

## Research Article | Araştırma Makalesi

# THE EVOLUTION OF AUTISM: A BIBLIOMETRIC ANALYSIS

## OTİZMİN GELİŞİMİ: BİBLİYOMETRİK ANALİZ

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### ABSTRACT

**Objective:** In parallel with the dramatic increase in the autism prevalence, a large number of articles has been published in recent years. The main aim of our study was to make descriptive and evaluative analysis of autism related publications using bibliometric mapping and provide better understanding of autism.

**Methods:** To make the bibliometric analysis of autism literature, all studies published from 1980 to 2020 on autism were selected from Web of Science. Density and network visualization maps according to certain bibliometric indicators (country, source, and keywords) were obtained with VOSviewer software.

**Results:** From 1980 to 2020, 59653 studies on autism were retrieved. The journal publishing the most studies on this subject is Journal of Autism and Developmental Disorders. The countries having the highest number of publications were USA (46.31%), England (11.39%) and Canada (6.02%). The top 3 organization that published most articles about autism were University of California System (3623), University of London (2671) and Harvard University (1663).

**Conclusion:** Studies on autism were on the rise worldwide, especially in the USA. They published in different fields and in many different sources. What needs to be done here is to increase cooperation in work with autism.

**Keywords:** Autism spectrum disorder, bibliometric analysis, VOSviewer

### ÖZ

**Amaç:** Son yıllarda otizm prevalansındaki ciddi artışa paralel olarak, bu konuda çok sayıda çalışma yapılmıştır. Çalışmamızın temel amacı, bibliyometrik analizi kullanarak otizmle ilgili yayınların tanımlayıcı analizini yapmak ve otizm ile ilgili yapılan çalışmaların daha iyi anlaşılmasını sağlamaktır.

**Yöntem:** Otizm literatürünün bibliyometrik analizini yapabilmek için 1980-2020 yılları arasında otizm üzerine yayınlanmış tüm çalışmalar Web of Science'dan elde edilmiştir. VOSviewer yazılımı ile belirli bibliyometrik göstergelere (ülke, kaynak ve anahtar kelimeler) göre yoğunluk ve ağ görselleştirme haritaları elde edilmiştir.

**Bulgular:** 1980'den 2020'ye kadar otizmle ilgili 59653 çalışma alındı. Bu konuda en fazla çalışmayı yayınlayan dergi, Journal of Autism and Developmental Disorders'dır. En fazla yayına sahip ülkeler ABD (%46,31), İngiltere (%11,39) ve Kanada (%6,02) olmuştur. Otizm hakkında en çok makale yayınlayan ilk 3 kuruluş University of California System (3623), University of London (2671) ve Harvard University (1663) olmuştur.

**Sonuç:** Başta ABD olmak üzere tüm dünyada otizmle ilgili çalışmalar artış göstermektedir. Bu çalışmalar farklı alanlarda ve birçok farklı kaynaktan yayımlanmışlardır. Burada amaç otizmle ilgili çalışmalarda iş birliğini artırmaktır.

**Anahtar Kelimeler:** Otizm spektrum bozukluğu, bibliyometrik analiz, VOSviewer

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## Introduction

Autism spectrum disorder (ASD) is a developmental problem with low interpersonal social interaction, repetitive movements and deficiencies in language development.<sup>1-3</sup> It was admitted as a comprehensible disorder by Kanner in 1943.<sup>4</sup> While the reasons of ASD have not been determined exactly until now, it was considered that the genetics have a significant effect on it.<sup>5,6</sup> Also the presence of toxins in utero insult during gestation was considered as another possible cause.<sup>6-9</sup> In the past ASD prevalence was approximately 4 to 5 in 10000 children and it was considered a rare disorder, however, it becomes a common disorder now.<sup>10</sup> ASD prevalence was 1 in 160 in 2019 according to the WHO's data. ASD was seen mostly in Hong Kong with 1 in 27, in South Korea with 1 in 38 and the USA with 1 in 45.<sup>11</sup> It is also seen 4 times higher in boys than girls.<sup>12</sup> Since the criteria for ASD diagnostics changed and awareness about ASD increased over time together with broadening of ASD, an increase was observed in ASD frequency.<sup>13</sup> Although there were several risk factors identified in epidemiological studies, none of them has been proved to be a possible cause of ASD yet.<sup>14</sup>

