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A scientometrics approach to schizophrenia research in India: An analysis of publications output during 2002–11

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ABSTRACT

Objectives: This study analyses the research output of India in schizophrenia research during 2002–11 on several parameters including the growth, rank and global publications share, citation impact, share of international collaborative papers, contribution of major collaborative partner countries, contribution of various subject-fields, contribution and impact of most productive institutions and authors, media of communication and characteristics of high cited papers.
Methods: The Scopus Citation Database has been used to retrieve the data for 10 years (2002–11) by searching the keywords schizophrenia research in the combined Title, Abstract and Keywords fields.
Results: Among the top 20 most productive countries in schizophrenia research, India ranks at 15th position (with 882 papers) with a global publication share of 1.58% and an annual average publication growth rate of 21.80% during 2002–11. Its citation impact per paper was 3.60 international collaborative publications share was 26.98% during 2002–11.
Conclusions: Concludes that India needs to increase both the quantity and quality of research and also increase the international collaborative research, besides strengthening and modernizing its research infrastructure. There is need to treat schizophrenia as a priority area in the current and future national S & T plans of India.

1. Introduction

The English term schizophrenia comes from two Greek words that mean "split mind." Schizophrenia is a serious disorder of the mind and brain. As per WHO (2013), schizophrenia is a severe form of mental illness affecting about 7 per thousand of the adult population, mostly in the age group 15–35 years. Although, it is a treatable disorder yet more than 50% of persons with schizophrenia are not receiving appropriate care and 90% of people with untreated schizophrenia are in developing countries. The incidence rate of schizophrenia seems consistent across the world for the last half-century. Schizophrenia affects around 0.3–0.7% of people at some point in their life or 24 million people worldwide as of 2011 (about one of every 285). Despite the received wisdom that schizophrenia occurs at similar rates worldwide, its prevalence varies across the world, within countries, and at the local and neighborhood level. It causes approximately 1% of worldwide disability-adjusted life years (DALYs). The prevalence of schizophrenia tends to be highest in Oceania, the Middle East and Southeast Asia, while the nations of Australia, Japan, the United States and Western Europe typically have low prevalence rates. Despite relative geographical proximity, the DALY rate of schizophrenia in Indonesia nearly doubles that of Australia (the nations with the highest and lowest respective rates). In India, for a population of more than one billion people, there are an estimated four million people with schizophrenia, with different degrees of impact on some 25 million family members. WHO (2012) has started the pilot programmes in few developing countries including India for providing care to people with severe mental illness through appropriate training of the primary health care personnel, provision of essential drugs, strengthening of the families for home care, referral support from mental health professionals and public education to decrease stigma and discrimination.

Only few quantitative studies analyzing world schizophrenia research literature has been carried out in the past. Theander and Wetterberg (2010) compare the quantity of publications on schizophrenia with the total medical literature in Medline during 57 years (1950–2006). During 1950–2006, 16.28 million references were added to Medline. Nearly 68,000, 0.42%, references were related to schizophrenia. The percentage of papers on schizophrenia among the psychiatric literature decreased from 5.2% to 2.6% during the above period. The present study indicates

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that the number of references on schizophrenia in Medline has followed the general increase of medical publications. This pattern differs compared to some other research fields such as dementia, HIV, and peptic ulcer. The results indicate that more resources are needed to enhance research activities on schizophrenia.

Morlino et al. (1997) assessed the publication trends (of 943 papers) on schizophrenia published by three general psychiatric journals (Archives of General Psychiatry (AGP), the British Journal of Psychiatry (BJP), and the Australian and New Zealand Journal of Psychiatry (ANZJP)) from three continents covering the period between 1980 and 1994. The authors carried out both a quantitative analysis, assessing the trends over time in the publication of papers on schizophrenia and a qualitative analysis, classifying the articles into eight scientific fields. The study revealed that the proportion of papers focusing on schizophrenia was higher in the AGP and in the BJP (18 and 15%) as compared with the ANZJP (5.6%). A substantially higher proportion of basic science articles was published in the AGP as compared with the BJP and the ANZJP, whereby a somewhat larger representation of epidemiological and psychosocial research was found in the latter journals.

Clement et al. (2003) compared the level of research activity in bipolar disorder and schizophrenia. It examine whether the relative size of medical literature on bipolar disorder and schizophrenia varies over time and across different scientific fields and found that there is a relative dearth of research activity on bipolar disorder compared with schizophrenia. Ratios (bipolar disorder: schizophrenia) ranged from 1:1.3 for the number of research funding awards to 1:7.6 for the number of clinical trials.

