

# Mapping of asthma research in India: A scientometric analysis of publications output during 1999-2008

B. M. Gupta, Adarsh Bala<sup>1</sup>

National Institute of Science, Technology and Development Studies, New Delhi, <sup>1</sup>Central Library, Government Medical College and Hospital, Sector 32, Chandigarh, India

## ABSTRACT

**Objective:** This study analyzes the research output of India in asthma during the period from 1999 till 2008. It analyzes the growth, rank and global publications share, citation impact, share of international collaborative papers, contribution of major collaborative partner countries and contribution of various subject fields. It also analyzes the characteristics of most productive institutions, authors and high-cited papers. **Materials and Methods:** SCOPUS database has been used to retrieve the data on publication output in asthma research. **Results:** India ranks 15<sup>th</sup> position among the top 23 countries in asthma research, with its global publication share of 1.27% (862 papers), registering an average citation per paper of 3.43 and achieved an h-index of 33 during 1999-2008. **Conclusion:** Indian research output on asthma is quite low in the global context as reflected from its publication output per thousand population (0.001) and its world publication share (1.27%) during 1999-2008. Also, the impact and quality of Indian research is low compared to select developed and developing countries.

**KEY WORDS:** Asthma, India, publication output

**Address for correspondence:** Dr. B. M. Gupta, National Institute of Science, Technology and Development Studies, New Delhi - 110 012, India.  
E-mail: bmgupta1@gmail.com

## INTRODUCTION

Asthma is a major chronic lung disease characterized by recurrent attacks of breathlessness and wheezing, which vary in severity and frequency from person to person. Although the fundamental causes of asthma are not completely understood, numerous antigens/allergens are capable of triggering the acute attacks of asthma.<sup>[1]</sup> Asthma is classified into several forms on the basis of cause of asthma symptoms, its severity, method of its control, and its prevalence among populations of different age groups.<sup>[2,3]</sup>

In the recent years, the morbidity and mortality of population due to asthma is increasing despite the advances being made in understanding of this disease and availability

of improved medications and information on treatment.<sup>[4]</sup> As per WHO estimates 2007, there are 300 million people currently suffering from asthma globally (a number that could increase by further 100 million by 2025) and 255,000 people died of asthma in 2005.<sup>[5-9]</sup> Most asthma related deaths occur in low- and lower-middle income countries. Prevalence rates of asthma are higher in western countries than in Asian countries.<sup>[6]</sup> Although the prevalence of asthma in India is somewhat similar to that seen in other Asian countries, the asthma incidences have increased significantly over the years in the country.<sup>[7]</sup> As per National family health survey of India, 2468 persons per 100,000 population are reported to be suffering from asthma, which is considerably higher in rural areas (2649 per 100,000 population) than in urban areas (1966 per 100,000 population).<sup>[8]</sup> According to the global burden of asthma report (GINA), over 50 million suffer from asthma in Central and Southern Asia and an absolute 2% increase in the prevalence of asthma in India would result in an additional 20 million people with this disease.<sup>[9]</sup>

## Objectives

The main objective of this study was to analyze the research performance of India on asthma, in the national

Access this article online	
<b>Quick Response Code:</b> 	<b>Website:</b> www.lungindia.com
	<b>DOI:</b> 10.4103/0970-2113.85683

and global context, as reflected in its publications output during 1999-2008. In particular, the study focuses on analyzing the following: (i) the Indian research output, its growth, rank and global publications share and impact; (ii) the patterns of international collaboration and major collaborative partners; (iii) the contribution by sub-fields of asthma; (iv) the patterns of research output among various types of asthma; (v) the publication productivity and impact of leading institutions and authors of India and (vi) the characteristics of high-cited papers.

