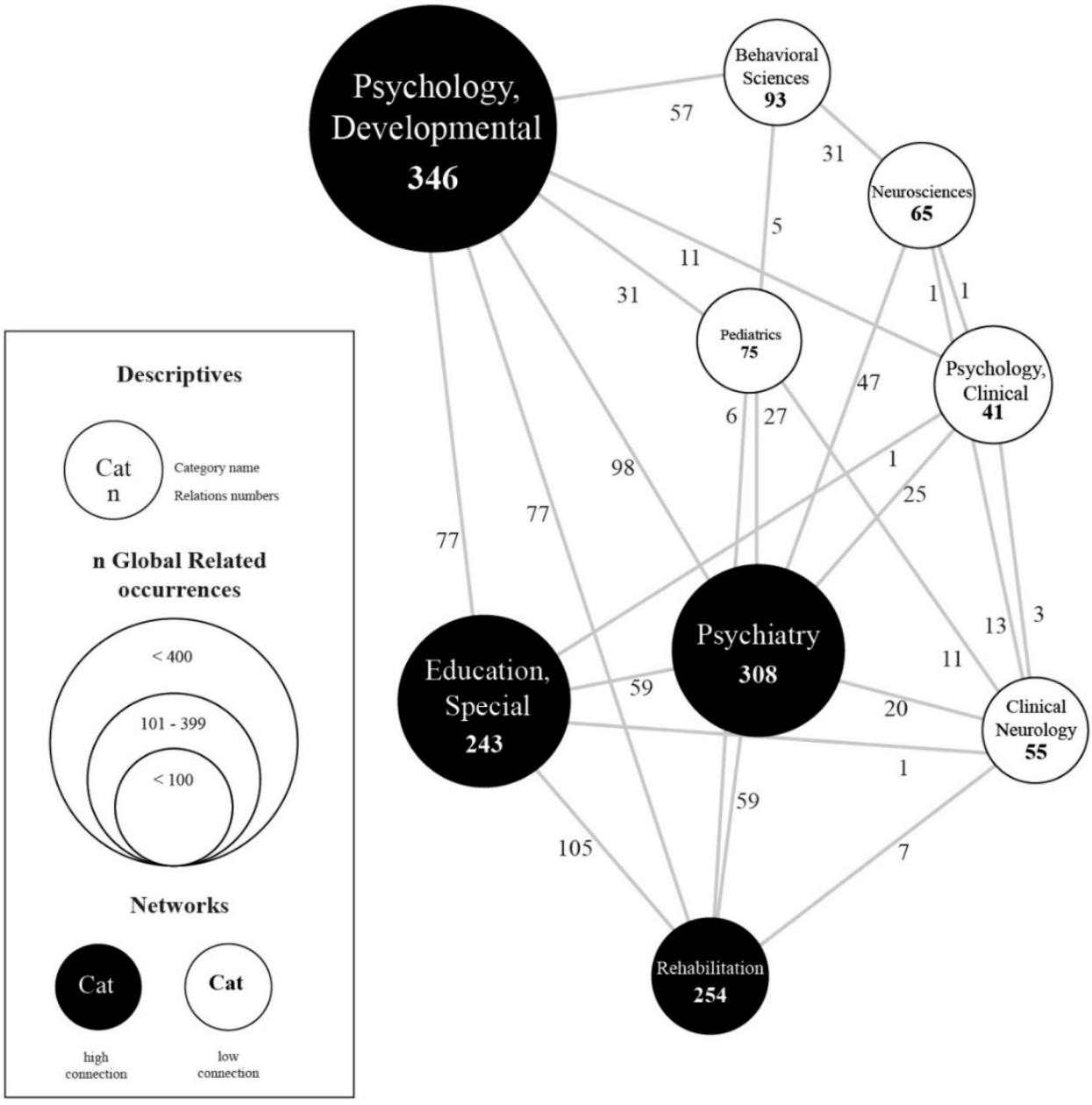

Figure 2. List of the main categories of the journals where Autism/Anxiety is published in the Web of Science documentation and their interrelationships.

demonstrating a strong inclination toward collaborative research. This trend resonates with the growing emphasis on collective expertise to address complex research issues in contemporary scientific inquiries. 'Research Impact': The academic influence of this corpus is denoted by an average citation count of 31 per document. This underlines the relevance and recognition of this body of literature within the larger research community.

In Table 3, we can see the documents with the highest number of citations historically and their average number of citations per year (normalized), the most cited documents globally are: 'The Health Status of Adults on the Autism Spectrum' (347 citations), pertaining to the Autism classification, the study is written by Croen et al. in 2015, the paper describes medical and psychiatric conditions among a population of adults with autism in the United States, finding that most medical conditions were more common in adults with autism. Followed by a 205-citation paper by Joshi G. et al. published in the *Journal of Autism and Developmental Disorders* entitled: 'Psychiatric Comorbidity and Functioning in a Clinically Referred Population of Adults with Autism Spectrum Disorders', which contrasted participants with and without ASD with measures assessing psychosocial functioning and psychiatric comorbidity, finding high levels of comorbidity and psychiatric dysfunction comparable to those in a population of adults without ASD.

Among the most effective documents—more citations in fewer years—, the systematic review and meta-analysis entitled: 'Prevalence of co-occurring mental health diagnoses in the autism population' with 185 citations for document published in 2019 written by Lai et al. and the

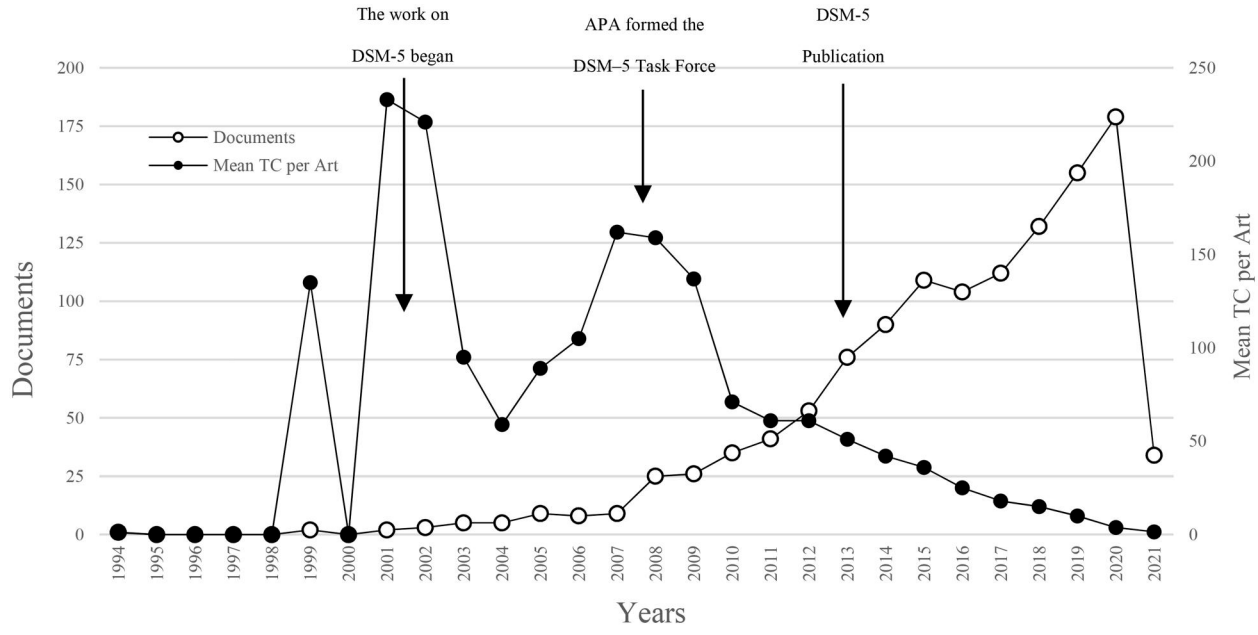

Figure 3. General scientific production about autism (1994–2021). Mean TC per Art: mean times cited per article.