A few quantitative studies analyzing schizophrenia literature focusing on specific countries/regions has been carried out in the past. Koskinen et al. (2008) utilized bibliometric data and indicators including publication counts, impact factors and received citations for evaluating research performance in Finnish schizophrenia research. The articles and citations were searched from the Web of Science database. The authors used schizophrenia as a keyword and defined address Finland, and limited years to 1996–2005. When we analyzed Finnish schizophrenia research, altogether 265 articles met our criteria. There were differences in impact factors and received citations between institutions. The number of annually published Finnish schizophrenia articles has tripled since the mid-1990s. International co-operation was common (43%). Bibliometric methods revealed differences between institutions, indicating that the methods can be applied in research evaluation.

AATRM and IMIM (2006) demonstrated, by means of bibliographic methods, the scientific production of research into schizophrenia in Spain. Around 1160 authors belonging to 363 institutions have been identified. The study obtained a map of effective collaborations among authors and research centers, by bringing to light the existing behind the scenes networks and schools of thought. This study enabled researchers to know the output of Spanish researchers from the various hospitals, universities and other Spanish research centers and also their international collaboration.

Avasthi and Singh (2004) reviewed various studies published on schizophrenia in the last decade (1990–2000) in the Indian Journal of Psychiatry. According to authors, in a developing country such as India, research into the various aspects of this schizophrenia disorder is still not a priority. Despite this scenario, large number of centers across the country has been conducting research in the last four decades. During the last decade, the scope, emphasis and quality of research seem to have undergone a lot of change. Important landmarks have been highlighted and limitations pointed out.

Kulhara et al. (2010) reviewed the studies published in the Indian Journal of Psychiatry since 1958. Starting with 3 articles in 1958, it has steadily published more than 200 papers on one or the other aspect of schizophrenia. From rudimentary research methodology and descriptive approach, schizophrenia research, as published in the Journal, seems to have come of age with more and more sophisticated research designs and methodologies. Notable contributions have been made in the field of epidemiology, course and outcomes and phenomenology of this disorder. However, research in psycho-social rehabilitation of schizophrenia and related areas is sparse and sporadic. The need to conduct research that impacts health policies and planning of services for this disorder is evident and our researchers would do well to provide impetus in these areas.

2. Objectives

The main objective of this study is to analyze the research output of India in schizophrenia research in national and global contexts, as reflected in its publications output during 2002–11. The study has the following objectives: (i) to study the Indian research output, its growth, rank and global publications share and citation impact, (ii) to study the patterns of international collaboration and identification of major collaborators, (iii) to study the contribution by sub-fields, (iv) to study the publications productivity and impact of leading institutions and authors of India and (v) to study the characteristics of highly cited papers.

3. Methodologies and source of data

This study used Scopus International Database [http://www.scopus.com/search/] to extract relevant data on schizophrenia research in India and other most productive countries for the 10 years (2002–11). An advanced search strategy involving schizophrenia research as the keyword was used to search and download data using Title, Abstract and Keywords fields together, resulting in downloading of 882 records on India related to schizophrenia.

For citations data, three years, two years, one year and zero year citation windows have been used for computing average citations per paper in schizophrenia research during 2002–08, 2009, 2010 and 2011. For example, for papers published in 2002, citation window is three years from 2002 to 2005. For papers published in 2009, citation window is two years from 2009 to 2011, and for papers published in 2010 citation window is one year 2010–11. For identifying India's international collaborative papers, a separate search strategy was prepared. For analyzing significant institutions, authors and journals, separate search strategies were developed, which later combined with the main string lead to the generation of the desired output. For generating high-cited papers, the main string was first run. Then, the tag "citation to" was ticked, to rearrange the entire output in the decreasing order of citations received by each paper with most high-cited papers at the top. Then the high-cited papers are marked and downloaded for analyses.

4. Analysis

4.1. Global publication share and rank

The global publication share of the top 20 most productive countries in schizophrenia research varies from 1.24% to 31.67% during 2002–11. The United States tops the list, with a share of 31.67% during 2002–11. The United Kingdom ranks second (with 12.32% share), followed by Germany, Canada, Australia and Japan (with publications share ranging from 4.39% to 8.03%. France, Italy,

Table 1
Publications output, share and rank of top 20 countries in Schizophrenia research, 2002–11.

