



Autism Research in India: A Scientometric Assessment of Publications Output during 2007-16

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Abstract

The paper examines 446 Indian publications on autism research as covered in Scopus database during 2007-16, experiencing an annual average growth rate of 23.86% and citation impact of 9.02. India's share in global output was 1.31% during 2007-16, which increased from 0.86% during 2007-11 to 1.57% during 2012-16. India's international collaborative publications share in autism research was 25.56% during 2007-16, which increased from 18.52% during 2007-11 to 27.81% during 2012-16. Medicine, among subjects, contributed the largest share (64.75%) to India's autism research during 2007-16, followed by neurosciences (21.97%), biochemistry, genetics & molecular biology (19.96%), psychology (9.64%), computer science (9.42%) and pharmacology and toxicology (7.17%) during 2007-16. The most productive 10 Indian organizations and authors together contributed 34.08% and 27.35% publication share and 46.61% and 16.29% citation share to total publications output by India on autism research during 2007-16. The top 10 most productive journals together accounted for 29.25% share of India's total publication output on autism research during 2007-16. Of the total India's autism research output, 11 high cited publications have registered citations from 59 to 555 and they together received 1881 citations, with 171 citations per paper. These 11 high cited papers involved the participation of 178 authors and 106 organizations. The 11 highly cited papers were published in 9 journals, with 3 papers in Proceedings of National Academy of Sciences of United States, and 1 paper each in other journals.

Keywords: Autism research, India, Scientometrics, Bibliometrics

1 Introduction



Autistic disorders are neuro developmental conditions characterized by deficits in communication, stereotyped, and ritualistic behaviors and marked social skills deficiencies (American Psychiatric Association, 2013). The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders, published in 2013, defines autism spectrum disorder (ASD) as follows: (i) persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays; (ii) Restricted, repetitive patterns of behavior, interests, or activities; (iii) Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities) and (iv) Symptoms together limit and impair everyday functioning (Autism Spectrum Disorder). There are four main sub-types of autism recognized within the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, published by the American Psychiatric Association. At present, the term 'autism' is sometimes used interchangeably with the term 'autism spectrum disorders' to mean any or all of the different forms of ASD. It is also sometimes used interchangeably with the term 'autistic disorder'. However the fifth edition of Diagnostic and Statistical Manual of Mental Disorders, DSM-5, published in May 2013 eliminated the four sub-types by dissolving them into one diagnosis called Autism Spectrum Disorder. According to the APA, this represents an effort to more accurately diagnose all individuals showing the signs of autism (Matson, 2007).

The growing recognition of the global impact of ASD has stimulated collaborative efforts of government agencies and private organizations worldwide to fund autism research. Increasing awareness of the impact of ASD on individuals, families, and society, as well as expanding knowledge of the biological underpinnings of ASD, has driven the rapid advancement of ASD research in recent years. Key priorities reflecting the urgent needs of the community include finding ways to (i) diagnose ASD earlier, (ii) understand the underlying biology and risk factors associated with ASD, and (iii) develop effective treatments, interventions, services and supports that can reduce disability and enhance quality of life for affected individuals and families across the lifespan. With the anticipated large number of children, adolescents, and adults on the autism spectrum who will be in need of treatments, interventions, and services in the future, as well as supports to assist them in integrating into their communities, the pressing need for scientific insight and breakthrough research across multiple disciplines has never been greater. We have witnessed the increasing prevalence of autistic disorders in the recent years. Some studies have reported that up to 1% of the population suffer from this illness (Matson and Kozlowski, 2011). Despite being over looked in the past, autistic disorders are now acknowledged as an incapacitating childhood disorder that has gained the attention of the public (Office of Autism Research Coordination, 2012). This has led to expanding autism research in developed countries, with many governmental and private funding companies and institutions to allocate funds for autism research (Types of Autism, 2016).