Bibliometrics uses mathematical and statistical methods to make a quantitative evaluation of publication patterns.<sup>15,16</sup> Therefore, it facilitates to understand the written communication process.<sup>16,17</sup> It determines the effective researchers, countries, organizations and their connections and also make the comparisons of them.<sup>16</sup> Bibliometric mapping provides researchers a powerful tool to study the structure and the dynamics of scientific fields and to understand their working field better.<sup>16, 18, 19, 20</sup>

With this study, we aim to understand ASD better by conducting the bibliometric analysis of ASD related publications.

## Methods

All articles published from 1980 to 2020 on ASD were selected from Web of Science (WoS, Core Collection database maintained by Clarivate Analytics) and analyzed using bibliometric methods. The search keywords were taken as "Autism", "Autistic", "Autism Spectrum Disorder", "ASD" and "Childhood Disintegrative Disorder". The keywords were chosen based on the commonly used definition of ASD. VOSviewer (version 1.6.16) package program was used for bibliometric network visualizations.<sup>21</sup>

The following bibliometric indicators were used in this study:<sup>20</sup>

- Publication type
- Publication language
- Country and institutional affiliation
- Most productive authors
- Source and the name of the journal in which the document was published
- Most cited articles

According to the h index, the number of citations and publications and also the top ten places in terms of authors, institutions and journals were determined.

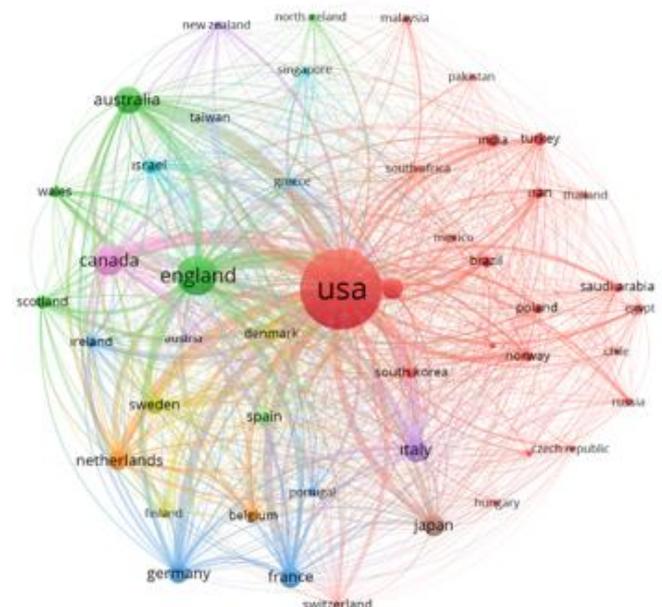
## Results

Studies on autism have increased significantly in recent years. While approximately 150 studies were published annually in the early 80's, approximately 6000 studies were published in 2020.

In this study, a total of 59653 publications were retrieved, 63.69% of which were original articles. The remaining publications were reviews, meeting abstracts, editorial materials, proceedings paper and etc. The primary language was English (96.70%) for the retrieved articles. Other languages like Spanish, French, German, Portuguese, Russian, Turkish and etc. were also encountered.