S. No.	Country	Number of papers			Share of papers			Total citations	ACPP
		2002	2011	2002–11	2002	2011	2002–11	2002–11	2002–11
1.	USA	1097	2236	17,678	28.55	32.81	31.67	222,012	12.56
2.	UK	431	824	6876	11.22	12.09	12.32	74,964	10.90
3.	Germany	324	525	4481	8.43	7.70	8.03	38,967	8.70
4.	Canada	188	363	2897	4.89	5.33	5.19	27,922	9.64
5.	Australia	122	371	2572	3.17	5.44	4.61	25,100	9.76
6.	Japan	166	353	2450	4.32	5.18	4.39	17,241	7.04
7.	France	155	257	2066	4.03	3.77	3.70	13,455	6.51
8.	Italy	117	298	2001	3.04	4.37	3.59	15,980	7.99
9.	Spain	89	270	1810	2.32	3.96	3.24	12,472	6.89
10.	Netherlands	111	259	1540	2.89	3.80	2.76	15,894	10.32
11.	China	38	242	1356	0.99	3.55	2.43	10,629	7.84
12.	Switzerland	88	165	1170	2.29	2.42	2.10	11,662	9.97
13.	Israel	74	97	1019	1.93	1.42	1.83	9845	9.66
14.	Sweden	55	98	900	1.43	1.44	1.61	11,202	12.45
15.	India	32	159	882	0.83	2.33	1.58	3175	3.60
16.	Taiwan	37	147	785	0.96	2.16	1.41	3926	5.00
17.	Brazil	37	116	761	0.96	1.70	1.36	3435	4.51
18.	Denmark	40	128	749	1.04	1.88	1.34	7819	10.44
19.	South Korea	25	110	699	0.65	1.61	1.25	3771	5.39
20.	Poland	37	97	693	0.96	1.42	1.24	2448	3.53
	World	3843	6815	55,815					

ACPP = average citation per paper.

Spain, Netherlands, China and Switzerland ranks at 7–12th positions (their global publications share ranging from 2.10% to 3.70%). The countries that fall between 13th and 20th positions are Israel, Sweden, India, Taiwan, Brazil, Denmark, South Korea and Poland with their global publications share ranging from 1.24% to 1.83% (Table 1).

The developed countries showing increase in their publications share are United States by 4.26%, followed by Australia (2.27%), Spain (1.64%), Italy (1.33%), Netherlands (0.91%), UK (0.87%), Japan (0.86%), Denmark (0.84%), Poland (0.46%), Canada (0.43%), Switzerland (0.13%) and Sweden (0.01) from the year 2002 to the year 2011. In contrast, the developed countries showing decrease in their publications share during the same period are Germany by 0.731% and France (0.26%). All developing countries except Israel, on the other hand, have shown rise in their publications share in schizophrenia research: China by 2.56%, followed by India (1.50%), Taiwan (1.20%), South Korea (0.96%) and Brazil (0.74%) from the year 2002 to the year 2011 (Table 1).

India ranks at 15th position among the top 20 most productive countries in schizophrenia research with its global publications share of 1.58% during 2002–11. China, Brazil and South Korea ranked at 11th, 17th and 19th positions, with global publications share of 2.43%, 1.36% and 1.25%, respectively during 2002–11. India's global publications share increased from 0.83% to 2.33% from the year 2002 to the year 2011. China, Brazil and South Korea's global publications share increased from 0.99% to 3.55%, 0.96% to 1.70% and 0.65% to 1.61% from the year 2002 to the year 2011 (Table 1).

Considering the quality of papers published by these productive countries, in terms of average citation per paper which varies from 3.53 to 12.56 during 2002–11. The highest citation impact is registered by USA with 12.56 citations per paper, followed by Sweden (12.45 citations per paper), UK (10.90 citations per paper), Denmark (10.44 citations per paper) and Netherlands (10.32 citations per paper). Switzerland, Australia, Israel, Canada, Germany, Italy, China, Japan, Spain and France scored the impact varying between 6.51 and 9.97 citations per paper. South Korea, Taiwan, India and Poland achieved the citations quality less than 6 citations per paper (Table 1).

