



Content Analysis of Abstracts Published in Autism Journals in 2021: The year in Review

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Abstract

Purpose Ever since Leo Kanner first described autism in 1943, the research in this field has grown immensely. In 2021 alone, 5837 SCOPUS indexed documents were published with a title that contained the words: “autism”, “autistic”, or “ASD”. The purpose of this study was to examine the most common topics of autism research in 2021 and present a geographical contribution to this research.

Methods We performed a content analysis of 1102 abstracts from the articles published in 11 Autism journals in 2021. The following journals, indexed by the SCOPUS database, were included: *Autism*, *Autism Research*, *Molecular Autism*, *Journal of Autism and Developmental Disorders*, *Research in Autism Spectrum Disorders*, *Focus on Autism and Other Developmental Disabilities*, *Education and Training in Autism and Developmental Disabilities*, *Review Journal of Autism and Developmental Disorders*, *Advances in Autism*, *Autism and Developmental Language Impairments*, and *Autism in Adulthood*.

Results According to the analysis, the main research topics were: mental health, social communication, social skills, quality of life, parenting stress, ADHD, Covid-19, self-efficacy, special education, and theory of mind. In relation to geographic distribution, most studies came from the USA, followed by the UK, Australia, and Canada.

Conclusion Research topics were aligned with the priorities set by stakeholders in autism, most notably persons with autism themselves and their family members. There is a big gap in research production between developed countries and developing countries.

Keywords Content analysis · Autism journals · SCOPUS · Research topics

Introduction

According to the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders*, Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and the pattern of stereotypical and repetitive behaviors (American Psychiatric Association, 2013). An Austrian-American psychiatrist Leo Kanner was the first scientist who described a condition that we now refer to as ASD in 1943 (Kanner, 1943). Ever since that seminal paper describing the case histories of 11 children was published, the interest in autism research has grown immensely. This is not surprising given the high prevalence

of the condition. Current estimates show that ASD is a common disorder, with a median prevalence of around 1%, and a median male-to-female ratio of 4.2:1 (Zeidan et al., 2022). The rise in the prevalence of autism has been associated with new research and investments in autism research internationally (Pellicano et al., 2014). Given this rise in research funds dedicated to autism research, it is of critical importance to determine the research priorities in this field. In a study examining research priorities, stakeholders preferred applied to basic research topics and gave importance to topics such as co-occurring conditions, health and well-being, and lifespan issues (Frazier et al., 2018). From the parents' perspective, the priorities are quite similar, and involve topics such as health and well-being, socialization and social support, community awareness, and understanding of Autism (Clark & Adams, 2020). Another topic of interest is the similarities and differences of the impact of autism in different world regions, as it is difficult to draw

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public attention to this condition in less developed countries (Hahler & Elsabbagh, 2015).

Thus, in this article, we examined the most frequent research topics in autism research in 2021 and reviewed from which countries these studies originate. The reference for this research is the SCOPUS database. The SCOPUS is an abstract and indexing database produced by Elsevier and covers abstracts and citations from 1966 to the present (Burnham, 2006). The SCOPUS database was selected for this analysis as it has broader coverage in the field of Social Sciences and Humanities than the Web of Science (Memisevic et al., 2019).

According to the SCOPUS database, in 2021, 5837 documents were published that in its title contained the words “autism”, “autistic” or “ASD”. Most of these documents were scientific articles (5034), with the rest of the documents including books, chapters, and conference papers. As an illustration of this growth in autism research, let us point to the fact that in 2001 there were 558 such documents, and in 2011, there were 2120 documents. More than 100 scientific journals had at least five articles published in 2021 with the terms “autism”, “autistic”, or “ASD” in their titles. Most of the articles were from the fields of medicine, psychology, neuroscience, social sciences, biochemistry, and health professions, but also some less expected fields such as engineering, environmental science, physics, business, and agriculture.