## Country

A total of 160 countries contributed to the advancement of autism research. The top 10 country that published the most articles about autism were USA (46.31%), England (11.39%), Canada (6.02%), Australia (5.23%), Italy (4.12%), France (3.51%), Japan (3.35%), China (3.34%), Netherlands (2.96%) and Germany (2.92%). Of these 160 countries, there were 60 countries that had at least 50 publications. Figure 1 demonstrated the international network visualization of these 60 world countries. The number of publications is given by the size of the circle, the strength of the relationship is indicated by the thickness of the lines and the clusters are shown by the colors.<sup>22</sup>



**Figure 1.** Network visualization map for international collaboration of worldwide countries during the period.

**Research Areas**

The top 10 research fields publishing the most articles about autism were psychology (36.41%), neurosciences neurology (22.59%), psychiatry (21.19%), rehabilitation (11.82%), educational research (11.38%), pediatrics (9.17%), genetic heredity (6.43%), behavioral sciences (4.95%), pharmacology (3.58%) and biochemistry molecular biology (2.80%).

**Authors**

The top 10 author that published the most articles about autism were Gillberg G. (417), Baron-Cohen (395), Lord L. (295), Matson JL. (294), Chairman T. (285), Dawson G.

(265), Zwaigenbaum L. (256), Szatmari P. (241), Bolte S. (233) and Happe F. (205). The number of publications, h-index, average citation per item and total citation were given in Table 1.

Density visualization map of co-authorship for autism research was given in Figure 2. Co-authorship refers to local and international collaborations. People who are away from the set have less co-authorship and collaboration than others. From yellow to blue, more collaborative authors are seen.

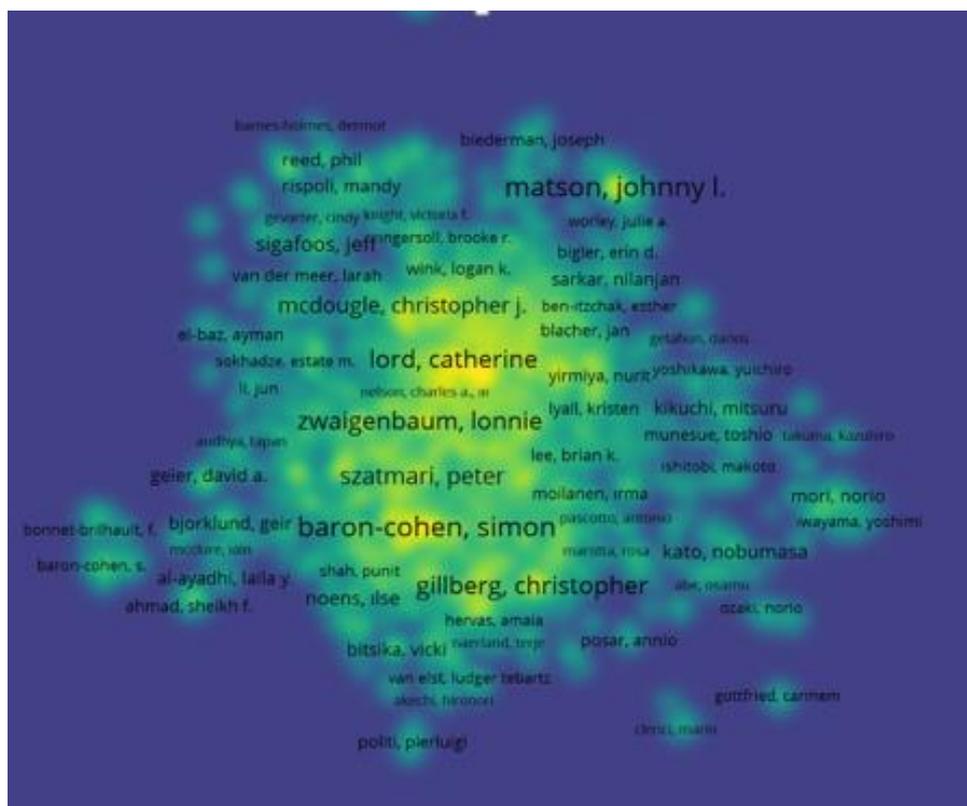
Moreover top 10 most cited articles according to number of citations per year on autism were given in Table 2.

