

Dementia research in India: A scientometric analysis of research output during 2002-11

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The study analyses the dementia research output from India during 2002-11 on different parameters including the growth, global publications share, citation impact, share of international collaborative papers, contribution of major collaborative partner countries, contribution of various subject fields and by type of dementia, productivity and impact of most productive institutions and authors and patterns of research communication in most productive journals. SCOPUS Citation Database has been used to retrieve the data for 10 years (2002-11) by searching different relevant keywords in its combined title, abstract and keywords fields. Among the top 20 most productive countries in dementia research, India ranks 16th (with 1109 papers) with a global publication share of 1.24% and an annual average publication growth rate of 25.58% during 2002-11. Its global publication share has increased over the years, rising from 0.54% in 2002 to 2.20% during 2011. Its citation impact per paper was 5.11 during 2002-11, which decreased from 7.29 during 2002-06 to 4.33 during 2007-11. Its international collaborative publications share was 24.54% during 2002-11, which decreased from 28.57% during 2002-06 to 23.07% during 2007-11. India's publications efforts are quite low considering that to 3.7 million people suffering from dementia in India. It, therefore, needs to increase its output and bring about improvement in the quality of its research efforts. Indian medical and social research funding agencies must establish a more ambitious funding program into the causes, prevention, cure and care of dementia. At the national level, there is a need to have a consultation for evolving research strategies and for delineating specific directions to investigate the etiology, treatment and care provisions for persons involved in dementia.

Key words: Dementia, diseases, publication, Scientometrics India

Introduction

Dementia is not a specific disease. It is a descriptive term for a number of symptoms that can be caused by a number of disorders that affect the brain. People with dementia have significantly impaired intellectual functioning that interferes with normal activities and relationships. They also lose their ability to solve problems and maintain emotional control, and they may experience personality changes and behavioral problems such as agitation, delusions, and hallucinations. While memory loss is a common symptom of dementia, memory loss by itself does not mean that a person has dementia. Doctors diagnose dementia only if two or more brain functions - such as memory, language skills, perception, or cognitive skills including reasoning and judgment - are significantly impaired without loss of consciousness¹. There are many disorders that can cause dementia. Alzheimer's disease (AD) is the most common cause of dementia in people aged 65 and older. Nearly all brain functions, including memory, movement,

language, judgment, behavior and abstract thinking are eventually affected. AD is characterized by two abnormalities in the brain: amyloid plaques and neurofibrillary tangles. Around 50-75% proportion of dementia cases in India are because of Alzheimer's disease. Vascular dementia is caused by brain damage from cerebrovascular or cardiovascular problems - usually strokes. It also may result from genetic diseases, endocarditis (infection of a heart valve), or amyloid angiopathy (a process in which amyloid protein builds up in the brain's blood vessels, sometimes causing hemorrhagic or "bleeding" strokes). In many cases, it may coexist with AD. There are several types of vascular dementia: (i) multi-infarct dementia (MID) - It is caused by numerous small strokes in the brain. MID typically includes multiple damaged areas, called infarcts, along with extensive lesions in the white matter, or nerve fibers, of the brain; (ii) Binswanger's disease - This rare form of dementia is characterized by damage to small blood vessels in the white matter of

the brain (white matter is found in the inner layers of the brain and contains many nerve fibers coated with a whitish, fatty substance called myelin). It leads to brain lesions, loss of memory, disordered cognition and mood changes, (iii) CADASIL (Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarct and Leukoencephalopathy) - It is linked to abnormalities of a specific gene, Notch3, which is located on chromosome 19. Around 20-30% proportion of dementia cases in India are because of vascular dementia¹.

Another type of dementia is Lewy body dementia (LBD). In LBD, cells die in the brain's cortex or outer layer, and in a part of the mid-brain called the substantia nigra. Many of the remaining nerve cells in the substantia nigra contain abnormal structures called Lewy bodies that are the hallmark of the disease. Lewy bodies may also appear in the brain's cortex or outer layer. Lewy bodies contain a protein called alpha-synuclein that has been linked to Parkinson's disease and several other disorders. Researchers, who sometimes refer to these disorders collectively as "synucleinopathies," do not yet know why this protein accumulates inside nerve cells in LBD. LBD typically also includes visual hallucinations, parkinsonian symptoms such as a shuffling gait and flexed posture and day-to-day fluctuations in the severity of symptoms. Less than 5% proportion of dementia cases in India are because of lewy body dementia.