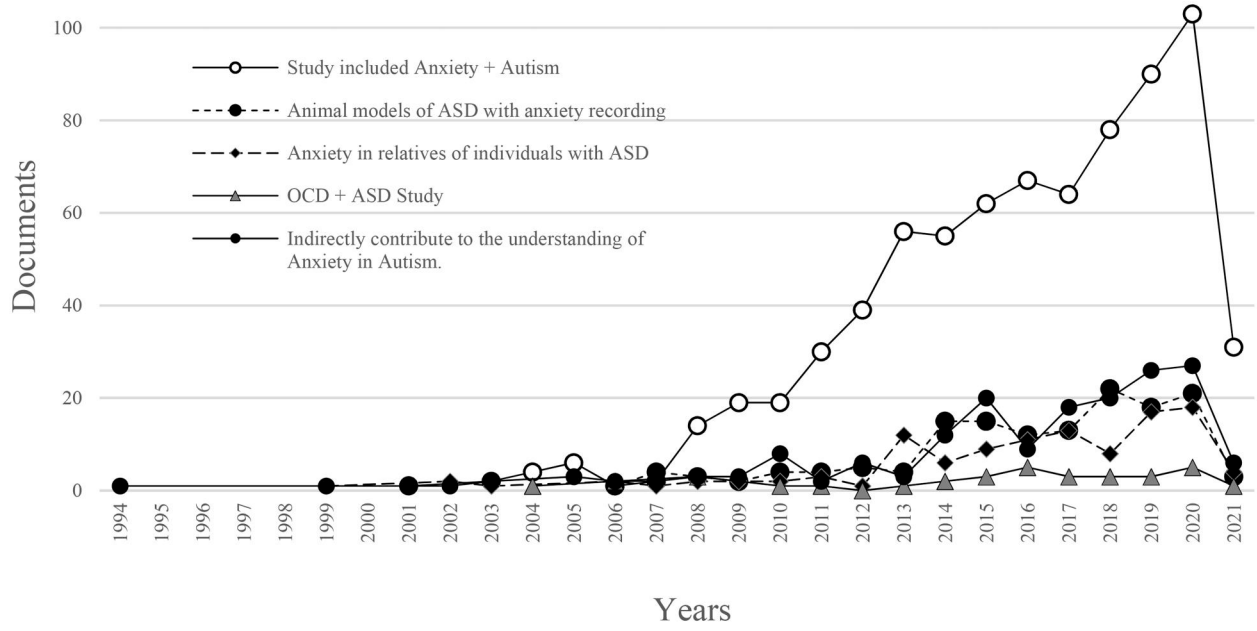

Figure 4. Scientific production of the categories' reclassifications filters (1994–2021). ASD: autism spectrum disorder; OCD: obsessive-compulsive disorder.

Table 2. Specific information data applying exclusion and inclusion criteria.

Category	Description	Results
Main information	Documents	991
	Journals	337
	Timespan	2013:2021
	Average citations per document	31
Document contents	Keywords (unprocessed)	1967
	Keywords plus	2174
Authors	Authors	3706
	Author appearances	5085
	Authors of single-authored documents	24
	Authors of multi-authored documents	3686
Collaboration	Documents per author	0.267
	Authors per document	3.74
	Co-authors per documents	5.13
	Collaboration index	3.82
	Single-authored documents	26

Table 3. Most cited papers within scientific production/output in associated themes with anxiety disorders (2013–2021).

Document	Category	Doi	Total citations	TC per Year	Normalized TC
Croen LA, 2015, *Autism* (Croen et al. 2015)	Anxiety + Autism	10.1177/1362361315577517	347	43.3	95.9
Joshi G, 2013, *J Autism Dev Disord* (Joshi et al. 2013)	Anxiety + Autism	10.1007/s10803-012-1679-5	205	20.5	40.0
Mazurek MO, 2013, *J Abnorm Child Psychol* (Mazurek et al. 2013)	Anxiety + Autism	10.1007/s10802-012-9668-x	196	19.6	38.2
Lai MC, 2019, *Lancet Psychiatry* (Lai et al. 2019)	Anxiety + Autism	10.1016/S2215-0366(19)30289-5	195	48.7	185.0
Lai MC, 2015, *Lancet Psychiatry* (Lai and Baron-Cohen 2015)	Indirectly contribute to the understanding	10.1016/S2215-0366(15)00277-1	182	22.7	50.3
Lever AG, 2016, *J Autism Dev Disord* (Lever and Geurts 2016)	Anxiety + Autism	10.1007/s10803-016-2722-8	177	25.3	68.3
Kerns CM, 2014, *J Autism Dev Disord* (Kerns et al. 2014)	Anxiety + Autism	10.1007/s10803-014-2141-7	154	17.1	36.2
Buck TR, 2014, *J Autism Dev Disord* (Buck et al. 2014)	Anxiety + Autism	10.1007/s10803-014-2170-2	154	17.1	36.2
Wigham S, 2015, *J Autism Dev Disord* (Wigham et al. 2015)	Anxiety + Autism	10.1007/s10803-014-2248-x	153	19.1	42.3
Liu Z, 2016, *Nature* (Liu et al. 2016)	Animal models of ASD with anxiety recording	10.1038/nature16533	152	21.7	58.6
Dykens EM, 2014, *Pediatrics* (Dykens et al. 2014)	Anxiety in relatives of individuals with ASD	10.1542/peds.2013-3164	141	15.6	33.1
Kataoka S, 2013, *Int J Neuropsychopharmacol* (Kataoka et al. 2013)	Animal models of ASD with anxiety recording	10.1017/S1461145711001714	138	13.8	26.9
Garfinkel SN, 2016, *Biol Psychol* (Garfinkel et al. 2016)	Anxiety + Autism	10.1016/j.biopsycho.2015.12.003	137	19.6	52.8
Hollocks MJ, 2019, *Psychol Med* (Hollocks et al. 2019)	Anxiety + Autism	10.1017/S0033291718002283	133	33.2	126.1
Boulter C, 2014, *J Autism Dev Disord* (Boulter et al. 2014)	Anxiety + Autism	10.1007/s10803-013-2001-x	132	14.7	31.0
Salazar F, 2015, *J Autism Dev Disord* (Salazar et al. 2015)	Anxiety + Autism	10.1007/s10803-015-2361-5	131	16.4	36.2
Woehr M, 2015, *Transl Psychiatr* (Wöhr et al. 2015)	Animal models of ASD with anxiety recording	10.1038/tp.2015.19	129	16.1	35.6
Storch EA, 2013, *J Am Acad Child Adolesc Psychiatr* (Storch et al. 2013)	Anxiety + Autism	10.1016/j.jaac.2012.11.007	125	12.5	24.3
Falk NH, 2014, *J Autism Dev Disord* (Falk, Norris, and Quinn 2014)	Anxiety in relatives of individuals with ASD	10.1007/s10803-014-2189-4	124	13.8	29.1

Table 4. Most locally cited papers within scientific production/output in associated themes with anxiety disorders (2013–2021).

Document	Doi	Local citations (LC)	Global citations (GC)	LC/GC ratio (%)
Kerns CM, 2014, *J Autism Dev Disord* (Kerns et al. 2014)	10.1007/s10803-014-2141-7	75	154	48.70
Hallett V, 2013, *J Autism Dev Disord* (Hallett et al. 2013)	10.1007/s10803-013-1775-1	53	94	56.38
Lecavalier L, 2014, *J Autism Dev Disord* (Lecavalier et al. 2014)	10.1007/s10803-013-1974-9	51	92	55.43
Sukhodolsky DG, 2013, *Pediatrics* (Sukhodolsky et al. 2013)	10.1542/peds.2013-1193	49	114	42.98
Boulter C, 2014, *J Autism Dev Disord* (Boulter et al. 2014)	10.1007/s10803-013-2001-x	49	132	37.12
Rodgers J, 2016, *Autism Res* (Rodgers et al. 2016)	10.1002/aur.1603	47	91	51.65
Wigham S, 2015, *J Autism Dev Disord* (Wigham et al. 2015)	10.1007/s10803-014-2248-x	42	153	27.45
Joshi G, 2013, *J Autism Dev Disord* (Joshi et al. 2013)	10.1007/s10803-012-1679-5	41	205	20.00
Vasa RA, 2014, *J Autism Dev Disord* (Vasa et al. 2014)	10.1007/s10803-014-2184-9	35	69	50.72
White SW, 2014, *Int J Dev Neurosci* (White et al. 2014)	10.1016/j.ijdevneu.2014.05.012	35	92	38.04
Buck TR, 2014, *J Autism Dev Disord* (Buck et al. 2014)	10.1007/s10803-014-2170-2	32	154	20.78
Croen LA, 2015, *Autism* (Croen et al. 2015)	10.1177/1362361315577517	32	347	9.22
Lever AG, 2016, *J Autism Dev Disord* (Lever and Geurts 2016)	10.1007/s10803-016-2722-8	30	177	16.95
Gotham K, 2013, *Autism Res* (Gotham et al. 2013)	10.1002/aur.1263	29	70	41.43
Russell AJ, 2013, *Depress Anxiety* (Russell et al. 2013)	10.1002/da.22053	29	78	37.18
Storch EA, 2015, *Depress Anxiety* (Storch et al. 2015)	10.1002/da.22332	29	58	50.00
Kerns CM, 2015, *Autism* (Kerns et al. 2015)	10.1177/1362361314558465	28	41	68.29
Wigham S, 2014, *PLoS One* (Wigham and McConachie 2014)	10.1371/journal.pone.0085268	27	56	48.21
Ozsivadjian A, 2014, *J Autism Dev Disord* (Ozsivadjian, Hibberd, and Hollocks 2014)	10.1007/s10803-013-1937-1	27	67	40.30
Renno P, 2013, *J Autism Dev Disord* (Renno and Wood 2013)	10.1007/s10803-013-1767-1	26	45	57.78