4.2. India's publication output in schizophrenia research

India's cumulative publication output in schizophrenia research consisted of 882 papers during 2002–11, with an average number of 88.2 papers per year and an annual average growth rate of 21.80%. The cumulative publications output of India in schizophrenia research increased from 253 papers during 2002–06 to 629 papers during 2007–11, witnessing a growth of 148.62% (Table 2).

In terms of impact and citation quality, the average citation per paper registered by India's publication output was 3.60 during 2002–11. The average citation per paper of cumulative publications in schizophrenia research of India has decreased from 5.20 during 2002–06 to 2.96 during 2007–11 (Table 2).

4.3. International collaboration in India's publication output

The total number of Indian papers involving international collaboration during 2002–11 is 238, accounting for 26.98% share in the cumulative publications output of India in schizophrenia research. India witnessed a decrease in the share of its

Table 2
Growth and international collaboration share of Indian schizophrenia publications, 2002–11.

Period	TP	TC	ACPP	ICP	%ICP
2002	32	112	3.50	2	6.25
2003	50	336	6.72	16	32.00
2004	40	182	4.55	15	37.50
2005	51	234	4.59	16	31.37
2006	80	452	5.65	32	40.00
2007	84	464	5.52	22	26.19
2008	105	644	6.13	28	26.67
2009	126	346	2.75	33	26.19
2010	155	370	2.39	38	24.52
2011	159	45	0.28	36	22.64
2002–06	253	1316	5.20	81	32.02
2007–11	629	1859	2.96	157	24.96
2002–11	882	3175	3.60	238	26.98

TP = total papers; TC = total citations; CPP = average citations per paper; ICP = international collaborative papers.

Table 3
Contribution of major collaborative partners of India in Schizophrenia Research during 2002–11.

S. No.	Names of collaborating countries with India	ICP			% ICP		
		2002–06	2007–11	2002–11	2002–06	2007–11	2002–11
1.	USA	44	80	124	54.32	50.96	52.10
2.	UK	29	49	78	35.80	31.21	32.77
3.	Australia	11	30	41	13.58	19.11	17.23
4.	Canada	5	22	27	6.17	14.01	11.34
5.	Israel	7	10	17	8.64	6.37	7.14
6.	Japan	0	14	14	0.00	8.92	5.88
7.	Thailand	2	11	13	2.47	7.01	5.46
8.	Germany	0	13	13	0.00	8.28	5.46
9.	Switzerland	3	9	12	3.70	5.73	5.04
10.	China	2	9	11	2.47	5.73	4.62
11.	Singapore	2	8	10	2.47	5.10	4.20
12.	Brazil	2	7	9	2.47	4.46	3.78
13.	Malaysia	0	9	9	0.00	5.73	3.78
14.	Belgium	0	9	9	0.00	5.73	3.78
15.	South Korea	0	9	9	0.00	5.73	3.78
	Total[a]	81	157	238	100.00	100.00	100.00

ICP = International Collaborative Papers.
[a] Total collaborating papers of India. In all collaborating papers of India, there are one or more foreign collaborating countries. As a result, the combined output of 15 foreign collaborating countries listed above in Indian international collaborative output will be more than its total international collaborative papers.

international collaborative papers from 32.02% during 2002–06 to 24.96% during 2007–11 in schizophrenia research (Table 2).

Among the major international collaborators (81 countries), 15 countries have published 9 or more collaborative papers with India during 2002–11 (Table 3). United States was the major collaborating partner of India during 2002–11 accounting for 52.10% of collaborative publications, followed by United Kingdom (with 32.77% share), Australia (17.23% share), Canada (11.34%) and Israel (7.14). Japan, Thailand, Germany and Switzerland (varying its share from 5.04% to 5.88%), China, Singapore, Brazil, Malaysia, Belgium and South Korea (varying its share from 3.78% to 4.62%) during 2002–2011.

Of these top 15 international collaborative countries, India's collaborative linkages has decreased with three countries with largest decrease in UK by 4.59%, followed by USA (3.36%) and Israel (2.27%) from 2002–06 to 2007–11. India's collaborative linkages have increased with 12 countries with maximum increase of 8.92% with Japan, followed by Germany 8.28%, Canada 7.84%, Malaysia, Belgium, South Korea 5.73% each, Thailand 5.54%, Australia 5.53%, China 3.26%, Singapore 2.63%, Switzerland 2.03% and Brazil 1.99% from 2002–06 to 2007–11 (Table 3).