Frontotemporal dementia (FTD), sometimes called frontal lobe dementia, describes a group of diseases characterized by degeneration of nerve cells - especially those in the frontal and temporal lobes of the brain. In many people with FTD, there is an abnormal form of tau protein in the brain, which accumulates into neurofibrillary tangles. This disrupts normal cell activities and may cause the cells to die. Around 5-10% proportion of dementia cases in India are because of frontotemporal dementia.

HIV-associated dementia (HAD) results from infection with the human immunodeficiency virus (HIV) that causes AIDS. HAD can cause widespread destruction of the brain's white matter. This leads to a type of dementia that generally includes impaired memory, apathy, social withdrawal, and difficulty concentrating. Huntington's disease (HD) is a hereditary disorder caused by a faulty gene for a protein called huntingtin. The disease causes degeneration in many regions of the brain and spinal cord. Cognitive symptoms of HD typically begin with

mild personality changes, such as irritability, anxiety, and depression, and progress to severe dementia.

Creutzfeldt-Jakob disease (CJD) is a rare, degenerative, fatal brain disorder that affects about one in every million people per year worldwide. Symptoms usually begin after age 60 and most patients die within 1 year. Many researchers believe CJD results from an abnormal form of a protein called a prion. Most cases of CJD occur sporadically - that is, in people who have no known risk factors for the disease. Patients with CJD may initially experience problems with muscular coordination; personality changes, including impaired memory, judgment, and thinking; and impaired vision. Other symptoms may include insomnia and depression. As the illness progresses, mental impairment becomes severe. Patients often develop myoclonus and they may go blind. They eventually lose the ability to move and speak, and go into a coma. Pneumonia and other infections often occur in these patients and can lead to death¹.

Nearly 3.7 million people in India are suffering from dementia and this number is set to double over the next 20 years, according to the World Health Organization (WHO). India's population of sufferers from Alzheimer's disease and Vascular Dementia (the two major afflictions that denote this condition) is estimated to more than double by 2030 and then grow exponentially by 2050. Worldwide, nearly 35.6 million people live with dementia as of 2010. This number is expected to double by 2030 (65.7 million) and more than triple by 2050 (115.4 million). Much of the increase will be in developing countries. Already 58% of people with dementia live in developing countries, but by 2050 this will rise to 71%. The fastest growth in the elderly population is taking place in China, India, and their South Asian and Western Pacific neighbors. There are 7.7 million new cases of dementia each year, implying that there is a new case of dementia somewhere in the world every four seconds. With a documented 3.7 million elderly people suffering from dementia, India currently ranks third, behind only China and the USA. Demographic ageing is a worldwide process that shows the successes of improved health care over the last century. Many are now living longer and healthier lives and so the world population has a greater proportion of older people. Dementia mainly affects older people, although there is a growing awareness of cases that start before the age of 65. By 2050,

people aged 60 and over will account for 22% of the world's population, with four-fifths living in Asia, Latin America or Africa²⁻³.

A few quantitative studies have been carried out in the area of dementia research. Mache et al⁴ evaluates the scientific efforts in Alzheimer disease by analyzing 50030 publications from 1985 to 2008. Large scale data analysis, density equalizing algorithms and scientific methods were used to evaluate the quantity and quality of research achievements in this area. Sorenson⁵ analyzed the role of Alzheimer's disease (AD) within neurosciences and presents the summary of the various research foci within the AD scientific community. It identifies the top 100 AD researchers and assesses their productivity and scientific impact. Baldwin *et al*⁶ presents the bibliometric analysis of keywords in the literature on ethics and dementia from 1980 to 2000. Here the keywords were first clustered into 19 broad subject categories and these categories were then examined for their frequency and co-occurrences. The strength of relationship between these categories was mapped. There are no specific studies available in the literature dealing with scientometric analysis of publications in the area of dementia research in India although such studies in Indian context on other diseases such as diabetes⁷, tuberculosis⁸, malaria⁹, asthma¹⁰ and AIDS/HIV¹¹ are available.

Objectives of the study

The main objective of this study is to analyze the research performance of India in dementia research in national and global context, as reflected in its publications output during 2002-11. In particular, the study focuses on the following objectives:

- To study the Indian research output, its growth, rank and global publications share and impact,
- To study the patterns of international collaboration and major collaborative partners,
- To study the contribution by sub-fields and by types of dementia research,
- To study the publications productivity and impact of leading institutions and authors of India; and
- To study the media of communication.

