

Cataract research in India: A scientometric study of publications output, 2002-2011

Abstract

Analyses the 1293 Indian publications in cataract research during 2002-2011, with a focus on contribution and citation impact of 15 most productive countries, India's overall contribution, its growth, citation impact, the share of international collaborative papers, identification of significant countries in India's international collaboration, different types of cataract research, analyses of research by sub-fields and different population age groups, productivity, and impact of leading Indian institutions and authors and pattern of communication of Indian output in most productive journals. The Scopus Citation Database has been used to retrieve the data for 10 years (2002-2011). Indian publications increased from 87 papers in 2002 to 195 papers in 2011, witnessing an annual average growth rate of 10.03%, registering an average citation impact per paper of 3.26 and international collaborative share of 21.58% during 2002-2011. Suggest that the government should encourage the decision makers and ophthalmologists and allied persons involved in ophthalmic services to make serious efforts in reducing the burden of cataract disease by increasing the R&D, strengthening of national and international collaboration and improve the existing training programs for ophthalmologic professionals.

Key words: Bibliometrics, cataract, eye disease, India, publication output, scientometrics

**K. K. Mueen Ahmed,
Ritu Gupta¹,
Brij Mohan Gupta²**

SciBiolMed.Org, #27, Bore Bank
Road Cross, Harris Main Road,
Benson Town,
Bengaluru, Karnataka,
¹Sri Venkateswar University,
Meerut, Uttar Pradesh,
²Panchkula, Haryana, India

Address for the Correspondence:

Dr. Mueen Ahmed,
SciBiolMed.Org,
#27, Bore Bank Road Cross,
Harris Main Road,
Benson Town,
Bangalore 560046, India.
E-mail: mueen.ahmed@gmail.com

Access this article online

Website: www.ijmedph.org

DOI: 10.4103/2230-8598.144054

Quick response code:



INTRODUCTION

Cataract is the major cause of blindness and visual impairment present in more than half of all cases worldwide. In 1998, it was estimated that some 20 million people were blind due to cataract.^[1] Cataract is a clouding of the lens of the eye, due to the clumping of the protein elements of the lens or a discoloration that occurs with age, excessive sunlight exposure, diabetes, under nutrition, and other risk factors. The normal lens, clear and transparent, sits behind the colored iris and pupil and helps focus light on the retina, which converts the light images to electrical and chemical signals that are carried to the brain. A cataract blurs the image on the retina, producing a visual effect that is like looking through a window that is frosted or fogged with steam. Cataracts can affect one or both eyes. In addition to blurry vision and changes in color perception, symptoms can include glare and halo effects from lights and sun, failing night vision, and double vision. Cataract is detected by an eye examination that includes a visual acuity test and dilated eye exam.^[2]

Cataract is a common problem in many countries especially in developing countries. The problem of cataract in India has been profound, given the country's huge population. An above average incidence of cataract it is the leading cause of avoidable blindness (62.6%) in our country^[3] in the early 1990s. It was estimated that more than 80% of blind people, or more than 10 million individuals, suffered from bilateral cataract, and another 10 million individuals had cataract in one eye in India. The prevalence of cataract increases with the aging population and in the female population, those who are illiterate and those residing in rural areas because exposure to smoke from indoor cooking represents a significant risk factor.^[4]

The government of India has taken a number of initiatives to deal with the problem of cataract. In 1963, India became one of the first countries in the world to organize a centrally sponsored national program to deal with eye diseases. In 1976, in recognition of the tremendous burden associated with cataract, India's National Program for Control of Blindness was formed as a 100% centrally

sponsored scheme to address the problem. In 1978, the National Program accepted assistance from (The Danish International Development Assistance Organization) for the nationwide expansion of infrastructure (equipment and mobile units) and training of paramedical ophthalmic assistants. In 1994, the World Bank assisted Cataract Blindness Control Program begun in seven states in India where the need was the most concentrated: Andhra Pradesh, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, and Uttar Pradesh with the objective to improve the quality of cataract surgery and lessen the prevalence of blindness by reducing the backlog of cataract blindness in the participating states. Due to these efforts, the overall population prevalence of cataract blindness was declined by 26% from 1.5% at baseline to 0.13%, during this program period.^[5]