4.4. Indian schizophrenia research output in context of different subjects

India's publication output in schizophrenia research during 2002–11 has been published in context of 7 subjects (as reflected in database classification based on journal subject content), with highest publications output coming from medicine (680 papers and 77.10% publications share), followed by neurosciences (215 papers and 24.38% publications share), pharmacology, toxicology and pharmaceutics (171 papers and 19.39% publications share), psychiatry and psychology (113 papers and 12.81% publications share), biochemistry, genetics & molecular biology (103 papers and 11.68% publications share), chemistry (27 papers and 3.06% publications share) and agricultural & biological sciences (14 papers and 1.59% publications share). On analyzing the quality and citation impact of schizophrenia research under different subjects, it was found that chemistry had scored the highest impact (10.70 citations per paper), followed by neurosciences (6.30 citations per paper), biochemistry, genetics & microbiology (6.17 citations per paper), agricultural & biological sciences (4.93), psychiatry and psychology (4.80 citations per paper), pharmacology, toxicology & pharmaceutics (4.43 citations per paper), and medicine (3.24 citations per paper) (Table 4).

Table 4
Subject-wise break-up of Indian schizophrenia publications during 2002–11.

Subject	2002–11		
	TP	TC	ACPP
Medicine	680	2205	3.24
Neurosciences	215	1355	6.30
Pharmacology, Toxicology & Pharmaceutics	171	757	4.43
Psychiatry & Psychology	113	542	4.80
Biochemistry, Genetics & Molecular Biology	103	635	6.17
Chemistry	27	289	10.70
Agricultural & Biological Sciences	14	69	4.93
Total[a]	882		

TP = total papers; TC = total citations; ACPP = average citations per paper.
[a] Total of India in schizophrenia research. There is some overlapping of literature under different subject fields. As a result, the combined output of India under 7 subject fields will be more than its total research output.

4.5. Research profile of most productive Indian institutions in schizophrenia research

The top 15 most productive Indian institutions involved in schizophrenia research have published 9 or more papers each during 2002–11. The publication profiles of these 15 Indian institutions along with their research output, citations received and h-index values are presented in Table 5. These 15 Indian institutions account for 65.87% share (581 papers) of the publications output of India with an average output per institution of 38.73. Four Indian institutions have registered higher publications share than the group average. These are National Institute of Mental Health & Neurosciences, Bangalore with 193 papers during 2002–11, followed by Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh (71 papers), Central Institute of Psychiatry, Ranchi (61 papers) and Christian Medical College & Hospital, Vellore (39 papers). The average citation per paper registered by the total papers of these 15 Indian institutions is 3.97 on a three year citation window. Six Indian institutions have registered comparative higher impact than the group average. The highest impact of 9.07 citations per paper was scored by the Institute of Genomics & Integrated Biology, Delhi, followed by Panjab University, University Institute of Pharmaceutical Sciences, Chandigarh (8.70 citations per paper), Dr Ram Manohar Lohia

Table 5
Productivity and impact of top 15 Indian institutions in schizophrenia research, 2002–11.

S. No.	Name	TP	TC	ACPP	h-Index
1	National Institute of Mental Health & Neurosciences, Bangalore	193	762	3.95	20
2	Postgraduate Institute of Medical Education & Research, Chandigarh	71	214	3.01	10
3	Central Institute of Psychiatry, Ranchi	61	223	3.66	10
4	Christian Medical College & Hospital, Vellore	39	158	4.05	10
5	Schizophrenia Research Foundation, Chennai	36	201	5.58	12
6	All India Institute of Medical Sciences, New Delhi	35	159	4.54	8
7	Dr Ram Manohar Lohia Hospital, New Delhi	33	238	7.21	12
8	G.B. Pant Hospital, Delhi	22	40	1.82	4
9	Chhatrapati Shahuji Maharaj Medical University, Lucknow	18	46	2.56	5
10	Institute of Human Behavior & Allied Sciences, Delhi	16	18	1.13	2
11	Institute of Genomics & Integrated Biology, Delhi	14	127	9.07	10
12	Kasturba Medical College, Manipal	13	8	0.62	2
13	Ranchi Institute of Neuropsychiatry & Allied Sciences, Ranchi	11	22	2.00	2
14	Panjab University, University Institute of Pharmaceutical Sciences, Chandigarh	10	87	8.70	7
15	Indira Gandhi Medical College	9	6	0.67	1

TP = total papers; TC = total citations; ACPP = average citations per paper.