Methodology

This study is based on the Indian publication data in dementia research retrieved from the Scopus Citation database [<http://www.scopus.com/search/>]

for the 10 years (2002-2011). The keywords dementia, alzheimer's disease, (vascular dementia or binswanger's disease), (multi-infarct dementia or multiinfarct dementia or cadasil or cerebral autosomal dominant arteriopathy), (fronto-temporal dementia, pick's disease or progressive aphasia), (aids and hiv and dementia), (lewy body or dementia), huntington's disease and creutzfeldt-jacob disease were used to carry out the search. The keywords in title, abstract and keywords fields and India in the country field was finally used for searching. Similar strings were used to generate publications output data on top 20 countries. For citations data, three years, two year, one year and zero years citations window has been used for computing average citations per paper in dementia research during 2002-08, 2009, 2010 and 2011. For searching and calculating the total international collaborative papers, a separate search strategy, which combines India's collaboration with 200 major countries, was prepared and this string was combined with the main string to generate India's total international collaborative output. For analyzing institutional, author and journals output, the separate search strategies for generating institutional, author and journal outputs were developed, which later combined with the main string to generate the desired output.

Analysis

The global publication share of the top 20 most productive countries in dementia research varies from 0.91% to 33.59% during 2002-2011. The United States tops the list with global publications share of 33.59% during 2002-11. The United Kingdom ranks second (with 10.14% publication share), followed by Germany, Japan, Italy, France, Canada, China, Spain and Australia (their global publications share ranging from 3.34% to 6.79% and rank from 3rd to 10th). Netherlands, Sweden, Switzerland, South Korea, Belgium, India, Brazil, Israel, Austria and Poland ranks at 11th to 20th positions (their global publications share ranging from 0.91% to 2.91%) (Table 1).

India is at 16th position among the top 20 most productive countries in dementia research with its global publication share of 1.24% during 2002-11. India's global publications share increased by 1.66% from the year 2002 to the year 2011. Compared to India, the global publications share has increased by 3.73% in China, 1.55% in South Korea and 1.04% in Brazil, in contrast to decrease in Israel by 0.38% from the year 2002 to the year 2011.

On analyzing the global publication share of developed countries, some countries have shown decrease in their publication share such as USA by 1.89%, Japan by 1.86% and Austria by 0.41%, in contrast to rise in global publication share in case of Australia by 1.54%, Italy by 1.49%, Canada by 1.42%, Spain by 1.20%, Netherlands by 0.60%, Poland by 0.47%, U.K. by 0.29%, France by 0.25%, Sweden by 0.21%, Belgium by 0.19%, Germany by 0.15% and Switzerland by 0.14% from the year 2002 to the year 2011 (Table 1).

India’s contribution, citation impact and international collaboration

Indian contribution in dementia research has increased from 35 papers in 2002 to 261 papers during 2011, witnessing an annual average growth rate of 25.58%. Its cumulative contribution has increased from 294 papers during 2002-06 to 815 papers during 2007-11, witnessing a growth rate of 177.21%. The average citation per paper registered by India’s research in dementia during 2002-11 was 5.11, which has decreased from 7.29 during 2002-06 to 4.33 during 2007-11. India has contributed 24.53% international collaborative papers share in dementia research during 2002-11, which has decreased from 28.57% during 2002-06 to 23.07% during 2007-11 (Table 2).

Table 1—Publication output and share of top 20 countries in dementia research

Country	Number of papers			Share of papers		
	2002	2011	2002-11	2002	2011	2002-11
USA	2199	3793	29934	33.93	32.04	33.59
U.K.	642	1 207	9041	9.91	10.20	10.14
Germany	429	801	6054	6.62	6.77	6.79
Japan	464	628	5226	7.16	5.30	5.86
Italy	284	695	4747	4.38	5.87	5.33
France	290	559	4203	4.47	4.72	4.72
Canada	233	594	4108	3.60	5.02	4.61
China	109	641	3383	1.68	5.41	3.80
Spain	192	493	3191	2.96	4.16	3.58
Australia	158	471	2974	2.44	3.98	3.34
Netherlands	156	356	2597	2.41	3.01	2.91
Sweden	161	319	2387	2.48	2.69	2.68
Switzerland	103	205	1639	1.59	1.73	1.84
South Korea	53	280	1388	0.82	2.37	1.56
Belgium	77	163	1164	1.19	1.38	1.31
India	35	261	1109	0.54	2.2	1.24
Brazil	39	194	1119	0.60	1.64	1.26
Israel	83	106	973	1.28	0.90	1.09
Austria	90	116	923	1.39	0.98	1.04
Poland	38	125	808	0.59	1.06	0.91
World	6481	11838	89129			