**Table 1.** Top 10 author, source and organization publishing on autism (1980-2020)

		Number of publications	h-index	Average citation per item	Total citation
<b>Author</b>	Gillberg G.	417	84	65.26	27213
	Baron- Cohen S.	395	100	92.07	36369
	Lord L.	295	100	149.62	44138
	Matson JL.	294	50	30.10	8848
	Chairman T.	285	68	58.33	16625
	Dawson G.	265	82	102.93	27277
	Zwaigenbaum L.	256	64	66.58	17044
	Szatmari P.	241	67	73.21	17644
	Bolte S.	233	42	37.61	8763
	Happe F.	205	55	71.82	14724
<b>Source</b>	Journal of Autism and Developmental Disorders	5364	171	39.28	210691
	Research in Autism Spectrum Disorders	1461	69	18.91	27360
	Autism	1408	85	24.50	34490
	Autism Research	1184	63	18.46	21859
	Journal of the American Academy of Child and Adolescent Psychiatry	1013	95	28.06	28421
	Journal of Intellectual Disability Research	846	45	9.08	7684
	Biological Psychiatry	687	92	36.12	24813
	Research in Developmental Disabilities	561	63	28.15	15793
	Molecular Autism	512	54	24.75	12.674
	Journal of Applied Behavior Analyses	487	60	27.63	13457
<b>Organization</b>	University of California System	3623	198	51.98	188320
	University of London	2671	172	53.64	143272
	Harvard University	1663	132	40.52	67388
	King s College London	1434	137	61.73	88521
	University of North Carolina	1249	122	51.87	64787
	University of California Los Angeles	1197	134	60.78	72749
	University College London	1181	118	55.65	65727
	Pennsylvania Commonwealth System of Higher Education	1154	116	46.75	53947
	Yale University	1061	124	57.42	60925
	University of California Davis	1058	118	49.12	51972

**Table 2.** Top 10 most cited articles according to number of citations per year on autism

Author	Title	Year	Source	Number of Citations
Lord et al.	Autism Diagnostic Interview-Revise-A Revised Version of a Diagnostic Interview for Caregivers of Individuals with Possible Pervasive Developmental Disorders	1994	Journal of Autism and Developmental Disorders	5762
Lord et al.	The Autism Diagnostic Observation Schedule-Generic: A Standard Measure of Social and Communication Deficits Associated with The Spectrum of Autism	2000	Journal of Autism and Developmental Disorders	4625
Baroncohen et al.	Does the Autistic-Child have a Theory of Mind	1985	Cognition	3653
Baroncohen et al.	The Autism-Spectrum Quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians	2001	Journal of Autism and Developmental Disorders	2854
Baroncohen et al.	The "Reading the Mind in the Eyes" test revised version. A Study with Normal Adults, and Adults with Asperger Syndrome or High-Functioning Autism	2001	Journal of Child Psychology and Psychiatry	2830
Pennington and Ozomoff	Executive Functions and Developmental Psychopathology	1996	Journal of Child Psychology and Psychiatry	1895
Sebat et al.	Strong association of de novo copy number mutations with autism	2007	Science	1796
Baroncohen and Wheelwright	The Empathy Quotient: An Investigation of Adults with Asperger Syndrome or High Functioning Autism, and Normal Sex Differences	2004	Journal of Autism and Developmental Disorders	1756
Bailey et al.	Autism as a Strongly Genetic Disorder-Evidence from a British Twin Study	1995	Psychological Medicine	1588
Simonoff et al.	Psychiatric Disorders in Children with Autism Spectrum Disorders: Prevalence, Comorbidity, and Associated Factors in a Population-Derived Sample	2008	Journal of The American Academy of Child and Adolescent	1560



**Figure 2.** Density visualization map of co-authorship for autism research (1980-2020)





### Compliance with Ethical Standards

Since this article is a bibliometric analysis, it does not contain any studies with human or animal subjects performed by any of the authors.

### Conflict of Interest

The authors declare no conflicts of interest.

### Author Contribution

Authors contributed equally to this work.

### Financial Disclosure

None

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