Hospital, New Delhi (7.21 citations per paper), Schizophrenia Research Foundation, Chennai (5.58 citations per paper), All India Institute of Medical Sciences, New Delhi (4.54 citations per paper) and Christian Medical College & Hospital, Vellore (4.05). Measuring the performance of these institutions on the basis of h-index, eight institutions have achieved a higher h-index value than the group average of 7.67. These are National Institute of Mental Health & Neurosciences, Bangalore with h-index of 20, followed by Schizophrenia Research Foundation, Chennai and Dr Ram Manohar Lohia Hospital, New Delhi (12 each), Postgraduate Institute of Medical Education & Research, Chandigarh, Central Institute of Psychiatry, Ranchi, Christian Medical College & Hospital, Vellore and Institute of Genomics & Integrated Biology, Delhi (10 each) and All India Institute of Medical Sciences, New Delhi (8) (Table 5).

4.6. Contributions and impact of most productive authors in Indian schizophrenia research

Fifteen authors have been identified as productive authors who have published 17 or more papers in schizophrenia research. These 15 authors together contributed 429 papers with an average of 28.60 papers per author and account for 48.64% of publications share in output of India during 2002–11. Four authors have published higher number of papers than the group average (28.60). These are: B.N. Gangadhar with 70 papers, followed by Ganesan Venkata Subramanian (56 papers), R. Thara (33 papers) and S. Grover (30 papers). Considering the quality/impact of papers, these productive authors have received a total of 1774 citations for 429 papers with an average of 4.13 citations per paper. Six authors have registered higher impact than the average. These are: B.K. Thelma with ACPP of 10.61, followed by S.N. Deshpande (8.27), S.K. Jain (8.0), S. Saddichha (6.65), R. Thara (5.48) and B.N. Gangadhar (4.14). Measuring the performance of these authors on the basis of h-index, five authors have achieved a higher h-index value than the group average of 7.07. These are B.N. Gangadhar and R. Thara with h-index of 12 each, Ganesan Venkata Subramanian, S.N. Deshpande and S.K. Jain (10 each) and B.K. Thelma (9) (Table 6).

4.7. Patterns of research communication

The 15 most productive Indian and foreign journals publishing Indian research papers together contributed 305 papers in schizophrenia research, which accounts for 34.58% of the total output of India during 2002–11. The cumulative publications share of these 15 most productive journals showed a increase in India's publications output from 28.46% during 2002–06 to 37.04% during 2007–11 (Table 7).

4.8. High cited papers

India has published 12 high cited papers in schizophrenia research in last 10 years (2002–11) and these have received from 50 to 217 citations per paper. Of these 12 high cited papers, 8 appeared as articles and 4 as review paper. Of these 12 papers,

Table 6
Productivity and impact of 15 most productive Indian authors in schizophrenia research, 2002–11.

S. No.	Name	Address	TP	TC	ACPP	h-Index
1	B.N. Gangadhar	National Institute of Mental Health & Neurosciences, Bangalore	70	290	4.14	12
2	Ganesan Venkata Subramanian	National Institute of Mental Health & Neurosciences, Bangalore	56	209	3.73	10
3	R. Thara	Schizophrenia Research Foundation, Chennai	33	181	5.48	12
4	S. Grover	Postgraduate Institute of Medical Education & Research, Chandigarh	30	81	2.70	5
5	Jagadisha Thirthali	National Institute of Mental Health & Neurosciences, Bangalore	26	105	4.04	7
6	N.P. Rao	National Institute of Mental Health & Neurosciences, Bangalore	26	26	1.00	2
7	Samir Kumar Praharaj	Kasturba Medical College, Manipal	24	45	1.88	4
8	D.N. Mendhekar	National Institute of Mental Health & Neurosciences, Bangalore	25	42	1.68	4
9	S.N. Deshpande	Dr Ram Manohar Lohia Hospital, New Delhi	26	215	8.27	10
10	C. Andrade	National Institute of Mental Health & Neurosciences, Bangalore	24	81	3.38	7
11	B.K. Thelma	University of Delhi South Campus, New Delhi	18	191	10.61	9
12	R.V. Behere	National Institute of Mental Health & Neurosciences, Bangalore	19	15	0.79	2
13	P. Kulhara	Postgraduate Institute of Medical Education & Research, Chandigarh	18	44	2.44	6
14	S.K. Jain	National Institute of Mental Health & Neurosciences, Bangalore	17	136	8.00	10
15	S. Saddichha	National Institute of Mental Health & Neurosciences, Bangalore	17	113	6.65	6

TP = total papers; TC = total citations; ACPP = average citations per paper.