Only few scientometric studies on cataract research were published in the past. Gupta *et al.*,^[6] analyzed the global publications in cataract research during 2002-2011 on several parameters including contribution and citation impact of top 15 most productive countries, different types of cataract research, research output by different population age groups, subject-wise break-up of research output, relatedness of various diseases to cataract research, research contribution and impact of top 15 institutions and authors and productivity of the top 20 journals. Tsai *et al.*,^[7] investigated the quantity and quality of world research output (8186 papers) in cataract research using SCI database during 1991-2005 focusing on growth, productivity, the authorship pattern, international collaboration and subject trends using keywords. Fan and McGhee^[8] identified the most-published authors on the topics of “cataract” and laser *in situ* keratomileusis (“LASIK”), the journals in which they publish, and the citation patterns of the most-cited articles by these authors over a 5 years publication period (2000-2004). USA and Australia together were the source of more than half of the most-published authors on cataract and LASIK and the majority of articles published by 30 most prolific authors were published in only 10 journals. Wu *et al.*,^[9] explored the distribution of research articles (45868) on cataract, as published in PubMed database, from 1913 to 2010. The cataract literature was primarily in English (34655-75.6%). Around 10299 papers, 23% were retrieved in 22 journals on ophthalmology (SCI-indexed). Chinese cataract literatures in PubMed appeared in 1946 and increased obviously since 1961. Chinese publications (732) were ranked at 7th rank with 1.59% share.

Among the studies conducted on country distribution of ophthalmology and visual science literature include: Davis *et al.*,^[10] studied Australia’s contribution to vision science domain literature during 1991-1995, using ISI’s SCI, SSCI, and AHCI databases. Zou, Wu *et al.*^[11] analyzed 961 ophthalmology, optometry, and visual science publications of China, using SCI database during 2000-2007. Kumaragurupari *et al.*,^[12] analyzed 2163 publications by Indian ophthalmologists and vision researchers during 2001-2006, with a view access their productivity, analyze trends in journal choice, publication types, and research funding and collaborative research.

Publications resulting from international collaborations increased from 3% in 2001% to 8% in 2006.

Objectives

The main objective of this study is to analyze the cataract research output in India during 2002-2011. The study has the following objectives:

1. To study the contribution and citation impact of top 15 most productive countries,
2. To study the India’s overall contribution, its growth pattern and citation impact,
3. To study the share of international collaboration in India’s overall research output, contribution of leading countries, and identification of leading foreign collaborating partners;
4. To study Indian contribution and impact of different types of cataract research, cataract research by sub-fields and cataract research output by different age groups and keywords,
5. To study the productivity and impact of leading Indian institutions and authors; and
6. To study the pattern of communication of Indian output in most productive journals.

METHODOLOGIES AND SOURCE OF DATA

This study used Scopus International Database [<http://www.scopus.com/search/>] to extract relevant data on cataract research of world and 15 most productive countries for 10 years (2002-2011) period. An advanced search strategy involving “cataract” as the keyword was used to search and download data using Title, Abstract, and Keywords field, resulting in downloading of 1293 records related to Indian cataract research. Separate strategies were developed in terms of keywords for identifying different type of cataract research and cataract research output by different keywords. 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 citations data, 3 years, 2 years, and 1-year citation windows have been used for computing average citations per paper in cataract research during 2002-2009, 2010, and 2011.

Analyses

Global publications output and citation impact

The global publication share of the top 15 most productive countries in cataract research varied from 1.29% to 24.08% during 2002-2011. United States tops the list, with a share of 24.08%, followed by United Kingdom and China (9.66% and 8.16% share, 2nd to 3rd rank) and Japan and Germany (6.11% and 5.71% share, 4th to 5th rank). India and Australia ranked at 6th to 7th positions (their global publications share of 4.78% and 3.56%). Canada, Italy, France, Turkey, Spain, Brazil, Netherlands, and Austria ranked at 8th to 15th positions (their global publications share ranging from 1.29% to 2.91%) [Table 1]. The developed countries showing increase in their publications share were Spain by 0.7%, followed by Turkey (0.42%), Canada (0.37%), and Italy (0.26%), in contrast to decrease

Table 1: Publications output, share, and rank of top 15 countries in cataract research, 2002-2011