Table 5. Productivity by country in associated themes with anxiety disorders (2013–2021).

Bradford	Country	Articles	Freq	SCP	MCP	N authors
Core	USA	389	0.39253	340	49	1970
	United Kingdom	126	0.12714	85	41	649
	Australia	116	0.11705	88	28	441
	Canada	41	0.04137	29	12	229
	China	40	0.04036	30	10	238
Zone 1	Netherlands	32	0.03229	24	8	141
	Spain	24	0.02422	20	4	78
	Japan	21	0.02119	17	4	101
	Italy	17	0.01715	11	6	78
	Denmark	15	0.01514	9	6	25
	France	14	0.01413	10	4	76
	India	14	0.01413	14	0	44
	Ireland	12	0.01211	9	3	37
	Turkey	12	0.01211	12	0	44
	Germany	11	0.01110	7	4	64
	Israel	10	0.01009	8	2	41
	Singapore	10	0.01009	2	8	46
	South Korea	8	0.00807	6	2	54
	New Zealand	7	0.00706	5	2	34
	Brazil	6	0.00605	1	5	30

Note: SCP: Single-Country Publications; MCP: Multi-Country Publications.
Source: Information obtained from Web of Science. August 2022.

Table 6. Most productive institutions in associated themes with anxiety disorders (2013–2021), including their respective countries.

Bradford	Institution	Country	N
Core	Kings Coll London	United Kingdom	156
	Univ S Florida	United States	120
	Vanderbilt Univ	United States	70
	Univ Calif Davis	United States	67
	Griffith Univ	Australia	64
	Univ Calif Los Angeles	United States	62
	Univ Missouri	United States	59
Zone 1	LA Trobe Univ	Australia	52
	Ohio State Univ	United States	51
	Newcastle Univ	United Kingdom	49
	Univ Toronto	Canada	44
	Yale Univ	United States	44
	Univ Penn	United States	38
	Stanford Univ	United States	33
	Brigham Young Univ	United States	32
	Johns Hopkins Univ	United States	32
	Natl Cheng Kung Univ	Taiwan	32
	Drexel Univ	United States	30
	Univ New England	Australia	30
	Univ Melbourne	Australia	28

Source: Information obtained from Web of Science. August 2022.

document of the same year, written by Hollocks et al. (2019) with 126 citations and entitled: 'Anxiety and depression in adults with autism spectrum disorder: a systematic review and meta-analysis'.

In Table 4, we can see the most cited documents internally, that is, citations within the sample. The document with the most citations, a total of 75, was written by Connor et al. and entitled 'Traditional and Atypical Presentations of Anxiety in Youth with Autism Spectrum Disorder'. In it, differential relationships between traditional anxiety, atypical anxiety, child characteristics, predictors of anxiety, and ASD symptomatology were explored, finding data suggesting that youth with ASD express anxiety similarly and dissimilarly to DSM definitions. The document entitled 'Exploring the Manifestations of Anxiety in Children with Autism Spectrum Disorders' written by Hallett et al. occupies the second place, with 53 citations. This study explores the measurement and manifestation of anxiety symptoms in children with ASD, referenced in the DSM-IV. In it, four underlying factors emerged: Generalized, Separation, Social, and Overexcitation Anxiety. Finally, the third most important document with 53 citations is 'Measuring Anxiety as a Treatment Endpoint in Youth with Autism Spectrum Disorder' written by Hallett et al. Their study conducted a systematic review of available measures of anxiety in youth with ASD.

Table 5 displays the top 20 countries contributing with the greatest number of papers. These have been

Table 7. Productivity by the scientific journal in associated themes with anxiety disorders (2013–2021).

Bradford	Sources	Articles	*H_index	**G_index	****TC	****PY_start
Core	*Journal of Autism and Developmental Disorders*	135	35	59	4093	2013
	Autism	68	24	40	1697	2013
	Research in Autism Spectrum Disorders	55	18	30	1010	2013
	Autism Research	52	19	31	1071	2013
Zone 1	*Journal of Developmental and Physical Disabilities*	17	9	15	231	2013
	Behavioural Brain Research	14	12	14	322	2014
	Research in Developmental Disabilities	14	9	14	430	2013
	Molecular Autism	13	8	13	335	2013
	Frontiers in Psychiatry	12	7	11	126	2017
	Journal of Child Psychology and Psychiatry	12	10	12	375	2013
	Child Psychiatry & Human Development	10	6	10	186	2015
	Journal of Child and Family Studies	10	7	10	261	2013
	PLoS One	10	9	10	311	2013
	Pediatrics	8	6	8	432	2013
	Advances in Autism	7	2	5	33	2016
	Neuropsychiatric Disease and Treatment	7	6	7	126	2016
	Translational Psychiatry	7	6	7	276	2014
	BMJ Open	6	4	6	41	2015
	Developmental Neurorehabilitation	6	5	6	89	2013
	Frontiers in Behavioral Neuroscience	6	5	6	107	2014

Source: Information obtained from Web of Science. August 2022.
*H_index: The index is based on the set of the scientist's most cited papers and the number of citations that they have received in other publications.
**G_index: A G-index of 'g' means that the top 'g' articles received together at least 'g^2' citations.
***TC (Total Citations): Total number of times that a scholar's articles have been cited by other articles.
****PY_start (Publication Year Start): Year when the journal started publishing on the subject.

segmented by Bradford's proportionality law, being the core countries (most relevant) the United States of America with 389 articles, followed by United Kingdom with 126 papers, Australia with 116 publications and finally Canada and China with 41 and 40 scientific articles respectively.

The United States of America is the country that collaborates the least and, at the same time, has the highest participation within the sample, its 'Multi-Country Publications' (MCP) indicator value shows 87.4% of its documents without international participation. The Core countries do not go below 67.5% of 'Single-Country Publications' (SCP), revealing that international collaboration in this specific area is not important. This last factor shows the little international influence of the most productive countries in terms of professional scientific articulation and the execution of local analyses over continental or transcontinental ones. As for the productive effectiveness of the countries in terms of the number of authors required to produce a scientific article, we can observe an average of 5 authors per paper in the case of the Core countries, except for Australia, which has an average of 3.8 authors per paper. Denmark, on the other hand, is the country with the highest productive effectiveness in the sample, requiring only 1.6 authors to generate a published paper.

Table 6 shows the 20 most relevant institutions in the study area, separating them according to Bradford's proportionality law. A total of seven universities tops this list of Core affiliations. King's College London (United Kingdom) is the most relevant institution with 156 papers, followed by the University of South Florida (USA), and Vanderbilt University (USA), with 120 and 70 papers respectively. The University of California at Davis, Griffith University, the University of California, and the University of Missouri, all from the United States, close the Core affiliation list of organizations that publish the most in the area, with 67, 64, 62 and 59 publications, respectively.