Table 7
List of most productive journals publishing Indian papers in schizophrenia, 2002–11.

S. No.	Name of the journal	Number of papers		
		2002–06	2007–11	2002–11
1	Indian Journal of Psychiatry	0	54	54
2	Schizophrenia Research	8	23	31
3	British Journal of Psychiatry	13	11	24
4	Asian Journal of Psychiatry	0	22	22
5	Acta Psychiatrica Scandinavia	9	12	21
6	Journal of ECT	8	12	20
7	German Journal of Psychiatry	5	14	19
8	Journal of Neuropsychiatry and Clinical Neurosciences	0	18	18
9	Indian Journal of Pharmacology	6	11	17
10	Australian & New Zealand Journal of Psychiatry	8	9	17
11	Indian Journal of Medical Research	5	10	15
12	Medical Hypothesis	4	9	13
13	Progress in Neuro Psychopharmacology and Biology Psychiatry	3	9	12
14	World Journal of Biological Psychiatry	0	11	11
15	Psychiatry Research	3	8	11

Table 8
High cited papers in schizophrenia research during 2002–11.

Author	Affiliation	Title	Journal title	Citation
Vaswani M., Linda F.K., Ramesh S.	All India Inst. of Medical Sciences, New Delhi	Role of selective serotonin reuptake inhibitors in psychiatric disorders: A comprehensive review	Progress in Neuro-Psychopharmacology and Biological Psychiatry. 2003; 27(1); 85–102	217
Ranjekar P.K., Hinge A., Hegde M.V. et al.	National Chemical Laboratory, Pune	Decreased antioxidant enzymes and membrane essential polyunsaturated fatty acids in schizophrenic and bipolar mood disorder patients	Psychiatry Research. 2003; 121(2); 109–122	143
Kumari A., Yadav S.K., Yadav S.C.	Institute of Himalayan Bioresource Technology, CSIR, Palampur	Biodegradable polymeric nanoparticles based drug delivery systems	Colloids and Surfaces B: Biointerfaces. 2010; 75(1); 1–18	129
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Arvindakshan M., Ghate M., Ranjekar P.K., Evans D.R., Mahadik S.P.	National Chemical Laboratory, Pune	Supplementation with a combination of ω-3 fatty acids and antioxidants (vitamins E and C) improves the outcome of schizophrenia	Schizophrenia Research. 2003; 62(3); 195–204	103
Andrade C., Kurinji S.	Natl. Inst. Mental Hlth./ Neurosci., Bangalore	Continuation and maintenance ECT: A review of recent research	Journal of ECT. 2002; 18(3); 149–158	62
Jayakumar P.N., Venkatasubramanian G., Gangadhar B.N. et al.	Natl. Inst. Mental Hlth./ Neurosci., Bangalore	Optimized voxel-based morphometry of gray matter volume in first-episode, antipsychotic-naïve schizophrenia	Progress in Neuro-Psychopharmacology and Biological Psychiatry. 2005; 29(4); 587–591	58
Das U.N.	Bharati Vidyapeeth University Medical College, Pune	Essential fatty acids and their metabolites could function as endogenous HMG-CoA reductase and ACE enzyme inhibitors, anti-arrhythmic, anti-hypertensive, anti-atherosclerotic, anti-inflammatory, cytoprotective, and cardioprotective molecules	Lipids in Health and Disease. 2008; 7(Article No. 37)	56
Dakhale G., Khanzode S., Khanzode S., Saoji A. et al.	Government Medical College, Nagpur	Oxidative damage and schizophrenia: The potential benefit by atypical antipsychotics	Neuropsychobiology. 2004; 49(4); 205–209	52
Cohen A., Patel V., Thara R., Gureje O.	Schizophrenia Research Foundation, Chennai	Questioning an axiom: Better prognosis for schizophrenia in the developing world?	Schizophrenia Bulletin. 2008; 34(2); 229–244	51
Rajender S., Singh L., Thangaraj K., Lee W.M.	Centre for Cellular and Molecular Biology, Hyderabad	Phenotypic heterogeneity of mutations in androgen receptor gene	Asian Journal of Andrology. 2007; 9(2); 147–179	51
Talkowski M.E., Seltman H., Bassett A.S., Brzustowicz L.M., Deshpande, S.N. et al.	Dr. Ram Manoher Lohia Hospital, New Delhi	Evaluation of a susceptibility gene for schizophrenia: Genotype based meta-analysis of RGS4 polymorphisms from thirteen independent samples	Biological Psychiatry. 2006; 60(2); 152–162	50