In all 91 countries participated in international collaboration with India in dementia research during 2002-11, of which contribution of top 20 countries are listed in Table 3. The largest contribution to international collaborative papers of India in dementia research comes from United States (with 47.79%), followed by UK (25.74% share), Italy (8.09%), China (7.72% share), Dominican Republic (7.35% share), Cuba, Peru and Venezuela (5.88% share each), Australia, Mexico and Japan (5.15% and the rest below 5%. It is seen that India's international collaboration has decreased with USA by 10.08%, Netherlands (4.35%) Japan (2.8%) Brazil (2.78%) Israel (1.44%) and soon. However, increase in collaboration is noticed with China. Cuba, Peru, Venezuela, Mexico, Canada, Australia, Argentina and Singapore (Table 3).

Areas of dementia research

Under different type of dementia research, the maximum publication output (597) of India during 2002-11 was on Alzheimer’s disease (53.83%), followed by Huntington’s disease (106 papers, 9.56%), vascular dementia (98 papers, 8.84%), AIDS/HIV dementia (58 papers, 5.23% share), front-temporal dementia (40 papers, 3.61%), lewy body dementia (18 papers, 1.62%) and creutzfeldt-Jacob disease (5 papers, 0.45%). In terms of citation impact per paper, the maximum citation impact (6.44) during 2002-11 was in Huntington’s disease, followed by Alzheimer’s disease (6.11), front-temporal dementia

Table 2—Growth, citation impact and international collaborative publication share of Indian publications in dementia research

Period	2002-11				
	TP	TC	ACPP	ICP	%ICP
2002	35	267	7.63	7	20.00
2003	43	322	7.49	10	23.26
2004	56	524	9.36	22	39.29
2005	79	507	6.42	26	32.91
2006	81	522	6.44	19	23.46
2007	92	718	7.80	24	26.09
2008	110	1052	9.56	28	25.45
2009	147	1194	8.12	37	25.17
2010	205	454	2.21	41	20.00
2011	261	111	0.43	58	22.22
2002-06	294	2142	7.29	84	28.57
2007-11	815	3529	4.33	188	23.07
2002-11	1109	5671	5.11	272	24.53

TP=Total Papers; TC=Total Citations; ACPP=Average Citations per Paper; ICP=International Collaborative Papers

Table 3—Major collaborative partners of India in dementia research

S. No.	Collaborating country	ICP			% ICP		
		02-06	07-11	02-11	02-06	07-11	02-11
1	USA	46	84	130	54.76	44.68	47.79
2	U.K.	20	50	70	23.81	26.60	25.74
3	Italy	5	17	22	5.95	9.04	8.09
4	China	1	20	21	1.19	10.64	7.72
5	Dominican Republic	4	16	20	4.76	8.51	7.35
6	Cuba	1	15	16	1.19	7.98	5.88
7	Peru	1	15	16	1.19	7.98	5.88
8	Venezuela	1	15	16	1.19	7.98	5.88
9	Australia	2	13	15	2.38	6.91	5.51
10	Mexico	1	14	15	1.19	7.45	5.51
11	Japan	6	8	14	7.14	4.26	5.15
12	Canada	1	11	12	1.19	5.85	4.41
13	Malaysia	0	12	12	0.00	6.38	4.41
14	Germany	2	10	12	2.38	5.32	4.41
15	Brazil	5	6	11	5.95	3.19	4.04
16	South Korea	1	8	9	1.19	4.26	3.31
17	Argentina	2	7	9	2.38	3.72	3.31
18	Singapore	2	6	8	2.38	3.19	2.94
19	Netherlands	5	3	8	5.95	1.60	2.94
20	Israel	3	4	7	3.57	2.13	2.57
	Total*	84	188	272	100.00	100.00	100.00