Country	Number of papers			Share of papers			Total citations	ACPP
	2002-2006	2007-2011	2002-2011	2002-2006	2007-2011	2002-2011	2002-2011	2002-2011
USA	3196	3318	6514	26.11	22.40	24.08	56,593	8.69
UK	1284	1328	2612	10.49	8.96	9.66	20,336	7.79
China	561	1647	2208	4.58	11.12	8.16	4678	2.12
Japan	820	832	1652	6.70	5.62	6.11	6785	4.11
Germany	749	795	1544	6.12	5.37	5.71	13,106	8.49
India	528	765	1293	4.31	5.16	4.78	4218	3.26
Australia	444	520	964	3.63	3.51	3.56	7662	7.95
Canada	331	455	786	2.70	3.07	2.91	6574	8.36
Italy	323	430	753	2.64	2.90	2.78	7590	10.08
France	362	374	736	2.96	2.52	2.72	6433	8.74
Turkey	290	413	703	2.37	2.79	2.60	2357	3.35
Spain	243	398	641	1.99	2.69	2.37	5429	8.47
Brazil	237	301	538	1.94	2.03	1.99	2225	4.14
Netherlands	196	212	408	1.60	1.43	1.51	3587	8.79
Austria	180	169	349	1.47	1.14	1.29	2979	8.54
World	12,239	14,814	27,053	100.00	100.00	100.00		0.00

ACPP = Average citation per paper

in USA by 3.71%, U.K.(1.53%), Japan (1.08%),Germany (0.75%), France (0.44%), Austria (0.33%), Netherlands (0.17%), and Australia (0.12%) from 2002-2006 to 2007-2011. All developing countries have shown rise in their publications share in cataract research: China by 6.54%, followed by India (0.85%) and Brazil (0.09%) from 2002-2006 to 2007-2011 [Table 1].

India ranks at 6th position among the top 15 most productive countries in cataract research with its global publications share of 4.78% during 2002-2011. China and Brazil ranked at 3rd and 13th positions, with global publications share of 8.16% and 1.99%, respectively, during 2002-2011. India's global publications share increased from 4.31% to 5.16% from 2002-2006 to 2007-2011. China and Brazil's global publications share increased from 4.58% to 11.12% and 1.94% to 2.03% from 2002-2006 to 2007-2011 [Table 1].

Considering the citation impact of papers published by these 15 most productive countries in terms of citation per paper, which varies from 2.12 to 10.08 during 2002-2011. The highest citation impact is registered by Italy with 10.08 citations per paper, followed by Netherlands (8.79), France (8.74), USA (8.69), Austria (8.54), Germany (8.49), Spain (8.47), Canada (8.36), Australia (7.95), and U.K. (7.79). Brazil and Japan scored the citation impact varying from 4.11 to 4.14 citations per paper. Turkey, India and China achieved the citations quality <4 citations per paper [Table 1].

India's contribution, citation impact and International collaboration

India's contribution in cataract research has increased from 87 papers in 2002 to 195 papers in 2011, witnessing an annual average growth rate of 10.03%. Its cumulative publications output has increased from 528 papers during 2002-2006 to 765 papers during 2007-2011, witnessing a growth rate of 44.89%. The average citation impact per paper registered by India's cataract research during 2002-2011 was 3.26, which has decreased from 4.07 during 2002-2006 to 2.71

during 2007-2011. India has contributed 21.58% international collaborative papers share in cataract research during 2002-2011, which has increased from 20.08% during 2002-2006 to 22.61% during 2007-2011 [Table 2].

In all 45 countries participated in international collaboration with India in cataract research during 2002-2011, of which contribution of top 12 countries is listed in Table 3. The largest contribution to international collaborative papers of India in cataract research comes from United States (with 45.52% share), followed by Australia (17.56%), UK (15.77%), Singapore (10.39%), Germany (8.96%), Canada (5.02%), Nepal and Italy (3.58%), China (3.23%), Tanzania (2.87%), Japan and South Korea (1.43% each). The share of international collaboration has decreased in USA by 11.79%, U.K. by 6.52%, Canada by 4.08%, Nepal by 1.83%, China by 0.88% and Germany by 0.76%, as against increase by 11.59% in Australia., 7.63% in Singapore, 2.31% in South Korea, 1.22% in Italy, 0.79% in Japan, and 0.06% in Tanzania from 2002-2006 to 2007-2011 [Table 3].