1.1 Literature Review



Only two studies have been published in the past on this topic, among such studies, Office of Autism Research Coordination report (Williams, Higgins and Brayne 2006) informed the Interagency Autism Coordinating Committee (IACC) and Autism Spectrum Disorder (ASD) stakeholders of the extent of research activities related to ASD and help identify potential gaps, research publications were analyzed as a measure of research outputs. Publication data can also be used to identify collaborations between investigators in the field. Zarafshani, Mohammadi, Motevalian, Abolhassani, Khaleghi and Sharifi (2016) carried out a scientometrics study by investigating published papers of Iranian researchers on autistic disorders, deriving information from 7 databases: local Iranian databases (Magiran, SID and Irandoc), and four English language databases (PubMed, Scopus, ProQuest and PsycInfo). Two hundred and six (95 Persian and 111 English) papers published between 1979 and 2015 were retrieved. Comparison between subject areas showed that non-pharmacological intervention and biological studies had the largest number with 64 and 61 papers, respectively.

2 Objectives

The main objectives of this study are to study the status of performance of global autism research during 2007-16, based on publications covered in Scopus database. In particular, the study focuses on the following objectives: (i) To study the comparative growth of the world on autism research, and determine its citation impact; (ii) To study the global publication share and citation impact of top 10 most productive countries; (iii) to study the national share of international collaborative papers of the top 10 most productive countries; (iv) to analyze research output by broad subject areas and trends by identifying significant keywords; (iv) To study the contribution and citation impact of top 10 most productive organizations and author; (vi) To study the medium of research communication; and (vii) To study the characteristics of top highly cited papers on autism research.

3 Methodology

The autism research landscape from 2007 through 2016 and the autism-related research publications were identified using the Scopus database (<http://www.scopus.com>). An automated keyword search was used to identify publications that contained the terms “autism” in the “journal title” and “ keywords tags” and restricting it to the period 2007-16 in “date range tag” was used for searching the global and Indian publication data and this become the main search string. The search has resulted into 34135 global and 446 Indian publications on autism during 2007-16. When the main search string was restricted to India “country tag”, as shown below, the publication data on India’s mobile research was obtained. The Indian search string is further restricted to “subject area tag”, “country tag”, “source title tag”, “journal title name” and



“affiliation tag”, to get information on distribution of publications by subject, collaborating countries, author-wise, organization-wise and journal-wise, etc. For citation data, citations to publications were also collected from date of publication till 10 April 2017..

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4 Analysis

The world and Indian output on autism research cumulated to 34135 and 446 publications in 10 years during 2007. India’s annual output surged from 12 in 2007 to 66 publications in 2016, averaging to 23.86% annual growth, whereas annual world output on autism research increased from 18619 to 24248 publications during the corresponding years, averaging to 9.93% growth. The world output on autism research registered 212.96% quinquennial growth, whereas India’s output registered 70.50% quinquennial growth during the same five-yearly period 2007-11 and 2012-16. India’s decennial world publications share on autism research was 1.31% during 2007-16; its quinquennial world share increased from 0.86% in 2007-11 to 1.57% during 2012-16. The citation impact of autism research by India averaged to 9.02 citations per publication (CPP) in 10 years during 2007-16, its quinquennial impact dropped from 19.56 in 2007-11 to 5.65 citations per publication (CPP) in 2012-16 (Table 1).