This review aimed to analyze the most prevalent research topics in Autism journals indexed in SCOPUS in the year 2021. We also provided a brief overview of the ten most frequent research topics and additional information on articles dealing with these topics. Lastly, we wanted to examine the main contributing countries to autism research.

Method

Materials

The SCOPUS scientific base was used to extract data for this study. We examined all journals indexed by SCOPUS whose titles had the word “autism”. There were 11 such journals: *Autism*, *Autism Research*, *Molecular Autism*, *Journal of Autism and Developmental Disorders*, *Research in Autism Spectrum Disorders*, *Focus on Autism and Other Developmental Disabilities*, *Education and Training in Autism and Developmental Disabilities*, *Review Journal of Autism and Developmental Disorders*, *Advances in Autism*, *Autism and Developmental Language Impairments*, and *Autism in Adulthood*.

Table 1 The number of abstracts of articles retrieved from Autism Journals

Journal name	N	%
1. <i>Journal of Autism and Developmental Disorders</i>	364	33.0
2. <i>Autism Research</i>	201	18.2
3. <i>Autism</i>	188	17.1
4. <i>Research in Autism Spectrum Disorders</i>	117	10.6
5. <i>Molecular Autism</i>	64	6.0
6. <i>Review Journal of Autism and Developmental Disorders</i>	36	3.2
7. <i>Education and Training in Autism and Developmental Disabilities</i>	32	2.9
8. <i>Autism in Adulthood</i>	32	2.9
9. <i>Advances in Autism</i>	26	2.3
10. <i>Focus on Autism and Other Developmental Disabilities</i>	21	1.9
11. <i>Autism and Developmental Language Impairments</i>	21	1.9

Procedure and Analysis

The inclusion criteria for this review were that the final version of the article was published in 2021, and that it was a research article including original scientific articles, brief reports, case studies, case reports, and review articles. We did not extract data from Editorials, Commentaries, Letters to Editor, Book Reviews, and Corrections. We extracted the following information for each article: (1) Journal’s name, (2) Title of the article, (3) Country of the corresponding author, and (4) Abstract. Total number of analyzed articles was 1102. From the analysis output, we created two categories. The first is related to research topic (theme). Phrases containing two or more words were extracted, and we manually selected meaningful research topics. The second category was related to the subjects (participants) of the studies. The data were analyzed with R computer program (R Core Team, 2021). In addition, we extracted information regarding the country of origin of the corresponding author as a proxy for geographical contribution to autism research.

Results

We first present the number of abstracts retrieved from each of the journals.

As can be seen from Table 1., almost 1/3 (68.3%) of all articles were retrieved from the top three journals: *Journal of Autism and Developmental Disorders*, *Autism Research*, and *Autism*.

The most common research topics in Autism Journals are presented in Table 2.

As can be seen from Table 2. Mental health was the topic most frequently explored in these articles. Another category that we explored in relation to these abstracts was “participants”.

Table 2 The 15 most common research topics in Autism Journals

Research topic	Count
<i>Mental health</i>	221
<i>Social communication</i>	92
<i>Social skills</i>	90
<i>Quality of life</i>	67
<i>Parenting stress</i>	59
<i>ADHD</i>	56
<i>Covid-19</i>	52
<i>Self-efficacy</i>	51
<i>Special education</i>	47
<i>Theory of mind</i>	46
<i>Adaptive functioning</i>	46
<i>Social anxiety</i>	46
<i>Physical activity</i>	42
<i>Sensory processing</i>	41
<i>Sleep problems</i>	39

Table 3 Frequency of terms related to the category “participants”

Subjects in the study	Count
<i>Children</i>	1908
<i>Parents</i>	995
<i>Individuals</i>	717
<i>Adults</i>	707
<i>Participants</i>	673
<i>Families</i>	390
<i>Students</i>	294
<i>People</i>	274
<i>Adolescents</i>	243
<i>Population</i>	236

Table 4 Corresponding author’s country

Country	N	%
USA	490	0.445
UK	144	0.131
Australia	88	0.080
Canada	61	0.055
China	39	0.035
Israel	23	0.021
France	19	0.017
Italy	18	0.016
Spain	18	0.016
The Netherlands	18	0.016
Belgium	16	0.015
Japan	16	0.015
Turkey	16	0.015
Taiwan	15	0.014
Sweden	12	0.011
Germany	10	0.009

These data are shown in Table 3.