Among the international collaborative partners of India as reflected in its international collaborative papers in cataract research during 2002-2011, the largest contribution (34 papers) comes from the University of Melbourne, Australia, followed by London School of Hygiene and Tropical Medicine, U.K (20 papers), Singapore Eye Research Institute (19 papers), John Hopkins Bloomberg School of Public Health, USA (13 papers), Medical University of South Carolina, USA and Vision Cooperative Research Center, Sydney (12 papers each) etc., [Table 4].

Different types of cataract research

Under different type of cataract research (classified by etiology), the maximum Indian publication output (282) during 2002-2011 was on congenital cataract with 21.81% publication share, followed by cataract associated with primary ocular diseases (272

papers, 21.4%), cataract associated with environmental exposure (193 papers, 14.93%), cataract associated with metabolic disorders (156 papers, 12.06%), age-related cataract (87 papers, 6.73%), traumatic cataract (44 papers, 3.40%), cataract associated with renal disease (19 papers, 1.47%), cataract associated with central nervous system (12 papers, 0.93%), cataract associated with cutaneous disease (10 papers, 0.77%), and cataract associated with connective tissue or skelton disorders (8 papers, 0.62%). In terms of citation impact, the highest (6.33) was achieved by cataract associated with central nervous system, followed by age-related cataract (6.31), cataract associated with environmental exposure (3.81), cataract associated with metabolic disorders (3.57), cataract associated with renal diseases (3.53), congenital cataract (3.43), cataract associated with cutaneous diseases (3.20), cataract associated with primary ocular diseases (3.14), traumatic cataract (1.68), and cataract associated with connective tissue or skelton disorders (0.75) [Table 5].

Table 2: India's publications output and international collaborative publications output in cataract research, 2002-2011

Publication year	TP	TC	ACPP	ICP	Percentage ICP
2002	87	331	3.80	14	16.09
2003	99	361	3.65	22	22.22
2004	107	468	4.37	20	18.69
2005	112	421	3.76	22	19.64
2006	123	566	4.60	28	22.76
2007	117	691	5.91	30	25.64
2008	115	612	5.32	24	20.87
2009	163	471	2.89	38	23.31
2010	175	244	1.39	39	22.29
2011	195	53	0.27	42	21.54
2002-2006	528	2147	4.07	106	20.08
2007-2011	765	2071	2.71	173	22.61
2002-2011	1293	4218	3.26	279	21.58

TP = Total papers, TC = Total citations, ACPP = Average citation per paper, ICP = International collaborative papers

Cataract research output in context of different subjects

India's publication output in cataract research during 2001-2011 has been published in the context of 5 subjects (as reflected in database classification), with highest publications output coming from medicine (1104 papers and 85.38% publications share), followed by neurosciences (128 papers and 9.90% publications share), pharmacology, toxicology and pharmaceuticals (108 papers and 8.35% publications share), biochemistry, genetics and molecular biology (87 papers and 6.73% publications share), and agricultural and biological Sciences (23 papers and 1.78% publications share) [Table 5]. Among these subjects, biochemistry, genetics, and microbiology scored the highest citation impact (4.67 citations per paper), followed by agricultural and biological sciences (4.04), medicine (3.39), neurosciences (2.51) and pharmacology, toxicology, and pharmaceuticals (2.12) [Table 6].

Cataract research by population age groups

The maximum focus of India cataract research in terms of research output during 2002-2011 was on adults (536 papers and 41.45% share), followed by middle aged persons (381 papers and 29.47% share), child (183 papers and 14.15% share), and adolescents (155 papers and 11.99% share). Similarly, the focus on males (689 papers and 53.29% share) was higher than female (594 papers and 45.94% share).