ICP =International Collaborative Papers

*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 20 foreign collaborating countries listed above in Indian international collaborative output will be more than its total international collaborative papers

Table 4—Indian and world publication output & citation quality in different types of dementia

Types of Dementia	India			World			India's Share in World
	TP	TC	ACPP	TP	TC	ACPP	
Alzheimer's Disease	597	3646	6.11	44697	485409	10.86	1.34
Vascular Dementia	98	397	4.05	7644	61366	8.03	1.28
Front-temporal Dementia	40	203	5.08	5486	55056	10.04	0.73
Lewy Body Dementia	18	14	0.78	3240	34726	10.72	0.56
AIDS/HIV Dementia	58	240	4.14	2244	19799	8.82	2.58
Huntington's Disease	106	683	6.44	4719	60363	12.79	2.25
Creutzfeldt-Jacob Disease	5	1	0.20	166	760	4.58	3.01

(5.08), AIDS/HIV dementia (4.14), vascular dementia (4.04), Lewy body dementia (0.78) and Creutzfeldt-Jacob disease (0.20). Compared to the world output, India's citation impact per paper was less in all types of dementia research. In terms of global publication share, the maximum (3.01%) was in Creutzfeldt-Jacob disease, followed by AIDS/HIV dementia (2.58% share),

Table 5—Indian publication output & its international collaborative publications share in different types of dementia

Types of Dementia	TP	ICP	%ICP	H-Index	Share in India's Output
Alzheimer's Disease	597	155	25.96	40	53.83
Vascular Dementia	98	17	17.35	14	8.84
Front-temporal Dementia	40	9	22.50	9	3.61
Lewy Body Dementia	18	2	11.11	3	1.62
AIDS/HIV Dementia	58	25	43.10	14	5.23
Huntington's Disease	106	18	16.98	17	9.56
Creutzfeldt-Jacob Disease	5	0	0.00	1	0.45

Huntington's disease (2.25% share), Alzheimer's disease (1.34% share), vascular dementia (1.28% share), front-temporal dementia (0.73% share) and Lewy body dementia (0.56% share). The largest share (43.10%) of the international collaborative papers was in AIDS/HIV dementia, followed by Alzheimer's disease (25.96%), front-temporal dementia (22.50%), vascular dementia (17.35%), Huntington's disease (16.98%), Lewy body dementia (11.11%) and Creutzfeldt - Jacob disease (0.00%) (Tables 4 & 5).

Dementia research output in context of different subjects

India's publication output in dementia research during 2001-11 has been published in the context of 8 subfields (as reflected in database classification based on journal subject), with highest publications output coming from medicine (533 papers and 48.06% publications share), followed by pharmacology, toxicology & pharmaceuticals (325 papers and 29.31%), biochemistry, genetics & molecular biology (320 papers and 28.85%), neurosciences (256 papers and 23.08% publications share), chemistry (75 paper and 6.76%),

psychiatry & psychology (47 papers and 4.24% publications share), agricultural & biological sciences (36 papers and 3.25%) and immunology and microbiology (27 papers and 2.43%).

On analyzing the quality and impact of dementia research output under different subfields, it was found that neurosciences had scored the highest impact (6.58 citations per paper), followed by biochemistry, genetics & microbiology (6.25 citations per paper), agricultural & biological sciences (6.11 citations per paper), immunology and microbiology (5.04 citations per paper), pharmacology, toxicology & pharmaceuticals (4.92 citations per paper), psychiatry & psychology (4.89 citations per paper), chemistry (4.63 citations per paper) and medicine (4.05 citations per paper) (Table 6).

Table 6—Subject-wise break-up of Indian publications in dementia research

Subfields	TP	TC	ACPP	% TP
Medicine	533	2161	4.05	48.06
Pharmacology, Toxicology & Pharmaceuticals	325	1598	4.92	29.31
Biochemistry, Genetics & Molecular Biology	320	2000	6.25	28.85
Neurosciences	256	1685	6.58	23.08
Chemistry	75	347	4.63	6.76
Psychology & Psychiatry	47	230	4.89	4.24
Agri. & Biol Sciences	36	220	6.11	3.25
Immunology & Microbiology	27	136	5.04	2.43
Total*	1109			

*Total of India in dementia research. There is some overlapping of literature under different sub-fields. As a result, the combined output of India under 8 sub-fields will be more than its total research output