Finally, we examined the corresponding author’s countries to see the geographical contribution to autism research. We only presented data for countries that had 10 or more articles published out of 1102 reviewed articles (Table 4).

By large margin, the USA had the largest share in autism research, followed by the UK, Australia, Canada, and China. There were total of 47 countries that contributed to the entire pool of studies, but the contribution of most of them was rather small. Actually, 32 countries had a contribution of less than 1%. Developing countries were largely underrepresented in the list of contributing countries.

Discussion

The goal of the present study was to review the most common research topics that were published in Autism journals in 2021. The most frequent topic was *mental health*. This is not surprising given the challenges that people with ASD are facing with, as well as their families in their everyday lives. The Covid-19 pandemic probably caused an additional incentive for researching this topic. Several factors during the pandemic, such as lockdowns, physical distancing, economic breakdowns, all increase the risk of mental health problems and can even deepen health inequalities (Moreno et al., 2020). Given that people with ASD have much higher risk of co-occurring mental health conditions than those without ASD (Ryzewska et al., 2018), research interest in mental health deserves to be on the top of priorities in autism research. In line with this, there is a need to create and validate assessment instruments designed specifically for autistic individuals. One such promising instrument is the Assessment of Concerning Behavior which has very good psychometric properties and can be used in future studies (Tarver et al., 2021). Mental health was also explored in relation to job prospects of autistic individuals. Thus, mental health issues need to be addressed as they appear to negatively impact job search and maintenance (Martin & Lanovaz, 2021). Besides targeting people with autism, research in mental health also dealt with parents of autistic individuals. The research showed that parental mental health could be significantly improved through support services and by strengthening personal relationships (Schiller et al., 2021).

A topic that attracted much scientific attention was social communication, which is one of the core features of ASD. When exploring the abstracts containing the phrase “social communication” we discovered that in many abstracts this was not the main topic of the study but just part in which the authors defined and described autism. However, some of the studies dealt with social communication per se. For example, one study explored how social communication is related to early spoken language and how it predicts later language skills (Blume et al., 2021). Also, social communication was the subject of neuroanatomical studies. In one such study, authors examined neural synchronization of tempoparietal

junction and found that participants with autism showed decreased neural synchrony of that brain region (Quiñones-Camacho et al., 2021). Lastly, let us mention an interesting study of yoga, in which authors indicated that creative yoga intervention might be a promising tool for improving social communication in children with ASD (Kaur et al., 2021).

Next in frequency was the topic of social skills. Social skills are quite susceptible to various treatment and can be improved. In one intervention study, the authors showed that Mixed Martial Arts intervention benefited social skills (Phung & Goldberg, 2021). A review of school-based social skills interventions was conducted by Dean & Chang (2021). In that review, the authors analyzed 18 intervention studies and concluded that these interventions improved social skills. The authors also pointed to the need for school practitioners to be more aware of school-intervention protocols to improve social skills of children with ASD. Eye-tracking task has been shown to predict social skills intervention outcomes (Raulston et al., 2021). Social skills were also examined in relation to another interesting concept, camouflaging. Camouflaging can be defined as behavioral adaptations of people with ASD to mask symptoms in social situations (Corbett et al., 2021). Camouflaging is more prevalent in autistic females than in males, which might be related to delays in the provision of support (Wood-Downie et al., 2021). Finally, let us mention the potential of modern technologies in improving social skills. One such promising modality for enhancing social skills is the video-enhanced activity schedules using tablet technology (Osos et al., 2021).