Table 1

Autism Research in India & the World: Growth,
Citation Impact & International Collaboration, 2007-16

Publication Period	World	India					
	TP	TP	TP	TC	CPP	ICP	% of world share
2007	1869	12	800	66.67	2	16.67	0.64
2008	2241	18	151	8.39	3	16.67	0.80
2009	2422	22	281	12.77	6	27.27	0.91
2010	2870	28	332	11.86	6	21.43	0.98
2011	3217	28	548	19.57	3	10.71	0.87
2012	3676	41	795	19.39	8	19.51	1.12
2013	4290	60	549	9.15	25	41.67	1.40
2014	4599	74	256	3.46	13	17.57	1.61
2015	4703	97	225	2.32	26	26.80	2.06
2016	4248	66	84	1.27	22	33.33	1.55
2007-11	12619	108	2112	19.56	20	18.52	0.86
2012-16	21516	338	1909	5.65	94	27.81	1.57



2007-16	34135	446	4021	9.02	114	25.56	1.31
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4.1 Top 10 Most Productive Countries in Autism Research

The global research output in the field of autism research originated from more than 100 countries in the world during 2007-16. Top 15 most productive countries in autism research had contributed 444 to 15855 publications each during 2007-16 (Table 2). Top 15 most productive countries in autism research together accounted for 98.30% global publication share during 2007-16. Their five-yearly output accounted for 95.95% global publication share during 2007-11 which increased to 98.30% during succeeding 5-year period 2012-16. Each of top 10 countries accounted for 1.30% to 46.54% global publication share during 2007-16, with USA accounting for the highest publication share (46.54%), followed by U.K (12.61% share), Canada and Australia (5.83% and 5.03%), Italy (4.29%), France, Netherlands, Japan and Germany (from 3.13% to 3.86%), Sweden and Spain (2.14% each), China, India, Israel and Brazil (from 1.30% to 1.93%) during 2007-16. The global publication share in five years increased by 1.83% in Australia, followed by 1.42% in China, 1.07% in Spain, 0.72% in India, 0.66% in Sweden, 0.40% in Italy, 0.30% in Brazil, 0.29% in Germany, 0.27% in Netherlands, 0.23% in Canada and 0.09% in Japan, as against decrease by 1.97% in USA, 1.06% in U.K., 0.41% in France and 0.11% in Israel from 2007-11 to 2012-16.

Table 2

Global Publication Share of Top 15 Most Productive Countries
in Autism Research during 2007-16

		Number of Papers			Global Share of Papers		
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16
1	USA	6029	9856	15885	47.78	45.81	46.54
2	U.K.	1675	2628	4303	13.27	12.21	12.61
3	Canada	718	1273	1991	5.69	5.92	5.83
4	Australia	489	1227	1716	3.88	5.70	5.03
5	Italy	509	954	1463	4.03	4.43	4.29
6	France	533	820	1353	4.22	3.81	3.96
7	Netherlands	439	806	1245	3.48	3.75	3.65
8	Japan	389	682	1071	3.08	3.17	3.14
9	Germany	372	697	1069	2.95	3.24	3.13
10	Sweden	217	513	730	1.72	2.38	2.14
11	China	131	529	660	1.04	2.46	1.93
12	Spain	185	545	730	1.47	2.53	2.14
13	Israel	174	273	447	1.38	1.27	1.31
14	India	108	338	446	0.86	1.57	1.31
15	Brazil	140	304	444	1.11	1.41	1.30



Total	12108	21445	33553	100.00	100.00	100.00
World	12619	21516	34135			
Share of Top 15 countries in Global Publications	95.95	99.67	98.30			

4.2 International Collaboration

India's decennial share of international collaborative publications on autism research was 25.56% during 2007-16. Its quinquennial share in ICP increased from 18.52% in 2007-11 to 27.81% in 2012-16. Its ICPs cumulated to a total of 2526 citations in 10 years, averaging to 22.16 citations per paper during 2007-16. India collaborated with more than 25 countries on autism research during 2007-16. Of the collaborating countries, United States accounted the largest international collaborative publications share (57.89%), followed by U.K. (28.95%), Australia, Canada and South Africa (from 11.40 to 14.04%), Germany and Italy (9.65% each), Brazil and Israel (8.77% each) and Israel (7.89%) during 2007-16. Except for Singapore, India's collaboration with other countries decreased from 2007-11 to 2012-16 (Table 3).