Table 7 presents the 20 journals that publish the most papers on Autism/Anxiety in WoS. The *Journal of Autism and Developmental Disorders* has the highest participation rate among the journals in the sample (135) as well as the highest number of total citations (4093). Followed by *Autism (68), Research in Autism Spectrum Disorders Autism Research (55)* and *Autism Research* (52), which have over 1000 citations (1697, 1010, 1071) each respectively as of the query date. These four journals complete the register of Core journals and are therefore the most influential in the sample. The remaining journals (among the 20 most relevant) have less than 432 citations and an h-index between 6 and 12, which shows a significant distance in terms of relevance from the Core journals and those belonging to zone 1.

Looking at the most relevant authors (Table 8) Storch EA leads the list with 36 scientific papers in the selected sample, followed by Lewin AB with 20 papers. However, it is noteworthy that Storch's publications have received the second highest number of citations (835). With an average of 23.19 citations per publication, Storch's number of citations differs markedly from the 52.12 citations per article achieved by RODGERS J, who has accumulated 886 citations in 17 articles.

Important to note that the 20 most relevant authors in terms of citations present a long history of contribution to the field of anxiety disorders. However, the distance to be a relevant author in the area is 14 papers.

Table 8. Most relevant authors in associated themes with anxiety disorders (2013–2021).

Lotka	Author	h_index	g_index	TC	NP	PY_start
Relevant	Storch EA	15	28	835	36	2013
	Lewin AB	10	20	519	20	2013
	Wood JJ	12	18	552	18	2013
	Rodgers J	13	17	886	17	2013
	Bitsika V	6	13	179	16	2013
	Adams D	9	13	186	15	2018
	Sharpley CF	6	13	179	15	2013
	Charman T	7	14	344	14	2014
	Kerns CM	10	14	443	14	2014
	Richdale AL	10	14	289	14	2014
	Scahill L	11	14	379	14	2013
Zone 1	Lecavalier L	10	13	438	13	2013
	White SW	8	13	297	13	2013
	Arnold EB	8	12	330	12	2013
	Simonoff E	9	12	393	12	2013
	Uljarevic M	9	12	296	12	2014
	Vasa RA	9	12	551	12	2013
	Hollocks MJ	9	10	433	10	2013
	Keen D	6	10	128	10	2018
	Happe F	8	9	394	9	2013

Note: TC: total citations; NP: number of publications; PY_start: publication year start

Source: Information obtained from Web of Science. August 2022.

Most of the authors with the most citations began publishing their findings in anxiety disorders in 2013, while the emerging researcher, is Adams D who has contributed 14 papers since 2018 (in four years), which represents a high output in a limited timeframe.

For the analysis of the authors' collaboration network, the 43 most representative authors were analyzed (based on their participation in eight or more documents). This analysis allowed us to elaborate Figure 5, which displays three large research groups. The consolidated group (group 1: Hard): This group is characterized by robust and consistent research relationships, as evidenced by the authors having collaborated on eight or more papers together over a significant period. It presents strong collaborative relationships. The medium group (group 2: Medium): This group consists of four to five authors who have collaborated on at least four papers together within a smaller timescale. The emerging or reduced group (group 3: Soft): Finally, the emerging group is composed of two to three authors who have begun to collaborate on research and have published two to three papers together in the recent past. These groups have been classified based on their collaboration history, considering both the quantity (number of papers) and quality (impact factor of the journals where their work is published) of their collaborative work, as well as the duration of their collaborative relationship. This classification reveals varying degrees of collaborative intensity and internationalization among the participants. In the context of invisible schools' networks, two consolidated groups can be identified. The first group, led by Storch EA, is supported by Lewin AB, Murphy TK, Arnold EB, and Mutch PJ. The second group consists of researchers led by Rodger J, Mazurek Mo, Charman T, and Lecavalier L. However, our network analysis does not show any binding authors or links between these different invisible schools. This finding indicates a lack of articulation with research schools beyond their anchor groups.

Figure 6 shows that the most frequent descriptor (keywords) is autism spectrum disorder (name of the disorder), with 427 occurrences followed by Anxiety, autism, and depression, with 377, 305 and 92 occurrences, respectively. In this case, the number of co-occurrences of two words indicates the number of publications in which both words appear in the list of keywords of the selected documents.

Discussion

This bibliometric study is the first one aimed to analyze the production of scientific research published in WoS related to anxiety in the autism spectrum. In this field of research 991 potentially relevant articles were published. From 2010 onwards, there is an exponential increase in publications on anxiety in the autism spectrum, which temporarily coincides with the publication of DSM-5 in 2013. This temporal coincidence demonstrates that anxiety in ASD is a topic that receives progressively more attention, turning it into a priority today. These findings are consistent with another bibliometric analysis that also addressed comorbid pathology with ASD, such as epilepsy (Wang et al. 2022). According to the criteria of Wallin (2005), documents such as articles and reviews are important transmitters of scientific information. In our study, we found that the types of documents of this nature were represented as follows: scientific articles (89.8%), followed by review articles (10.1%).

The research shows a trend of multidisciplinary integration. The research was published primarily in four subject categories: (a) developmental psychology, (b) psychiatry, (c) special education, and (d) rehabilitation. It is necessary that future research considers studying anxiety in ASD from the field of clinical psychology and pediatrics, since they are areas that have received fewer related documents.

The largest number of published documents was found under the heading of anxiety disorders. However, in particular, social anxiety disorder is the clinical category that has been studied the most in the field of ASD. There are a number of possible explanations for why social anxiety disorder is the most commonly studied in people on the autism spectrum. For example, the clinical symptoms of autism have to do with problems with social interaction (Phung and Goldberg 2021). Another reason could be that social anxiety is one of the disorders prevalent in people with ASD, with reported estimates of up to 50% (Spain et al. 2018).

The most cited studies at the international level were related to health status, psychosocial functioning and psychiatric comorbidity. These areas continue to be topics of great interest today (Forde et al. 2021, Lew-Koralewicz 2022, Parenteau et al. 2021), due to the impact they have on the socio-emotional life of people within the autism