Quality of life is a topic of universal importance to all stakeholders in the field of autism. Earlier reviews have also shown that quality of life is one of the most important topics in autism research (Memišević & Đorđević, 2020). One of the studies reviewed investigated the relationship between sleep quality and quality of life in autistic adults (McLean et al., 2021). The authors concluded that interventions that target both sleep quality and stress could improve the quality of life of autistic individuals. The quality of life of caregivers of autistic persons is dependent on behavioral problems in persons with autism. A study by Kurokawa et al., (2021), indicated a relationship between gastrointestinal symptoms and behavioral problems. Thus, the appropriate assessment and treatment of gastrointestinal symptoms might lead to decreased problematic behavior and improved quality of life.

The next research topic we identified is parenting stress. It is well-established that parents of children with ASD have more stress than parents of typically developing children (Bonis, 2016). This review found studies that identified factors associated with higher stress levels. For example, in a study by Raff et al., (2021), the authors found that parental

perceptions about family support, symptom predictability, and treatment beliefs were related to parental stress. Similarly, a study by Kurtz et al., (2021) pointed to the relationship between a child's problem behavior and parental stress. The authors highlighted the importance of determining the function of problematic behavior in relation to parental stress. Interestingly, one study found that parental stress was not associated with ASD symptom severity (Voliovitch et al., 2021). These authors have also pointed that parental stress should be assessed prior to the diagnostic evaluation of the child.

A frequent co-occurring condition with autism is Attention Deficit Hyperactivity Disorder (ADHD). This topic has also attracted much scientific attention, especially the studies on the prevalence of ADHD in ASD. One of the studies from 2021 was the meta-analysis of the ADHD prevalence in ASD, and the results showed a prevalence rate of 38.5% for pooled current estimate and 40.2% for lifetime prevalence (Rong et al., 2021). The prevalence of ADHD symptoms in preschool children with ASD revealed that 27% of children belonged to high ADHD symptom group, and 30% to moderate ADHD symptom group (Hong et al., 2021). However, a note of caution is necessary here as that study was referring to ADHD symptoms and not a clinically confirmed ADHD diagnosis.

The next topic was not on the list of autism research priorities before 2020, and that is the topic related to the Covid-19 pandemic. This pandemic has affected all spheres of life, including health, safety, and well-being of individuals and communities (Pfefferbaum & North, 2020). Autistic individuals might have an even higher risk of difficulties coping with Covid-19 due to unexpected changes in their routines (Spain et al., 2021). Spain et al. stressed that Covid-19 caused major disruption or loss of service provisions to people with ASD. The concern for mental health of persons with ASD was also expressed in an article by Bal et al., (2021). In that article, the authors found that younger females with personal Covid-19 experience (knowing someone who had Covid-19) reported the greatest negative impacts. According to the authors, one way to cope with this situation is for mental health providers to focus on positive aspects on one's life, such as fostering hope. Researchers have also investigated the Covid-19 vaccination rate in people with ASD (Weinstein et al., 2021). The authors stressed that individuals with ASD are more susceptible to COVID-19 morbidity and should be prioritized for vaccination.

The topic of self-efficacy was ranked on the 8th place. This topic was investigated in relation to job seeking and interview process of autistic individuals. Again, the modern technologies, such as virtual reality, might be very helpful in gaining confidence. For example, virtual interactive training agents were found to increase self-efficacy skills and

consequently outcomes for people with ASD (Burke et al., 2021). In addition to self-efficacy in autistic people, important consideration needs to be self-efficacy in parents of children with ASD. Findings indicate that parents who are more involved in their child's therapeutic interventions also report higher levels of self-efficacy (Kurzrok et al., 2021).