Table 3

Share of Leading Countries Collaborating with India on Autism Research during 2007-16

S.No	Name of Collaborative Country	Number of International Collaborative Papers			Share of International Collaborative Papers		
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16
1	USA	14	52	66	70.00	55.32	57.89
2	U.K.	7	26	33	35.00	27.66	28.95
3	Australia	5	11	16	25.00	11.70	14.04
4	Canada	6	9	15	30.00	9.57	13.16
5	South Africa	3	10	13	15.00	10.64	11.40
6	Germany	3	8	11	15.00	8.51	9.65
7	Italy	2	9	11	10.00	9.57	9.65
8	Brazil	3	7	10	15.00	7.45	8.77
9	Singapore	1	9	10	5.00	9.57	8.77
10	Israel	2	7	9	10.00	7.45	7.89
	World	20	94	114	100.00	100.00	100.00

4.3 Autism Research Output by Subject



India's output on autism research during 2007-16 intersected with six top sub-fields (as reflected in Scopus database classification). Its publications output was highest (64.57%) in medicine, followed by neurosciences (21.97%), biochemistry, genetics & molecular biology (19.96%), psychology (9.64%), computer science (9.42%) and pharmacology and toxicology (7.17%) during 2007-16. Their search activity on autism research, as seen from activity index measure, went up in computer science (from 9.83 to 128.81) and pharmacology and toxicology (from 77.43 to 107.21). The activity index dropped in medicine (from 113.28 to 95.76), neurosciences (from 117.99 to 94.25), biochemistry, genetics & molecular biology (from 134.56 to 88.96) and psychology (from 105.64 to 98.20) from 2007-11 to 2012-16. In terms of citations per paper, neurosciences scored the highest citation impact of 19.70, followed by biochemistry, genetics & molecular biology (11.76), medicine (8.16), pharmacology and toxicology (7.19), psychology (5.14) and computer science (3.29) during 2007-16 (Table 4)

Table 4

Subject-Wise Break-up of Publications output by India in Autism Research during 2007-16

S.No	Subject	Number of Papers			Activity Index		TC	CPP	%TP
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16	2007-16	2007-16
1	Medicine	79	209	288	113.28	95.76	2350	8.16	64.57
2	Neurosciences	28	70	98	117.99	94.25	1931	19.70	21.97
3	Biochemistry, Genetics & Molecular Biology	29	60	89	134.56	88.96	1047	11.76	19.96
4	Psychology	11	32	43	105.64	98.20	221	5.14	9.64
5	Computer Science	1	41	42	9.83	128.81	138	3.29	9.42
6	Pharmacology and Toxicology	6	26	32	77.43	107.21	230	7.19	7.17
	Indian output	108	338	446	100.00	100.00			

4.4 Significant Keywords

Around 30 significant keywords have been identified from the literature. These keywords are listed in Table 5 in the decreasing order of the frequency of occurrence during 2007-16. Examination of frequently used words in publication text can be helpful in identifying key research themes. This approach was used to identify key themes in autism research articles published between 2007 and 2016

Table 5

List of Significant Keywords in Literature on Indian Autism Research during 2007-16



S.No	Keyword	Frequency	S.No	Keyword	Frequency
1	Autistic Disorder	62	18	Learning	14
2	Attention Deficit Disorder	52	19	Mood Disorders	13
3	Autism Spectrum Disorder	49	20	Childhood Disease	13
4	Neuroimaging	27	21	Mental Health	12
5	Depression	26	22	Psychosis	12
6	Social Behavior	25	23	Speech Therapy	12
7	Genetics	24	24	Motor Performance	11
8	Social Interaction	24	24	Neurons	11
9	Neurological Disease	22	25	Brain Development	10
10	Anxiety Disorders	21	26	Brain Disease	10
11	Bipolar Disorders	19	27	Brain Mapping	10
12	Learning Disorders	19	28	Conduct Disorders	10
13	Cognitive Defects	15	29	Down Syndrome	10
14	Language Disabilities	15	30	Emotion	10
15	Mental Disorders	15			
16	Asperger Syndrome	14			
17	Development Disabilities	14			

4.5 Citation Distribution

Of the 446 papers, 158 received zero citations and 286 papers received citations from 1 to 555. Of the 286 papers, 4 papers received citations from 170 to 555, 7 papers received citations from 59 to 83, 12 papers received citations from 30 to 48, 56 papers received citations from 11 to 29, and the remaining papers received citations from 1 to 10.