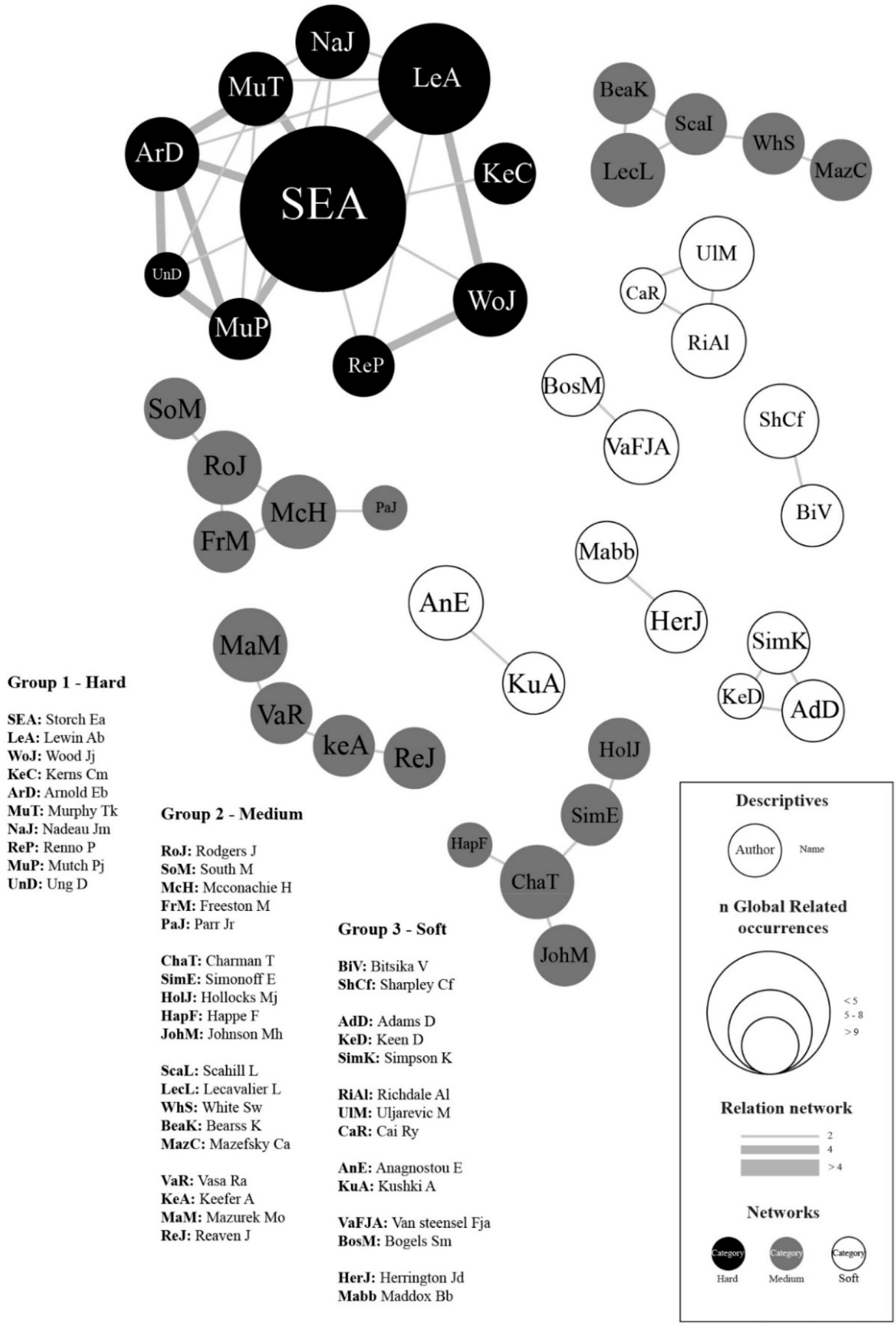

Figure 5. Collaboration groups among authors in associated themes with anxiety.

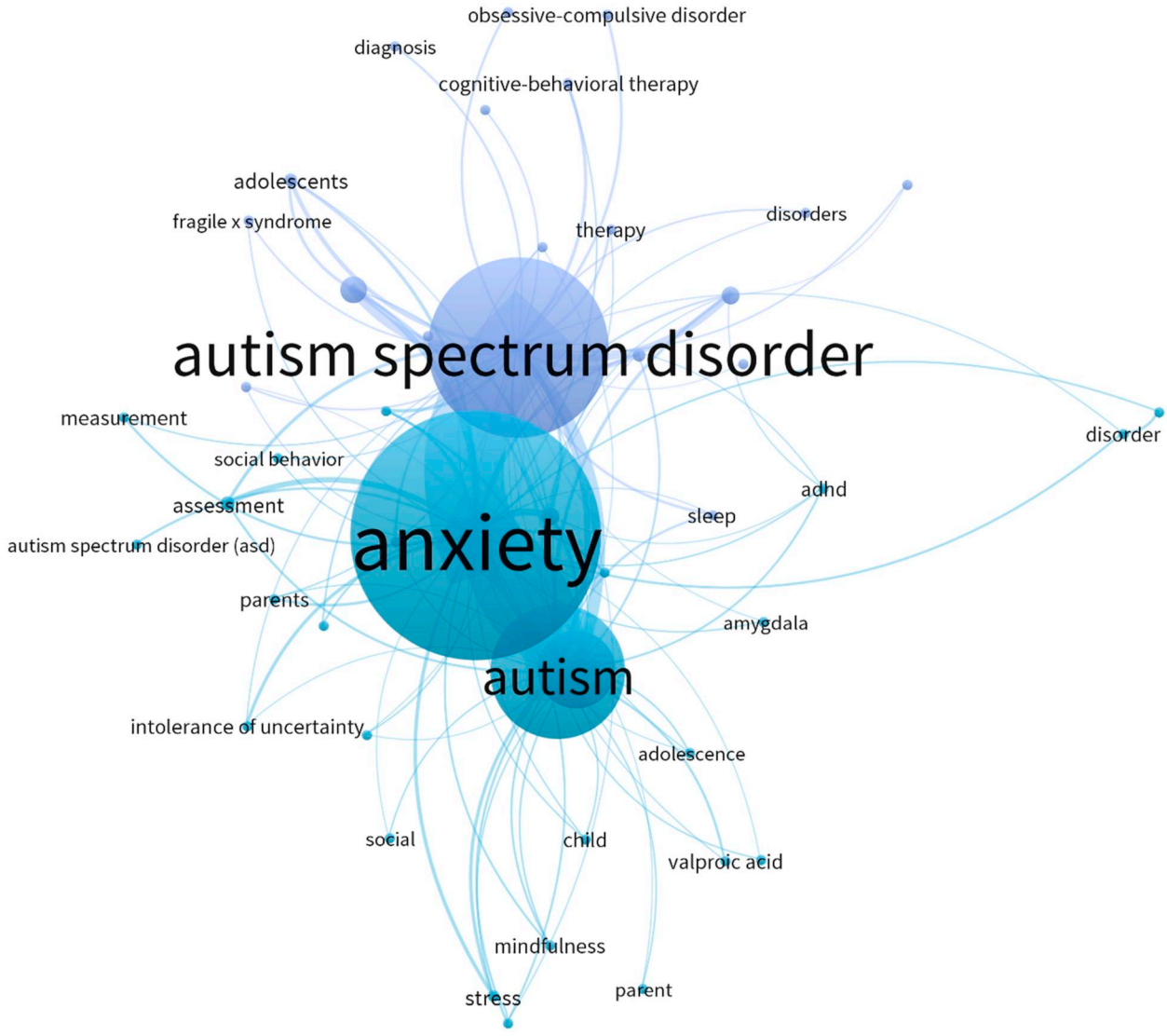

Figure 6. Thematic relations associated with anxiety disorders (1991–2021).

spectrum. In fact, one of the recent lines of research is psychosocial functioning and mental health of autistic mothers (Adams et al. 2021, Hampton et al. 2022). This partially explains why the articles linked to these topics received a large number of citations.

The United States is the country with the highest number of contributions in the world. It was also found that the United States has published the largest number of articles in bibliometric studies related to executive functions (Shekarro et al. 2021), Physical-Activity (Feng et al. 2022) and artificial intelligence in treatment of autism spectrum disorders (Zhang et al. 2022). The research work carried out by United Kingdom and Australia is also notable. The most universities in these countries were Kings College London ($n = 156$ documents), University of Florida ($n = 120$ documents), Vanderbilt University ($n = 70$ documents), University of California, Davis ($n = 67$ documents), Griffith University ($n = 64$ documents), University of California, Los Angeles (n = 62documents) and University of Missouri ($n = 59$ documents). These results suggest that developing countries such as Latin Americans should collaborate closely with the Anglo-Saxon culture to provide comparative and valuable information in this area of knowledge.

The *Journal of Autism and Developmental Disorders* was the most productive in the field of research on anxiety disorders and ASD. This journal seeks to promote theoretical and applied research, as well as examine and evaluate clinical diagnoses and treatments for autism and related disabilities. Its wide-ranging multidisciplinary nature partly explains the large number of articles on ASD. The second most prolific journal was Autism, which is interdisciplinary in nature and focuses on research in many areas, including intervention; diagnosis; training; education; translational issues related to neuroscience and epidemiological research. The third most prolific journal was Research in Autism Spectrum Disorders, which focuses on publishing high-quality empirical articles and reviews that contribute to a better understanding of ASD at all levels of description. It is possible to observe that the journals that are more open to publishing topics related to anxiety disorders in ASD are not specialized in a specific field of research and are

multidisciplinary in nature. Therefore, it is possible to assert that the theme selected as the topic of study will receive more acceptance in specialized journals as the number of articles increases.

The most prolific authors included Storch EA (Baylor College of Medicine), Lewin AB (University of South Florida) and Wood JJ (University of California, Los Angeles). Currently these researchers are involved in studying issues related to diagnostic evaluation and treatment of anxiety in autism spectrum disorder. There is currently a lack of consensus on what constitutes the gold standards for assessing anxiety in ASD (Kent and Simonoff 2017) and there is still great uncertainty about what the best practices are for identifying and treating anxiety within this population (Winch et al. 2022). This may explain why authors who are relevant to this study topic are interested in particular issues related to evaluation and treatment. This could serve as a guide for new researchers who are interested in producing new information.