Research Profile of most productive Indian organizations in cataract research

The top 15 most productive Indian organizations in cataract research have published 15-162 papers and together have contributed 57.62% share (with 745 papers) in the cumulative publications output of India during 2001-2011. The scientometric profile of these 15 Indian organizations is presented in Table 7. Four organizations have registered higher publications share than the group average of 49.67: (i) All India Institute of Medical Sciences, Dr Rajendra Prasad Center for Ophthalmological Sciences, New Delhi (162

Table 3: Major collaborative partners of India in cataract research, 2002-2011

Collaborating country	ICP			Percentage ICP		
	2002-2006	2007-2011	2002-2011	2002-2006	2007-2011	2002-2011
USA	56	71	127	52.83	41.04	45.52
Australia	11	38	49	10.38	21.97	17.56
UK	21	23	44	19.81	13.29	15.77
Singapore	6	23	29	5.66	13.29	10.39
Germany	10	15	25	9.43	8.67	8.96
Canada	8	6	14	7.55	3.47	5.02
Nepal	5	5	10	4.72	2.89	3.58
Italy	3	7	10	2.83	4.05	3.58
China	4	5	9	3.77	2.89	3.23
Tanzania	3	5	8	2.83	2.89	2.87
Japan	1	3	4	0.94	1.73	1.43
South Korea	0	4	4	0.00	2.31	1.43
Total*	106	173	279			

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

Table 4: Foreign collaborating centers with India along with their output in cataract research, 2002-2011

Name of foreign collaborating organization	Research output
University of Melbourne, Australia	34
London School of Hygiene and Tropical Medicine, UK	20
Singapore Eye Research Institute	19
John Hopkins Bloomberg School of Public Health, USA	13
Medical University of South Carolina, Storm Eye Institute, Charleston, USA	12
Vision Cooperative Research Center, Sydney, Australia	12
The John Hopkins University, School of Medicine, Wilmer Eye Institute, Baltimore, USA	11
Tan Tock Seng Hospital, Singapore International Eye Cataract Retina Center, Singapore	11
Finders University of South Australia, Centre for Clinical Eye Research SA, Australia	11
National Eye Institute, National Institute of Health, Bethesda, USA	9

Table 5: Indian publication output and citation quality in different types of cataract research, 2002-2011

Cataract by etiology	TP	TC	ACPP	Percentage TP
Age related cataract	87	549	6.31	6.73
Congenital cataract	282	968	3.43	21.81
Traumatic cataract	44	74	1.68	3.40
Cataract associated with environmental exposure	193	735	3.81	14.93
Cataract associated with primary ocular diseases	272	854	3.14	21.04
Cataract associated with systematic diseases				
Cataract associated with metabolic disorders	156	557	3.57	12.06
Cataract associated with renal disease	19	67	3.53	1.47
Cataract associated with central nervous system	12	76	6.33	0.93
Cataract associated with connective tissue or skelton disorders	8	6	0.75	0.62
Cataract associated with cutaneous disease	10	32	3.20	0.77
Total	1293			

TP = Total papers, TC = Total citations, ACPP = Average citation per paper

papers), L.V. Prasad Eye Institute, Hyderabad (144 papers), Iladevi Cataract Intraocular Lens Research, Ahmedabad and Aravind Eye Hospital, Pondicherry (75 papers each), and PostGraduate Institute of Medical Education and Research, Chandigarh (62 papers). Nine Indian organizations have registered higher citation impact per paper than the group average of 4.04 during 2002-2011: (i) National Institute of Nutrition, Hyderabad (9.42), H V Desai Eye Hospital, Pune (7.67), Aravind Medical Research Foundation, Madurai (7.13), Aravind Eye-Care System, Lions Aravind Institute of Community

Table 6: Subject-wise break-up of Indian publications in cataract research during 2002-2011

Subfields	TP	TC	ACPP	Percentage TP
Medicine	1104	3742	3.39	85.38
Neurosciences	128	321	2.51	9.90
Pharmacology, toxicology, and pharmaceutics	108	229	2.12	8.35
Biochemistry, genetics, and molecular biology	87	406	4.67	6.73
Agricultural and biological sciences	23	93	4.04	1.78
Total*	1293			1293

*Total of India in cataract 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, TP = Total papers, TC = Total citations, ACPP = Average citation per paper

Table 7: Scientometric profile of top 15 Indian organizations in cataract research, 2002-2011