Research profile of most productive Indian institutions in dementia research

The top 15 most productive Indian institutions involved in dementia research have published 17 and more papers each during 2001-11. The publications profile of these 15 Indian institutions along with their research output, citations received and h-index values are presented in Table 7. These 15 Indian institutions involved in dementia research together have contributed 40.58% share (with 450 papers) in the cumulative publications output of India in dementia research, with an average of 30 papers per institution. Only 3 Indian institutions have registered higher publications share than the group average. These are National Institute of Mental Health & Neurosciences, Bangalore with 67 papers, followed by University

Table 7—Productivity & citation impact of top fifteen major Indian institutions in dementia research

Sl. No.	Name	TP	TC	ACPP	H-Index
1	National Institute of Mental Health & Neurosciences, Bangalore	67	462	6.90	13
2	University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh	61	378	6.20	15
3	All India Institute of Medical Sciences, New Delhi	51	142	2.78	11
4	Christian Medical College & Hospital, Vellore	30	202	6.73	9
5	Central Food Technological Research Institute, Mysore	27	191	7.07	10
6	Guru Jambheshwar University of Science & Technology, Hisar	26	139	5.35	11
7	Postgraduate Institute of Medical Education and Research, Chandigarh	25	48	1.92	5
8	Sree Chitra Institute of Medical Science & Technology, Thiruvananthapuram	25	107	4.28	8
9	National Brain Research Centre, Manesar, Gurgaon	24	237	9.88	11
10	Mysore Medical College	24	116	4.83	9
11	Saha Institute of Nuclear Physics, Kolkata	20	84	4.20	8
12	The Voluntary Health Services, Chennai	18	180	10.00	8
13	Central Leather Research Institute, Chennai	18	84	4.67	7
14	National Institute of Pharmaceutical Education & Research, Mohali	17	178	10.47	9
15	Punjabi University, Patiala	17	63	3.71	8
	Total	450	2611	5.80	9.47
	Total of the Country	1109			
	Share of Top 15 Institutions in Country Output	40.58			

TP =Total Papers; TC = Total Citations; ACPP = Average Citations Per Paper

Institute of Pharmaceutical Sciences, Panjab University, Chandigarh (61 papers) and All India Institute of Medical Sciences, New Delhi (51 papers).

The average citation per paper registered by the total papers of these 15 Indian institutions is 5.80 during 2002-11. Only 7 Indian institutions have registered higher impact than the group average. Amongst these seven Indian institutions, the highest impact of 10.47 citations per paper was scored by the National Institute of Pharmaceutical Education & Research, Mohali, followed by The Voluntary Health Services, Chennai (10.00 citations per paper), National Brain Research Centre, Manesar, Gurgaon (9.88 citations per paper), Central Food Technological Research Institute, Mysore (7.07 citations per paper), National Institute of Mental Health & Neurosciences, Bangalore (6.90 citations per paper), Christian Medical College & Hospital, Vellore (6.73 citations per paper) and University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh (6.20 citations per paper).

The average h-index value of these 15 Indian most productive institutions was 9.47 during 2002-11. The six Indian institutions have scored higher h-index value than group's average of 9.47. Amongst these six Indian institutions, the highest h-index value (15) was achieved by University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh followed by National Institute of Mental Health & Neurosciences, Bangalore (13), All India Institute of Medical Sciences, New Delhi (11), Guru Jambheshwar University of Science & Technology, Hisar (11), National Brain Research Centre, Manesar, Gurgaon (11) and Central Food Technological Research Institute, Mysore (10).

Contributions and impact of most productive authors in Indian dementia research

Ten authors having been identified as most productive, who have published 10 and above papers in dementia research. These 10 authors together contributed 188 papers with an average of 18.8 papers per author and account for 16.95% share in the cumulative publications output of India during 2002-11. Four authors have published higher number of papers than the group average (18.8). These are: A. Kumar with 37 papers, followed by M. Parle (27 papers), P. Kumar (24 papers) and K.S. Jacob (23 papers). Considering the quality/impact of papers, these 10 productive authors have received a total of 1133 citations for 188 papers with an average of 6.02 citations per paper. Five authors have registered higher impact than the average impact of papers of all authors (6.02). These are: K.S. Jacob with 8.04 citations per paper, K.S.J. Rao (7.50 citations per paper), K.S. Shaji (7.50 citations per paper), P. Kumar (6.88 citations per paper) and A. Kumar (6.62 citations per paper). Measuring the performance of these authors on the basis of h-index, five authors have achieved the higher h-index value than the group average of 7.7. These authors are A.Kumar with h-index of 12, followed by M. Parle (11), P. Kumar (9), K.S.J. Rao (9) and K.S. Jacob (8) (Table 8).