The next topic on the list was special education. Some of the studies focused on special education eligibility as there seems to be a discrepancy between clinical diagnoses of ASD and the determination of special education eligibility (Stichter et al., 2021). Some studies were aimed at special education teachers. In one such study, special education teachers were asked whether they felt prepared to use evidence-based strategies in their work (Hamrick et al., 2021). The results of that study indicated a research-to-practice gap as special education teachers reported using many practices that were not identified as evidence-based practices. An interesting review was conducted by Rios & Burke (2021) regarding the facilitators and barriers to positive special education experiences. In that review, the authors found that facilitators to positive experience were: understanding special education services, parent-school communication, and parent support. On the other hand, barriers to positive special education experience included: limited access to resources, stigma, cultural divergence, and lack of access to special education knowledge.

We end this short overview of topics with theory of mind (TOM), ranked 10th on our list. TOM is the ability to impute mental states to oneself and others, including thoughts, feelings, intentions, and beliefs (Premack & Woodruff, 1978). There are some inconsistent results regarding TOM in people with ASD. While some studies reported that people with ASD have difficulties in TOM, (Baron-Cohen, 2000; Schneider et al., 2013), there are authors who stated that the claim that autistic individuals lack of TOM is not empirically supported and that such claims of autistic persons lack TOM can even be societally harmful (Gernsbacher & Yergeau, 2019). In any case, assessing TOM is a very important task in creating intervention programs. Here we will mention two instruments for measuring TOM, one for children and one for adults. The Theory of Mind Inventory-2 for children is a promising measure in assessing TOM. The research indicates that Theory of Mind Inventory –2 is appropriate for reflecting children's developmental stages of theory of mind (Lee et al., 2021). This in turn, can inform treatment options for improving social cognition. On the other hand, there is a promising attempt at creating instruments for measuring TOM in adults. Hutchins et al., (2021) created a Theory of Mind Inventory: Self-Report Adult and suggested it could be used as a promising research and clinical tool for the assessment of social cognition in adults.

These were the ten most common research themes published in 2021 that we identified in this review. Due to space constraints, we could not provide more information on other articles and research topics that are equally worthy of scientific attention. We hope this overview of topics will help and encourage authors, especially from developing countries, to conduct these kinds of studies in their own countries.

In relation to the participants of the studies, we can conclude that all groups seem to be well represented, including children, adolescents, and adults. In the future, the differences in the number of studies including children and those including adults will probably be further reduced as the topics related to lifelong supports, transitions, and employment are gaining its momentum.

As for the contributing countries to autism research, it is evident that most corresponding authors come from the USA, UK, Australia, and Canada. Although 47 countries contributed to the pool of 1102 articles published in 2021, only small portion of articles actually came from developing countries. In order to create effective policies, it is important to understand the global burden of autism (Baxter et al., 2015), which is much more severe in developing countries. So, why are there not more autism articles originating from developing countries? Some of the reasons are: poor scientific production, poor preparation of manuscripts, poor access to scientific literature, poor participation in publication-related decision-making processes, and bias of journals (Langer et al., 2004). Initiatives such as joint collaboration of authors from developing and developed countries, increased regional representation of scientists from developing countries on editorial boards of autism journals, and special issues of international journals that will have regional focus, are all ways to increase, at least partially, the contribution from developing countries.

Let us mention some of the limitations of the current review. Due to the selection criteria, we did not include many journals that produced articles on autism in this review. Thus, future reviews might be more inclusive and diverse in relation to reviewed journals. Next, in the description of the ten most common research topics, there was some part of subjectivity on the side of authors. We could not reference all published papers on the certain research topic and probably the selection of articles would be different in other authors.

It is quite encouraging that research topics were very much aligned with the priorities set by stakeholders in autism, most notably persons with autism themselves and their family members. We also hope the next review will include more articles from developing countries.

Conflict of interest Authors report no conflict of interest. All the data are available from the corresponding author upon request.

Ethics Approval The study was approved by the University of Sarajevo, Faculty of Educational Studies.

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