Name	TP	TC	ACPP	H-index
All India Institute of Medical Science, Dr Rajendra Prasad Center for Ophthalmological Sciences, New Delhi, India	162	556	3.43	25
L.V. Prasad Eye Institute, Hyderabad, India	144	502	3.49	18
Iladevi Cataract Intraocular Lens Research, Ahmedabad	75	349	4.65	15
Aravind Eye Hospital, Pondicherry	75	365	4.87	15
Postgraduate Institute of Medical Education and Research, Chandigarh	62	176	2.84	12
Vision Research Foundation India, Chennai	42	157	3.74	10
Aravind Eye Care System, Lions Aravind Institute of Community Ophthalmology, Madurai	33	175	5.30	13
National Institute of Nutrition, Hyderabad	26	245	9.42	14
Medical Research Foundation, Chennai	22	61	2.77	9
Joseph Eye Hospital, Institute of Ophthalmology, Tiruchirappalli, Tamil Nadu	20	80	4.00	6
Maulana Azad Medical College, Delhi	19	33	1.74	4
Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry	17	32	1.88	4
Osmania University, Department of Genetics, Hyderabad	17	51	3.00	8
Aravind Medical Research Foundation, Madurai	16	114	7.13	10
H.V. Desai Eye Hospital, Pune	15	115	7.67	8
Total	745	3011	4.04	171
Total of India	1293	4218	3.26	11.4
Share of top 15 institutions in India's output	57.62			

TP = Total papers, TC = Total citations, ACPP = Average citations per paper

Ophthalmology, Madurai (5.30), Aravind Eye Hospital, Pondicherry (4.87), and Iladevi Cataract Intraocular Lens Research, Ahmedabad

(4.65). Seven Indian institutions have scored higher h-index value than group's average of 11.4 during 2002-2011: (i) All India Institute of Medical Sciences, Dr Rajendra Prasad Center for Ophthalmic Sciences, New Delhi (25), (ii) L.V. Prasad Eye Institute, Hyderabad (18), (iii-iv) Iladevi Cataract Intraocular Lens Research, Ahmedabad and Aravind Eye Hospital, Pondicherry (15 each), (v) National Institute of Nutrition, Hyderabad (14), (vi) Aravind Eye-Care System, Lions Aravind Institute of Community Ophthalmology, Madurai (13), and (vii) PostGraduate Institute of Medical Education and Research, Chandigarh (12).

Scientometric profile of most productive Indian authors in cataract research

Fifteen authors have been identified as most productive, who have published 17-110 papers in cataract research and together contributed 449 papers, accounting for 34.73% share in the cumulative Indian output during 2002-2011. Four authors have published higher number of papers than the group average (29.93): (i) A. R. Vasavada (110 papers), M.R. Praveen (39 papers), S.M. Raj (32 papers), and N. Sharma (30 papers). Six authors have registered higher citation impact per paper than the average of all authors (4.09): (i) R.D. Thulasiraj (8.18 citations), P.K. Nirmalan (8.15), P. Gogate (5.63), S.M. Raj (5.06), G.N. Rao (4.68), and P.A. Thomas (4.53). Five authors have achieved the higher h-index value than the group average of 9.33: (i-ii) A.R. Vasavada and P.K. Nirmalan with h-index of 16 each, (iii) R.D. Thulasiraj (13), (iv) G.N. Rao, and (v) S.M. Raj (11 each) [Table 8].

Research communication in high productive journals

The 15 most productive journals publishing Indian research papers in cataract research together contributed 533 papers, which account for 41.22% share of the total output of India during 2002-2011. The cumulative publications output share of these 15 most productive journals showed an increase in India's

publications output from 40.72% during 2002-2006 to 41.57% during 2007-2011 [Table 9].

Summary

India has published 1293 papers in cataract research during 2002-2011, which has increased from 87 papers in 2002 to 195 papers in 2011, witnessing an annual average growth rate of 10.03%, and registering a citation impact per paper of 3.26 during 2002-2011. India is ranked at 6th position among the top 15 most productive countries in cataract research, with its global publication share of 4.78% during 2002-2011. India's global publications share increased from 4.31% during 2002-2006 to 5.16% during 2007-2011. The international collaborative papers share of India in cataract research was 21.58% during 2002-2011, which has increased from 20.08% during 2002-2006 to 22.61% during 2007-2011. In all 45 countries participated in international collaboration with India in cataract research during 2002-2011. The largest contribution to international collaborative papers of India in cataract research comes from United States (with 45.52% share), followed by Australia (17.56% share), UK (15.77% share), etc.