The analysis of the keywords indicates that the areas of study closely related to anxiety in the autistic spectrum are social behavior, sleep quality, parenting, diagnostic evaluation and treatment, which suggests that the study of anxiety disorders covers a wide range of topics and is expanding. The possibility of counting the frequency of occurrence of keywords, allows us to analyze the hot spots of disciplines giving us a visual image of trending topics (Huai and Chai 2016).

Limitations

This research has some limitations that should be mentioned. First, we only searched the WoS database, and no other such as PubMed and Scopus. Using these databases in future studies could contribute to provide a complementary view of the literature related to anxiety disorders in ASD. Second, although the authors manually eliminated irrelevant literature, assigned to each anxiety category the relevant documents and participated in data analysis, this does not preclude subjective judgment. Third, some studies relevant to this field have been published recently which will also bias the research results.

Conclusions

A total of 991 documents published in WoS (Web of Science Core Collection) were analyzed. The results of this study have shown an association between the growth of publications related to anxiety disorders in autism and the year of publication of the DSM-5. The largest number of publications were found under the label of anxiety disorders and social anxiety disorder, this last being the most studied. Among the countries involved in research on this field of knowledge, the United States is the most influential. The *Journal of Autism and Developmental Disorders* published the most articles on the subject and Storch EA stood out as the most productive author. For future research, it is suggested to complement this bibliometric review with other documentary techniques such as systematic reviews or umbrella reviews. This may allow us to delve into specific topics on anxiety disorders in ASD.

Ethical approval

The authors declare that the research complies with all ethical requirements and adheres to the legal requirements subscribed to in the Declaration of Helsinki. The entry records were made using the University of Granada's licenses. Individual values may vary according to the institutional agreement signed.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Rosario Spencer-Contreras http://orcid.org/0000-0002-4546-4226
Osvaldo Hernández-González http://orcid.org/0000-0002-1319-6167

Data availability statement

The data generated or analyzed during the current study are available from the authors on reasonable request.

References

Adams, D., Stainsby, M. and Paynter, J. 2021. Autistic mothers of autistic children: a preliminary study in an under-researched area. *Autism in Adulthood: Challenges and Management*, 3, 339–346.

American Psychiatric Association. 2013. *DSM 5 diagnostic and statistical manual of mental disorders*. Washington, DC: American Psychiatric Association.

American Psychiatric Association. 2022. *Diagnostic and statistical manual of menta disorders, 5th ed, text revision*. Washington, DC: American Psychiatric Association.

Aria, M. and Cuccurullo, C. 2017. bibliometrix: an R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11, 959–975.

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., Kurzius-Spencer, M., Zahorodny, W., Robinson Rosenberg, C., White, T., Durkin, M. S., Imm, P., Nikolaou, L., Yeargin-Allsopp, M., Lee, L.-C., Harrington, R., Lopez, M., Fitzgerald, R. T., Hewitt, A., Pettygrove, S., Constantino, J. N., Vehorn, A., Shenouda, J., Hall-Lande, J., Van Naarden Braun, K. and Dowling, N. F. 2018. Prevalence of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2014. *Morbidity and Mortality Weekly Report. Surveillance Summaries*, 67, 1–23.

Batagelj, V. and Mrvar, A. 1999. Pajek - program for large network analysis. Retrieved March 11, 2021, from papers2://publication/uuid/09C6E0F6-77DF-4BE8-B808-E42191C5C44A.

Boulter, Christina, Mark Freeston, Mikle South, and Jacqui Rodgers. 2014. "Intolerance of Uncertainty as a Framework for Understanding Anxiety in Children and Adolescents with Autism Spectrum Disorders." *Journal of Autism and Developmental Disorders* 44 (6): 1391–402. https://doi.org/10.1007/s10803-013-2001-x.

Buck, Tara R., Joseph Viskochil, Megan Farley, Hilary Coon, William M. McMahon, Jubel Morgan, and Deborah A. Bilder. 2014. "Psychiatric Comorbidity and Medication Use in Adults with Autism Spectrum Disorder." *Journal of Autism and*

Developmental Disorders 44 (12): 3063–3071. https://doi.org/10.1007/s10803-014-2170-2.

Costello, E. J., Egger, H. L. and Angold, A. 2005. The developmental epidemiology of anxiety disorders: phenomenology, prevalence, and comorbidity. *Child and Adolescent Psychiatric Clinics of North America*, 14, 631–648, vii.

Croen, Lisa A., Ousseny Zerbo, Yinge Qian, Maria L. Massolo, Steve Rich, Stephen Sidney, and Clarissa Kripke. 2015. "The Health Status of Adults on the Autism Spectrum." *Autism: The International Journal of Research and Practice* 19 (7): 814–823. https://doi.org/10.1177/1362361315577517.

Dykens, Elisabeth M., Marisa H. Fisher, Julie Lounds Taylor, Warren Lambert, and Nancy Miodrag. 2014. "Reducing Distress in Mothers of Children with Autism and Other Disabilities: A Randomized Trial." *Pediatrics* 134 (2): e454–63–e463. https://doi.org/10.1542/peds.2013-3164.

Feng, X. W., Hadizadeh, M. and Cheong, J. P. G. 2022. Global trends in physical-activity research of autism: bibliometric analysis based on the Web of Science Database (1980–2021). *International Journal of Environmental Research and Public Health*, 19, 7278.

Falk, Nicholas Henry, Kimberley Norris, and Michael G. Quinn. 2014. "The Factors Predicting Stress, Anxiety and Depression in the Parents of Children with Autism." *Journal of Autism and Developmental Disorders* 44 (12): 3185–3203. https://doi.org/10.1007/s10803-014-2189-4.

Fombonne, E., Green Snyder, L., Daniels, A., Feliciano, P. and Chung, W. 2020. Psychiatric and medical profiles of autistic adults in the SPARK cohort. *Journal of Autism and Developmental Disorders*, 50, 3679–3698.

Forde, J., Bonilla, P. M., Mannion, A., Coyne, R., Haverty, R. and Leader, G. 2021. Health status of adults with autism spectrum disorder. *Review Journal of Autism and Developmental Disorders*, 9, 427–437.

Garfinkel, Sarah N., Claire Tiley, Stephanie O'Keeffe, Neil A. Harrison, Anil K. Seth, and Hugo D. Critchley. 2016. "Discrepancies Between Dimensions of Interoception in Autism: Implications for Emotion and Anxiety." *Biological Psychology* 114 (February): 117–126. https://doi.org/10.1016/j.biopsycho.2015.12.003.

Gordon-Lipkin, E., Marvin, A.R., Law, J.K. and Lipkin, P.H. 2018. Anxiety and mood disorder in children with autism spectrum disorder and ADHD. *Pediatrics*, 141, e20171377.

Gotham, Katherine, Somer L. Bishop, Vanessa Hus, Marisela Huerta, Sabata Lund, Andreas Buja, Abba Krieger, and Catherine Lord. 2013. "Exploring the Relationship between Anxiety and Insistence on Sameness in Autism Spectrum Disorders." *Autism Research: Official Journal of the International Society for Autism Research* 6 (1): 33–41. https://doi.org/10.1002/aur.1263.

Halim, A. T., Richdale, A. L. and Uljarević, M. 2018. Exploring the nature of anxiety in young adults on the autism spectrum: a qualitative study. *Research in Autism Spectrum Disorders*, 55, 25–37.

Hampton, S., Allison, C., Aydin, E., Baron-Cohen, S. and Holt, R. 2022. Autistic mothers' perinatal well-being and parenting styles. *Autism: The International Journal of Research and Practice*, 26, 1805–1820.

Hallett, Victoria, Luc Lecavalier, Denis G. Sukhodolsky, Noreen Cipriano, Michael G. Aman, James T. McCracken, Christopher J. McDougle, et al. 2013. "Exploring the Manifestations of Anxiety in Children with Autism Spectrum Disorders." *Journal of Autism and Developmental Disorders* 43 (10): 2341–2352. https://doi.org/10.1007/s10803-013-1775-1.

Hollocks, M. J., Lerh, J. W., Magiati, I., Meiser-Stedman, R. and Brugha, T. S. 2019. Anxiety and depression in adults with autism spectrum disorder: a systematic review and meta-analysis. *Psychological Medicine*, 49, 559–572.