4.6 Top 10 Most Productive Organizations

The publication productivity of 10 most productive Indian organizations in autism research varied over a wide range from 8 to 31 publications. Together these top 10 organizations contributed 34.08% publication share (152 publications) and 46.61% citation share (1874) to total publications output by India on autism research during 2007-16. The scientometric profile of these 10 Indian organizations is presented in Table 6. Four of the top 20 organizations registered publications output above the group average of 15.2 publications per organization: National Institute of Mental Health & Neurosciences, Bangalore (31 papers), Christian Medical College, Vellore (25 papers), Medical College, Thiruvananthapuram (23 papers) and Postgraduate Institute of Medical Education & Research, Chandigarh (16 papers) during 2007-16. Four organizations registered citation impact above the average citations per publication (12.33) of the top 10 organizations during 2007-16: National Institute of Mental Health & Neurosciences, Bangalore (36.03), Manovikas Kendra Rehabilitation & Research Institute for Handicapped, Kolkata (21.38), Assam Autism Foundation, Guwahati (17.0) and Indian Statistical Institute, Kolkata (13.25) during 2007-16. Four organizations registered h-index above



the group average (5.0): Indian Statistical Institute, Kolkata (8), National Institute of Mental Health & Neurosciences, Bangalore, Manovikas Kendra Rehabilitation & Research Institute for Handicapped, Kolkata and Assam Autism Foundation, Guwahati (7 each) during 2007-16. Four organizations contributed international collaborative publications share above the group average (13.82%) of all organizations: National Institute of Mental Health & Neurosciences, Bangalore (32.26%), Manovikas Biomedical Research & Diagnostic Centre, Kolkata (22.22%), Indian Statistical Institute, Kolkata and All India Institute of Medical Sciences, New Delhi (16.67% each) during 2007-16. Four organizations registered relative citation index above the group average (1.37) of all organizations: National Institute of Mental Health & Neurosciences, Bangalore (3.99), Manovikas Kendra Rehabilitation & Research Institute for Handicapped, Kolkata (2.37), Assam Autism Foundation, Guwahati (1.88) and Indian Statistical Institute, Kolkata (1.47) during 2007-16.

Table 6

Scientometric Profile of Top 10 Most Productive Indian Organizations in Autism Research in India during 2007-16

S.No	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	National Institute of Mental Health & Neurosciences, Bangalore	31	1117	36.03	7	10	32.26	3.99
2	Christian Medical College, Vellore	25	88	3.52	3	1	4.00	0.39
3	Medical College, Thiruvananthapuram	23	36	1.57	3	1	4.35	0.17
4	Postgraduate Institute of Medical Education & Research, Chandigarh	16	59	3.69	5	2	12.50	0.41
5	All India Institute of Medical Sciences, New Delhi	12	41	3.42	3	2	16.67	0.38
6	Indian Statistical Institute, Kolkata	12	159	13.25	8	2	16.67	1.47
7	Manovikas Biomedical Research & Diagnostic Centre, Kolkata	9	56	6.22	5	2	22.22	0.69
8	Anna University, Chennai	8	11	1.38	2	0	0.00	0.15
9	Manovikas Kendra Rehabilitation & Research Institute for Handicapped, Kolkata	8	171	21.38	7	0	0.00	2.37
10	Assam Autism Foundation, Guwahati	8	136	17.00	7	1	12.50	1.88
	Total of 10 organizations	152	1874	12.33	5.0	21	13.82	1.37