5 were international collaborative (2 bilateral and 3 multilateral), 1 was national collaborative and remaining 6 have no collaboration. Of the international collaborative papers, Indian institutions were first author in 10 papers and foreign authors in 2 papers. In overall, Indian participation in these 12 papers was from 9 institutions including 3 papers from National Chemical Laboratory, Pune, 2 papers from National Institute of Mental Health and Neurosciences, Bangalore and one paper each from 7 other institutions. These 12 papers appeared in 10 journals including 2 papers each in *Progress in Neuro-Psychopharmacology* and *Biological Psychiatry* and 1 paper each in 8 other journals (Table 8).

5. Summary and discussion

Indian scientists together have published 882 papers in schizophrenia research during 2002–11. India ranks 15th among the top 20 countries in schizophrenia research with a global publications share of 1.58% during 2002–11. India has witnessed increase in its global publications share from 0.83% in 2002 to 2.33% in 2011. It witnessed an annual average publication growth rate of 21.80% and registered an average of 3.60 citations per paper during 2002–11, which has decreased from 5.20 during 2002–06 to 2.96 during 2007–11. International collaboration of India in schizophrenia research accounts for 26.98% share during 2002–11, which has decreased from 32.02% during 2002–06 to 24.96% during 2007–11. USA is India's major collaborative partner during 2002–11 with a share of 52.10%, followed by United Kingdom (with 32.77% share). In terms of quality of papers published by these productive countries the average citation per paper varies from 3.53 to 12.56 during 2002–11. The highest impact is registered by USA with 12.56 citations per paper.

The distribution of Indian schizophrenia research under different subjects shows that the highest research output (680 papers) coming from medicine with 77.10% publications share, followed by neurosciences (24.38%), pharmacology, toxicology & pharmaceutics (19.39%), psychiatry and psychology (12.81%), biochemistry, genetics & molecular biology (11.68%), chemistry (3.06%) and agricultural & biological sciences (1.59%). Chemistry had scored the highest citation impact of 10.70 citations per paper, followed by neurosciences (6.30), biochemistry, genetics & microbiology (6.17), agricultural & biological sciences (4.93), psychiatry and psychology (4.80), pharmacology, toxicology & pharmaceutics (4.43) and medicine (3.24).

The 581 cumulative publications from 15 most productive Indian institutions in schizophrenia research accounts for 65.87% share in India's total publications output, registered an average citation impact of 3.97 citations per paper and an average h-index value of 7.67 during 2002–11. The 15 most productive Indian authors in schizophrenia research together contributed 429 papers and 48.64% publications share, registered an average impact of 4.13 citations per paper and an average h-index of 7.07 per author during 2002–11. The 15 most productive journals publishing Indian research papers in schizophrenia research together accounts for 34.58% (305 papers) share of the total output of India during 2002–11, which increased from 28.46% during 2002–06 to 37.04% during 2007–11.

India has published 12 high cited papers in schizophrenia research in last 10 years (2002–11) and these have received from 50 to 217 citations per paper. Of these, 5 papers were of international collaborative (2 bilateral and 3 multilateral) and Indian participation in these 12 papers was from 9 institutions.

In spite of 4 million elderly people suffering from schizophrenia in India by 2011, it had produced only 882 papers during the last ten years from 2002 to 2011. There is, therefore, an urgent need to increase both the quantity and quality of research and also increase the international collaborative research, besides strengthening & modernizing its research infrastructure. There is need to treat schizophrenia as a priority area in the current and future national S & T plans of India. For control, prevention and treatment of schizophrenia in India, a number of new initiatives and programmes need to be undertaken by Govt. of India through its National Policy for Older Persons, National Mental Health Program, etc. Indian medical and other related funding agencies must establish a more ambitious funding program for the causes, prevention, cure and care of schizophrenia. A coordinated national schizophrenia plan with manifest political commitment is now a necessity. There is also need to develop relevant training programmes at different levels to manage the problems associated with schizophrenia, besides developing adequate trained manpower at graduate and postgraduate level.

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