Hollocks, Matthew J., Jian Wei Lerh, Iliana Magiati, Richard Meiser-Stedman, and Traolach S. Brugha. 2019. "Anxiety and Depression in Adults with Autism Spectrum Disorder: A Systematic Review and Meta-Analysis." *Psychological Medicine* 49 (4): 559–572. https://doi.org/10.1017/S0033291718002283.

Huai, C. and Chai, L. 2016. A bibliometric analysis on the performance and underlying dynamic patterns of water security research. *Scientometrics*, 108, 1531–1551.

Joshi, Gagan, Janet Wozniak, Carter Petty, Mary Kate Martelon, Ronna Fried, Anela Bolfek, Amelia Kotte, et al. 2013. "Psychiatric Comorbidity and Functioning in a Clinically Referred Population of Adults with Autism Spectrum Disorders: A Comparative Study." *Journal of Autism and Developmental Disorders* 43 (6): 1314–1325. https://doi.org/10.1007/s10803-012-1679-5.

Kataoka, Shunsuke, Kazuhiro Takuma, Yuta Hara, Yuko Maeda, Yukio Ago, and Toshio Matsuda. 2013. "Autism-like Behaviours with Transient Histone Hyperacetylation in Mice Treated Prenatally with Valproic Acid." *The International Journal of Neuropsychopharmacology* 16 (1): 91–103. https://doi.org/10.1017/S1461145711001714.

Kent, W. 1983. A simple guide to five normal forms in relational database theory. *Communications of the ACM*, 26, 120–125.

Kent, R., & Simonoff, E. (2017). Prevalence of anxiety in autism spectrum disorders. In E. Simonoff (Ed.), *Anxiety in Children and Adolescents with Autism Spectrum Disorder* (pp. 5-32). Academic Press.

Kerns, C. M., Kendall, P. C., Berry, L., Souders, M. C., Franklin, M. E., Schultz, R. T., Miller, J. and Herrington, J. 2014. Traditional and atypical presentations of anxiety in youth with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 44, 2851–2861.

Kerns, Connor Morrow, Brenna B. Maddox, Philip C. Kendall, Keiran Rump, Leandra Berry, Robert T. Schultz, Margaret C. Souders, Amanda Bennett, John Herrington, and Judith Miller. 2015. "Brief Measures of Anxiety in Non-Treatment-Seeking Youth with Autism Spectrum Disorder." *Autism*." *Autism: The International Journal of Research and Practice* 19 (8): 969–979. https://doi.org/10.1177/1362361314558465.

Kerns, Connor Morrow, Philip C. Kendall, Leandra Berry, Margaret C. Souders, Martin E. Franklin, Robert T. Schultz, Judith Miller, and John Herrington. 2014. "Traditional and Atypical Presentations of Anxiety in Youth with Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 44 (11): 2851–2861. https://doi.org/10.1007/s10803-014-2141-7.

Kupfer, D.J. 2015. Anxiety and DSM-5. *Dialogues in Clinical Neuroscience*, 17, 245–246.

Lai, Meng-Chuan, and Simon Baron-Cohen. 2015. "Identifying the Lost Generation of Adults with Autism Spectrum Conditions." *The Lancet. Psychiatry* 2 (11): 1013–1027. https://doi.org/10.1016/S2215-0366. (15)00277-1.

Lai, Meng-Chuan, Caroline Kassee, Richard Besney, Sarah Bonato, Laura Hull, William Mandy, Peter Szatmari, and Stephanie H. Ameis. 2019. "Prevalence of Co-Occurring Mental Health Diagnoses in the Autism Population: A Systematic Review and Meta-Analysis." *The Lancet. Psychiatry* 6 (10): 819–829. https://doi.org/10.1016/S2215-0366. (19)30289-5.

Lawani, S. M. 2012. Analysis scientific the quality of productivity. *BioScience*, 27, 26–31.

Lecavalier, Luc, Jeffrey J. Wood, Alycia K. Halladay, Nancy E. Jones, Michael G. Aman, Edwin H. Cook, Benjamin L. Handen, et al. 2014. "Measuring Anxiety as a Treatment Endpoint in Youth with Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 44 (5): 1128–1143. https://doi.org/10.1007/s10803-013-1974-9.

Lever, Anne G., and Hilde M. Geurts. 2016. "Psychiatric Co-occurring Symptoms and Disorders in Young, Middle-Aged, and Older Adults with Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 46 (6): 1916–1930. https://doi.org/10.1007/s10803-016-2722-8.

Leyfer, O. T., Folstein, S. E., Bacalman, S., Davis, N. O., Dinh, E., Morgan, J., Tager-Flusberg, H. and Lainhart, J. E. 2006. Comorbid psychiatric disorders in children with autism: interview development and rates of disorders. *Journal of Autism and Developmental Disorders*, 36, 849–861.

Lew-Koralewicz, A. 2022. Psychosocial functioning and the educational experiences of students with ASD during the COVID-19 pandemic in Poland. *International Journal of Environmental Research and Public Health*, 19, 9468.

Liu, Zhen, Xiao Li, Jun-Tao Zhang, Yi-Jun Cai, Tian-Lin Cheng, Cheng Cheng, Yan Wang, et al. 2016. "Autism-like Behaviours and Germline Transmission in Transgenic Monkeys Overexpressing MeCP2." *Nature* 530 (7588): 98–102. https://doi.org/10.1038/nature16533.

Mazurek, Micah O., Roma A. Vasa, Luther G. Kalb, Stephen M. Kanne, Daniel Rosenberg, Amy Keefer, Donna S. Murray, Brian Freedman, and Lea Ann Lowery. 2013. "Anxiety, Sensory over-Responsivity, and Gastrointestinal Problems in Children with Autism Spectrum Disorders." *Journal of Abnormal Child Psychology* 41 (1): 165–176. https://doi.org/10.1007/s10802-012-9668-x.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & TP Group. 2009. Linee guida per il reporting di revisioni sistematiche e metaanalisi: il PRISMA Statement. *PLoS Med*, 6 (7), e1000097.

Ozsivadjian, Ann, Charlotte Hibberd, and Matthew J. Hollocks. 2014. "Brief Report: The Use of Self-Report Measures in Young People with Autism Spectrum Disorder to Access Symptoms of Anxiety, Depression and Negative Thoughts." *Journal of Autism*