Total of India	446	4021	9.02					
Share of top 10 organizations in India's total	34.08	46.61						
TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index								

4.7 Top 10 Most Productive Authors

The publications productivity of top 10 most productive Indian authors varied over a wide range from 9 to 23 publications. Together these top 10 Indian authors contributed 27.35% publications share (122 publications), and accounted for 16.29% citations share (655) during 2007-16. The scientometric profile of these 100 Indian authors is presented in Table 7. Three of top 10 authors registered their productivity above the group average of 12.2: P.S.S. Russel (23 papers), M.K.C. Nair (17 papers) and S. Sinha (13 papers) during 2007-16. Four of top authors have registered citation impact above the group average of 5.37 citations per publication of all authors: S. Ghosh (16.33), S. Sinha (12.08), N. Singhal (8.78) and U. Lahiri (8.33) during 2007-16. Three of top authors registered h-index above the group average (3.6) of all authors: S. Sinha and S. Ghosh (7 each) and N. Singhal (4) during 2007-16. Three of top 10 authors contributed international collaborative publications share above the group average (11.48%) of all authors: N. Singhal (66.67%), U. Lahiri (55.56%) and S. Sinha (15.38%) during 2007-16. Four authors registered relative citation index above the group average (0.60) of all authors: S. Ghosh (1.81), S. Sinha (1.34), N. Singhal (0.97) and U. Lahiri (0.92) during 2007-16.

Table 7
Scientometric Profile of Top 10 Most Productive Indian Authors
In Autism Research in India during 2007-16

S.No	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI	ICP	%ICP	RCI
1	P.S.S. Russel	Christian Medical College, Vellore	23	64	2.78	3	0	0	0.31
2	M.K.C. Nair	Medical College, Thiruvananthapuram	17	25	1.47	2	0	0	0.16
3	S. Sinha	Manovikas Kendra Rehabilitation & Research Institute for Handicapped, Kolkata	13	157	12.08	7	2	15.38	1.34
4	B. George	Medical College, Thiruvananthapuram	12	20	1.67	2	0	0.00	0.18
5	M.L. Leena		10	18	1.80	2	0	0.00	0.20



S.No	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI	ICP	%ICP	RCI
6	P. Mammen	Christian Medical College, Vellore	10	35	3.50	3	0	0.00	0.39
7	S. Russel	Christian Medical College, Vellore	10	35	3.50	3	0	0.00	0.39
8	S. Ghosh	Indian Statistical Institute, Kolkata	9	147	16.33	7	1	11.11	1.81
9	U. Lahiri	Indian Institute of Technology, Gandhinagar	9	75	8.33	3	5	55.56	0.92
10	N. Singhal	National Centre for Autism, New Delhi	9	79	8.78	4	6	66.67	0.97
		Total of 10 authors	122	655	5.37	3.6	14	11.48	0.60
		Total of India	446	4021	9.02				
		Share of top 10 authors in India's total	27.35	16.29					

4.8 Medium of Research Communication

The top 10 most productive journals which reported autism research papers by India over a wide range varying from 5 to 35 papers per journal. Together they accounted for 29.25% share (117 papers) of India's total publication output on autism research during 2007-16. The publication share of these top 10 most productive journals in five years decreased from 30.65% to 28.99% during 2007-11 and 2012-16. The most productive journal (with 35 papers) was *Indian Journal of Pediatrics*, followed by *Journal of Indian Association of Child & Adolescent Mental Health* (18 papers Indian Pediatrics (13 papers), *Indian Journal of Psychiatry* (12 papers), etc. during 2007-16 (Table 8).