Research communication in high productive journals

The 15 most productive Indian and foreign journals publishing Indian research papers in dementia research together contributed 241 papers, which accounts for 21.73% share of the total output of India during 2002-11. The cumulative publications output

Table 8—Productivity & citation impact of ten most productive Indian authors in dementia research

Sl. No	Name	Address	TP	TC	ACPP	H-Index
1	Kumar, A	University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh	37	245	6.62	12
2	M. Parle	Guru Jambheshwar University of Science & Technology, Hisar	27	142	5.26	11
3	Kumar, P	University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh	24	165	6.88	9
4	K.S. Jacob	Christian Medical College & Hospital, Vellore	23	185	8.04	8
5	H. Kalonia	University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh	15	37	2.47	5
6	H. Joshi	Sonia Educational Trust College of Pharmacy, Dharwad	14	59	4.21	6
7	R. Jayakumar	Central Leather Research Institute, Chennai	14	76	5.43	7
8	K.S.J. Rao	Central Food Technological Research Institute, Mysore	14	105	7.50	9
9	V. Dhikav	All India Institute of Medical Sciences, New Delhi	10	44	4.40	4
10	K.S. Shaji	Medical College, Trissur	10	75	7.50	6
	Total		188	1133	6.02	7.7
	Total of the Country		1109			
	Share of Top 10 Authors in Country Output		16.95			

TP = Total Papers; TC = Total Citations; ACPP = Average Citations Per Paper

Table 9—List of most productive journals publishing Indian papers in dementia research

Sl. No.	Journal	Number of papers		
		2002-06	2007-11	2002-11
1	Neurology	20	19	39
2	Annals of Indian Academy of Neurology	2	29	31
3	Journal of Association of Physicians of India	8	9	17
4	Indian Journal of Psychiatry	0	16	16
5	Journal of Alzheimer S Disease	1	15	16
6	Journal of Indian Medical Association	8	7	15
7	International Journal of Pharma & Biosciences	0	14	14
8	International Journal of Geriatric Psychiatry	8	6	14
9	Neuroscience Letters	5	8	13
10	Indian Journal of Medical Research	4	8	12
11	Neurochemistry International	0	11	11
12	British Journal of Psychiatry	6	5	11
13	International Psychogeriatrics	3	8	11
14	Pharmacology Biochemistry and Behavior	4	7	11
15	Biochemical and Biophysical Research Communication	3	7	10
	Total	72	169	241
	Total of the Country	294	815	1109
	Share of Top 10 5 Journals in Country Output	24.49	20.74	21.73

share of these 15 most productive journals showed a decrease in India's publications output from 24.49% during 2002-06 to 20.74% during 2007-11 (Table 9)

Conclusion

In spite of 3.7 million elderly people suffering from dementia by 2010 in India, it had produced only 1109 papers during the last ten years from 2002-11. There is therefore an urgent need to increase both the quantity and quality of research. This can be achieved by government by taking number of steps. To begin with dementia must be made a publicly stated national health and social care priority. Indian medical and social research funding agencies must establish a more ambitious funding program into the causes, prevention, cure and care of dementia. At the national level, there is a need to have a consultation for evolving research strategies and for delineating specific directions to investigate the etiology, treatment and care provisions for persons involved in dementia (PwD). Dementia care and research must be prioritized in the Five Year plans of the Ministries of Health and Social Welfare. Health and Social Welfare departments must develop local plans to support increasing numbers of PwD and their families. Current government policies, including the National Policy for Older Persons, National Mental Health Program, the Persons with Disabilities Act and the National Trust Act could be starting points. Although mental health is a national clinical priority along with cancer and heart disease, dementia has not received

the attention it requires. A coordinated national dementia plan with manifest political commitment is now a necessity. There is also need to develop training programmes at different levels to manage the problems associated with dementia, besides developing adequate trained manpower at graduate and postgraduate level. There is also need to increase international collaboration, which will increase both the quantity and quality of research in dementia.

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