and Developmental Disorders 44 (4): 969–974. https://doi.org/10.1007/s10803-013-1937-1.
Parenteau, C. I., Tsipan, R. M. and Hendren, R. L. 2021. Integrating treatment for autism: psychiatric comorbidities and comprehensive treatment. *Autism and Developmental Disorders*, 19, 44–52.
Phung, J. N. and Goldberg, W. A. 2021. Mixed martial arts training improves social skills and lessens problem behaviors in boys with autism spectrum disorder. *Research in Autism Spectrum Disorders*, 83, 101758.
Quevedo-Blasco, R., Ruiz-Herrera, N. and Guillén-Riquelme, A. 2021. Análisis bibliométrico de las revistas españolas de psicología indexadas en el emerging source citation index (2018-2020). *Papeles Del Psicólogo - Psychologist Papers*, 42, 170–176.
Renno, Patricia, and Jeffrey J. Wood. 2013. "Discriminant and Convergent Validity of the Anxiety Construct in Children with Autism Spectrum Disorders." *Journal of Autism and Developmental Disorders* 43 (9): 2135–2146. https://doi.org/10.1007/s10803-013-1767-1.
Rodgers, Jacqui, Sarah Wigham, Helen McConachie, Mark Freeston, Emma Honey, and Jeremy R. Parr. 2016. "Development of the Anxiety Scale for Children with Autism Spectrum Disorder (ASC-ASD.")." *Autism Research: Official Journal of the International Society for Autism Research* 9 (11): 1205–1215. https://doi.org/10.1002/aur.1603.
Russell, Ailsa J., Amita Jassi, Miguel A. Fullana, Hilary Mack, Kate Johnston, Isobel Heyman, Declan G. Murphy, and David Mataix-Cols. 2013. "Cognitive Behavior Therapy for Comorbid Obsessive-Compulsive Disorder in High-Functioning Autism Spectrum Disorders: A Randomized Controlled Trial." *Depression and Anxiety* 30 (8): 697–708. https://doi.org/10.1002/da.22053.
Salazar, Fernando, Gillian Baird, Susie Chandler, Evelin Tseng, Tony O'sullivan, Patricia Howlin, Andrew Pickles, and Emily Simonoff. 2015. "Co-occurring Psychiatric Disorders in Preschool and Elementary School-Aged Children with Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 45 (8): 2283–2294. https://doi.org/10.1007/s10803-015-2361-5.
Shekarro, M., Fazeli-Varzaneh, M. and Kuravackel, G. M. 2021. A bibliometric analysis of executive functions in autism spectrum disorder. *Current Psychology*, 42, 6117–6130.
Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T. and Baird, G. 2008. Psychiatric disorders in children with autism spectrum disorders: prevalence, comorbidity, and associated factors in a population-derived sample. *Journal of the American Academy of Child and Adolescent Psychiatry*, 47, 921–929.
Somers, J. M., Goldner, E. M., Waraich, P. and Hsu, L. 2006. Prevalence and incidence studies of anxiety disorders: a systematic review of the literature. *Canadian Journal of Psychiatry. Revue Canadienne de Psychiatrie*, 51, 100–113.
South, M., Rodgers, J. and Van Hecke, A. 2017. Anxiety and ASD: current progress and ongoing challenges. *Journal of Autism and Developmental Disorders*, 47, 3679–3681.
Spain, D., Sin, J., Linder, K. B., McMahon, J. and Happé, F. 2018. Social anxiety in autism spectrum disorder: a systematic review. *Research in Autism Spectrum Disorders*, 52, 51–68.
Strang, J. F., Kenworthy, L., Daniolos, P., Case, L., Wills, M. C., Martin, A. and Wallace, G. L. 2012. Depression and anxiety symptoms in children and adolescents with autism spectrum disorders without intellectual disability. *Research in Autism Spectrum Disorders*, 6, 406–412.
Storch, Eric A., Elysse B. Arnold, Adam B. Lewin, Josh M. Nadeau, Anna M. Jones, Alessandro S. De Nadai, P. Jane Mutch, Robert R. Selles, Danielle Ung, and Tanya K. Murphy. 2013. "The Effect of Cognitive-Behavioral Therapy versus Treatment as Usual for Anxiety in Children with Autism Spectrum Disorders: A Randomized, Controlled Trial." *Journal of the American Academy of Child and Adolescent Psychiatry* 52 (2): 132–42.e2. https://doi.org/10.1016/j.jaac.2012.11.007.
Storch, Eric A., Adam B. Lewin, Amanda B. Collier, Elysse Arnold, Alessandro S. De Nadai, Brittney F. Dane, Joshua M. Nadeau, P. Jane Mutch, and Tanya K. Murphy. 2015. "A Randomized Controlled Trial of Cognitive-Behavioral Therapy versus Treatment as Usual for Adolescents with Autism Spectrum Disorders and Comorbid Anxiety." *Depression and Anxiety* 32 (3): 174–181. https://doi.org/10.1002/da.22332.
Sukhodolsky, Denis G., Michael H. Bloch, Kaitlyn E. Panza, and Brian Reichow. 2013. "Cognitive-Behavioral Therapy for Anxiety in Children with High-Functioning Autism: A Meta-Analysis." *Pediatrics* 132 (5): e1341–e1350. https://doi.org/10.1542/peds.2013-1193.
Ung, D., Selles, R., Small, B. J. and Storch, E. A. 2015. A systematic review and meta-analysis of cognitive-behavioral therapy for anxiety in youth with high-functioning autism spectrum disorders. *Child Psychiatry and Human Development*, 46, 533–547.
Van Eck, N. J. and Waltman, L. 2010. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84, 523–538.
van Steensel, F. J. A., Bögels, S. M. and Perrin, S. 2011. Anxiety disorders in children and adolescents with autistic spectrum disorders: a meta-analysis. *Clinical Child and Family Psychology Review*, 14, 302–317.
van Steensel, F. J. A. and Heeman, E. J. 2017. Anxiety levels in children with autism spectrum disorder: a meta-analysis. *Journal of Child and Family Studies*, 26, 1753–1767.
Vasa, R. A., Kalb, L., Mazurek, M., Kanne, S., Freedman, B., Keefer, A., Clemons, T. and Murray, D. 2013. Age-related differences in the prevalence and correlates of anxiety in youth with autism spectrum disorders. *Research in Autism Spectrum Disorders*, 7, 1358–1369.
Vasa, Roma A., Laura M. Carroll, Alixandra A. Nozzolillo, Rajneesh Mahajan, Micah O. Mazurek, Amanda E. Bennett, Logan K. Wink, and Maria Pilar Bernal. 2014. "A Systematic Review of Treatments for Anxiety in Youth with Autism Spectrum Disorders." *Journal of Autism and Developmental Disorders* 44 (12): 3215–3229. https://doi.org/10.1007/s10803-014-2184-9.
Wallin, J. A. 2005. Bibliometric methods: pitfalls and possibilities. *Basic & Clinical Pharmacology & Toxicology*, 97, 261–275.
Waltman, L. and van Eck, N. J. 2015. Field-normalized citation impact indicators and the choice of an appropriate counting method. *Journal of Informetrics*, 9, 872–894.
Wang, Y., Huo, X., Li, W., Xiao, L., Li, M., Wang, C., Sun, Y. and Sun, T. 2022. Knowledge atlas of the co-occurrence of epilepsy and autism: a bibliometric analysis and visualization using VOSviewer and CiteSpace. *Neuropsychiatric Disease and Treatment*, 18, 2107–2119.
White, Susan W., Carla A. Mazefsky, Gabriel S. Dichter, Pearl H. Chiu, John A. Richey, and Thomas H. Ollendick. 2014. "Social-Cognitive, Physiological, and Neural Mechanisms Underlying Emotion Regulation Impairments: Understanding Anxiety in Autism Spectrum Disorder." *International Journal of Developmental Neuroscience: The Official Journal of the International Society for Developmental Neuroscience* 39 (1): 22–36. https://doi.org/10.1016/j.ijdevneu.2014.05.012.
Wigham, Sarah, and Helen McConachie. 2014. "Systematic Review of the Properties of Tools Used to Measure Outcomes in Anxiety Intervention Studies for Children with Autism Spectrum Disorders." *PLoS ONE* 9 (1): e85268. https://doi.org/10.1371/journal.pone.0085268.
Wigham, Sarah, Jacqui Rodgers, Mikle South, Helen McConachie, and Mark Freeston. 2015. "The Interplay Between Sensory Processing Abnormalities, Intolerance of Uncertainty, Anxiety and Restricted and Repetitive Behaviours in Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 45 (4): 943–952. https://doi.org/10.1007/s10803-014-2248-x.
Winch, A. T., Klaver, S. J., Simpson, S., Calub, C. A. and Alexander, K. 2022. Identifying and treating anxiety in youth with autism spectrum disorder/intellectual developmental disorder: a review. *Evidence-Based Practice in Child and Adolescent Mental Health*, 7, 160–172.
Wittkopf, S., Stroth, S., Langmann, A., Wolff, N., Roessner, V., Roepke, S., Poustka, L. and Kamp-Becker, I. 2021. Differentiation of autism spectrum disorder and mood or anxiety disorder. *Autism: The International Journal of Research and Practice*, 26, 1056–1069.
Wöhr, M., D. Orduz, P. Gregory, H. Moreno, U. Khan, K. J. Vörckel, D. P. Wolfer, et al. 2015. "Lack of Parvalbumin in Mice Leads to Behavioral Deficits Relevant to All Human Autism Core Symptoms and Related Neural Morphofunctional Abnormalities." *Translational Psychiatry* 5 (3): e525–e525–e525. https://doi.org/10.1038/tp.2015.19.
Wood, J. J. and Gadow, K. D. 2010. Exploring the nature and function of anxiety in youth with autism spectrum disorders. *Clinical Psychology: Science and Practice*, 17, 281–292.
Zaboski, B. A. and Storch, E. A. 2018. Comorbid autism spectrum disorder and anxiety disorders: a brief review. *Future Neurology*, 13, 31–37.
Zhang, S., Wang, S., Liu, R., Dong, H., Zhang, X. and Tai, X. 2022. A bibliometric analysis of research trends of artificial intelligence in the treatment of autistic spectrum disorders. *Frontiers in Psychiatry*, 13, 967074.