Table 8

Top 10 Most Productive Journals Reporting Autism Research in India during 2007-16

S.No	Name of the Journal	Number of Papers		
		2007-11	2012-16	2007-16



1	Indian Journal of Pediatrics	3	32	35
2	Journal of Indian Association of Child & Adolescent Mental Health	1	17	18
3	Indian Pediatrics	6	7	13
4	Indian Journal of Psychiatry	4	8	12
5	Autism Research	0	9	9
6	Indian Journal of Psychological Medicine	1	6	7
7	International Journal of Pharma & BioSciences	3	4	7
8	Journal of Clinical & Diagnostic Research	1	5	6
9	Asian Journal of Psychiatry	0	5	5
10	Journal of Autism & Development Disorders	0	5	5
	Total of 10 journals	19	98	117
	Total Indian journal output	62	338	400
	Share of 10 journals in Indian journal output	30.65	28.99	29.25

5 Findings

India has produced 446 publications on autism research as indexed in Scopus database in 10 years during 2007-16, increasing from 12 to 66 from the year 2007 to year 2016, averaging to 23.86% annual growth. India's global publications share on autism research was 1.31% during 2007-16; which increased from 0.86% to 1.57% from 2007-11 to 2012-16. India's citation impact on autism research averaged to 9.02 citations per publication during 2007-16, which dropped from 19.56 to 5.65 from 2007-11 to 2012-16. The share of international collaborative papers of India in its research output on autism was 25.56% during 2007-16, which increased from 18.52% to 27.81% from 2007-11 to 2012-16. Its international collaborative papers output averaged to 22.16 citations per paper during 2007-16. India collaborated with more than 25 countries on autism research during 2007-16, of which, United States accounted for the largest international collaborative publications share (57.89%), followed by U.K. (28.95%), Australia, Canada and South Africa (from 11.40 to 14.04%), Germany and Italy (9.65% each), Brazil and Israel (8.77% each) and Israel (7.89%) during 2007-16. Except for Singapore, India's collaboration with other countries decreased from 2007-11 to 2012-16

Medicine, among subjects, contributed the largest share (64.75%) to India's autism research during 2007-16, followed by neurosciences (21.97%), biochemistry, genetics & molecular biology (19.96%), psychology (9.64%), computer science (9.42%) and pharmacology and toxicology (7.17%) during 2007-16. The research activity on autism research increased in computer science and pharmacology and toxicology, as against decrease in medicine,



neurosciences, biochemistry, genetics & molecular biology and psychology from 2007-11 to 2012-16. In terms of citations per paper, neurosciences scored the highest citation impact of 19.70, followed by biochemistry, genetics & molecular biology (11.76), medicine (8.16), pharmacology and toxicology (7.19), psychology (5.14) and computer science (3.29) during 2007-16

The top 10 most productive organizations and authors together contributed 34.08% and 27.35% publication share and 46.61% and 16.29% citation share to total publications output by India on autism research during 2007-16. The top 10 most productive journals together accounted for 29.25% share (117 papers) of India's total publication output on autism research during 2007-16, which decreased from 30.65% to 28.99% from 2007-11 to 2012-16.

6 Conclusion

Concludes that the needs of the collective autism community are vast and varied and may include: (i) Recognizing the symptoms and signs of autism early to enable early intervention and maximize potential to reduce disability; (ii) Understanding the biological underpinnings that help explain autism symptoms and can serve as a foundation for research advances; (iii) Identifying genetic and environmental risk factors; (iv) Developing an array of treatments and interventions that are safe and effective for use across the lifespan; (v) Ensuring that high-quality, evidence-based services and supports are available and accessible to everyone who needs them; It implies that autism can result in changing needs and disability throughout life and that research is needed to understand and meet the needs of all people with autism across the lifespan. So there is a strong requirement to develop the infrastructure of the autism research field to coordinate, accelerate, and increase the effectiveness of autism research; and improving autism surveillance efforts to enable more accurate assessment of Autism Spectrum Disorder (ASD) prevalence in populations in India.

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