Among different types of cataract research in India during 2002-2011, the largest contribution (21.81%) was on congenital cataract, followed by cataract associated with primary ocular diseases (21.4% share), cataract associated with environmental exposure (14.93% share), cataract associated with metabolic disorders (12.06% share), age-related cataract (6.73% share), traumatic cataract (3.40% share), cataract associated with renal disease (1.47% share), cataract associated with central nervous system (0.93% share), cataract associated with cutaneous disease (0.77% share), and cataract associated with connective tissue or skelton disorders (0.62% share). The maximum focus of Indian cataract research in terms of research output during 2002-2011 was on adults (with 41.45% share), followed by middle-aged (29.47% share), child (14.15% share), and adolescents (11.99%

Table 8: Scientometric profile of India's top 15 authors in cataract research, 2002-2011

Name	Address	TP	TC	ACPP	H-index
A.R. Vasavada	Iladevi Cataract Intraocular Lens Research, Ahmedabad	110	395	3.59	16
M.R. Praveen	Iladevi Cataract Intraocular Lens Research, Ahmedabad	39	117	3.00	7
S.M. Raj	Iladevi Cataract Intraocular Lens Research, Ahmedabad	32	162	5.06	11
N. Sharma	All India Medical Science, Dr Rajendra Prasad Center for Ophthalmological Sciences, New Delhi, India	30	108	3.60	7
J. Ram	Postgraduate Institute of Medical Education and Research, Chandigarh	29	68	2.34	7
R.B. Vajpayee	L.V. Prasad Eye Institute, Hyderabad, India	26	90	3.46	7
P.K. Nirmalan	L.V. Prasad Eye Institute, Hyderabad, India	26	212	8.15	16
P. Gogate	Dr Gogate's Eye Clinic, Pune	24	135	5.63	9
J.S. Titiyal	All India Medical Science, Dr Rajendra Prasad Center for Ophthalmological Sciences, New Delhi, India	23	47	2.04	7
G.S. Brar	Grewal Eye Institute, Chandigarh	21	56	2.67	7
G.N. Rao	L.V. Prasad Eye Institute, Hyderabad, India	19	89	4.68	11
A. Gupta	Postgraduate Institute of Medical Education and Research, Chandigarh	18	70	3.89	8
L. Vijaya	Medical Research Foundation, Chennai	18	73	4.06	8
P.A. Thomas	Joseph Eye Hospital, Institute of Ophthalmology, Tiruchirappali, Tamil Nadu	17	77	4.53	6
R.D. Thulasiraj	Aravind Eye Care System, Lions Aravind Institute of Community Ophthalmology, Madurai	17	139	8.18	13

TP = Total papers, TC = Total citations, ACPP = Average citations per paper

Table 9: India: Media of communication in cataract research, 2002-2011

Journal title	Number of papers		
	2002-2006	2007-2011	2002-2011
Indian Journal of Ophthalmology	64	82	146
Eye	23	31	54
Journal of Cataract	12	24	36
Journal of Cataract and Refractive Surgery	17	17	34
Ophthalmology	12	22	34
British Journal of Ophthalmology	17	13	30
Clinical and Experimental Ophthalmology	9	18	27
Asian Journal of Ophthalmology	4	24	28
Molecular Vision	12	14	26
Investigative Ophthalmology and Visual Science	13	13	26
European Journal of Ophthalmology	7	15	22
Cornea	8	11	19
Annals of Ophthalmology	0	18	18
Journal of the Indian Medical Association	10	7	17
Archives of Ophthalmology	7	9	16

share). Among the sub-field-wise distributions of Indian cataract research during 2002-2011, the largest contribution (85.38% share) comes from medicine and biochemistry, genetics and microbiology had scored the highest impact (4.67 citations per paper). The top 15 most productive Indian institutions involved in cataract research have together contributed 57.62% share in the cumulative Indian publications output, with an average of 49.67 papers per institution. The average citation per paper and h-index registered by the total papers of these 15 institutions was 4.04 and 11.4 during 2002-2011. The 15 most productive Indian authors together contributed 34.73% share in the cumulative Indian publications output during 2002-2011, with an average of 29.93 papers per author. The average citation per paper and h-index registered by the total papers of these 15 authors was 4.09 and 9.33 during 2002-2011. The 15 most productive journals publishing Indian research papers in cataract research together accounts for 41.22% share of the total Indian output during 2002-2011, which increased from 40.72% during 2002-2006 to 41.57% during 2007-2011.

In spite of cataract being the main cause of avoidable blindness (62.6%), India has published only 1293 papers on cataract research during the last 10 years. It means the research efforts need to be strengthened quiet substantially by way of investment in R&D. Both research output and quality of research should be increased and strengthened, and international collaborative research may further be widened to learn from the experiences of other countries. Besides

this, there is a need to encourage the decision makers, managers, and most importantly ophthalmologists, ophthalmic personnel, paramedics, and all other persons involved in ophthalmic surgical services to make serious efforts in reducing the burden of cataract disease. To eliminate the main causes of avoidable blindness, that is, cataract appropriate national planning is necessary. Government should plan a comprehensive strategy related to availability, affordability, accessibility, and acceptability of eye-care services to achieve the goal “Vision 2020: The Right to Sight India.”^[12-13] In addition to this, Government should enhance the quality of care, technical and operational norms, use of modern surgical techniques, expand the coverage of rural and isolated population through massive communications, and develop human resources for an eye-care delivery. Efforts should also be made to increase the training programs for ophthalmologic professionals, sharing the results of research and monitoring to motivate improvements.

REFERENCES

1. World Health Organization. Global Initiative for the Prevention of Avoidable Blindness. Geneva, Switzerland: World Health Organization; 1997. WHO/PBL/97.61.
2. Available from: <http://www.aoa.org/documents/CPG-8.pdf> [Last accessed on 2014 Aug 28].
3. Available from: [http://www.who.int/macrohealth/action/NCMH_Burden%20of%20disease_\(29%20Sep%202005\).pdf](http://www.who.int/macrohealth/action/NCMH_Burden%20of%20disease_(29%20Sep%202005).pdf) [Last accessed on 2014 Aug 28].
4. Pokhrel AK, Smith KR, Khalakdina A, Deuja A, Bates MN. Case-control study of indoor cooking smoke exposure and cataract in Nepal and India. *Int J Epidemiol* 2005;34:702-8.
5. Available from: http://www.cgdev.org/doc/millions/MS_case_19.pdf [Last accessed on 2014 Aug 28].
6. Gupta BM, Adarsh B, Avinash K. World Cataract Research: A Scientometric Analysis of Publications Output during 2002-11. *Library Philosophy and Practice* (ejournal), Paper 895; 2013. Available from: <http://www.digitalcommons.unl.edu/libphilprac/895> [Last accessed on 2014 Aug 28].
7. Tsai CL, Wang MH, Ho YS. Bibliometric analysis of cataract research from 1991 through 2006, analyzed with the science citation index. *Acta Soc Ophthalmol Sinicae* 2008;47:101-11.
8. Fan JC, McGhee CN. Citation analysis of the most influential authors and ophthalmology journals in the field of cataract and corneal refractive surgery 2000-2004. *Clin Experiment Ophthalmol* 2008;36:54-61.
9. Wu JB, Xu CT, Wang BL. Bibliometric analysis of the literature of cataract in PubMed database during 1813-2010. *Int J Ophthalmol* 2011;11:1577-81.
10. Davis M, Wilson CS, Hood WW. Ophthalmology and optics: An informetric study of Australia's contribution to fields in the vision science domain, 1991-95. *Scientometrics* 1999;46:399-416.
11. Feng Z, Wu M, Wu K. Outcomes associated with ophthalmology, optometry and visual science literature in the science citation index from Mainland China, 2000-2007. *Scientometrics* 2009;81:671-82.
12. Kumaragurupari R, Sieving PC, Lalitha P. A bibliometric study of publications by Indian ophthalmologists and vision researchers, 2001-06. *Indian J Ophthalmol* 2010;58:275-80.
13. Available from: <http://www.vision2020india.org/pdfs/cataract-manual-vision2020.pdf>. [Last accessed on 2014 Apr 5].

How to cite this article: Ahmed KM, Gupta R, Gupta BM. Cataract research in India: A scientometric study of publications output, 2002-2011. *Int J Med Public Health* 2014;4:311-7.

Source of Support: Nil, **Conflict of Interest:** None declared.