### Review of literature

Very few studies have been undertaken in the past on worldwide asthma research activities. Klaewsongram and Reantragoon<sup>[10]</sup> analyzed the asthma research of Asia-Pacific countries during 1998-2007 using PUBMED database. Among the Asia-Pacific countries, Australia and Japan are the leading countries in contributing the highest research output on asthma. Similarly, New Zealand and Australia are the leading countries in receiving highest impact (in terms of citations count per paper) for their publications as well as for publishing them in high-impact journals. There was a drastic increase in the number of asthma publications and its quality from South Korea, Taiwan, Hong Kong and Singapore in the last decade. Although the publication output of China and India on asthma research has increased during 1998-2007, it is of low quality.

Chen, Chiu and Ho<sup>[11]</sup> made the bibliometric study of publications output on asthma in children during 1991-2002 using SCI online version database. The parameters analyzed included language of publications, types of document, page count, publication output by country, authorship pattern and the most frequently cited papers. In addition, performance of research workers, institutions and countries based on publications and citations data had been undertaken. Groneberg-Kloft *et al.*<sup>[12]</sup> conducted a scientometric study on the research activities of two obstructive airway diseases, bronchial asthma and chronic obstructive pulmonary disease, during 1987-2006 using Web of Science database. The study compared 8874 publications (with 20.55% of their publications involving international collaboration and scoring a citation impact of 24.48 per paper) from UK and 3341 publications (with 27.63% of their publications involving international collaboration and scoring a citation impact of 17.62 per paper) in asthma research. Poureslami *et al.*<sup>[13]</sup> conducted a systematic review of publications on asthma, health and literacy topic during 1980-2006 using various databases to find the link between asthma and health literacy in a cultural ethnic perspective in Canada.

## MATERIALS AND METHODS

### Source of data

This study was based on the Indian publication data in asthma, retrieved from the Scopus Citation database, for 10 years (1999-2008). The search strategy/keyword used to

retrieve the data on asthma was “asthm\*”. To retrieve the Indian articles on asthma, the following string was used in Scopus database:

```
(AFFIL(India) AND TITLE-ABS-KEY(asthm*)) AND
PUBYEAR AFT 1998 AND PUBYEAR BEF 2009.
```

Similarly, the research output of other countries had been retrieved with this string. For retrieving the population of these countries, Wikipedia had been used.<sup>[14]</sup> “Limit To” option of Scopus database was used to retrieve the data on different sub-fields by clicking on the concerned subject one by one with the above-mentioned main string. For searching the research output on various types of asthma, the keywords used were allerg\*, occupa\*, exerc\*, noctur\*, child\*, adult\* season\* in TITLE-ABS-KEY and these searches were combined with the main string.

For citations data, 4-year, 3-year and 2-year citations window had been used for computing average citations per paper in asthma research during 1999-2006, 2007 and 2008. However, for high-cited papers, the total citations had been used. Multilateral, Bilateral, National and Zero Collaborations in high-cited papers means the collaborative papers of India with more than two countries, with only two countries, with national institutions only and with no collaborations, respectively. For calculating the total international collaborative papers, a separate search strategy that combines India's collaboration with 140 major countries was prepared. For analyzing and generating institutional and authors' output, separate search strategies were developed.

## RESULTS

### World asthma research output and ranking of countries

The research output, publication share and ranking of top 23 countries of world in asthma research during 1999-2008 are presented in Table 1. The publication share of these 23 countries varies from 0.30 to 26.12% in global publication output during 1999-2008. United States scores the 1<sup>st</sup> position with a publication share of 26.12% and United Kingdom comes 2<sup>nd</sup> with a publication share of 11.37%. Germany, Japan, Canada, France, Italy, Australia and The Netherlands are placed from 3<sup>rd</sup> to 9<sup>th</sup> positions with publications share ranging from 5.49% to 3%, respectively. The countries that rank between 10<sup>th</sup> and 19<sup>th</sup> positions are Spain, Sweden, China, Poland, Switzerland, India, Belgium, Turkey, Brazil and South Korea, with their global publications share ranging from 1 to 2.99%. Of the 23 countries, 16 witnessed increase in their publication share from the year 1999 to the year 2008. India ranks 15<sup>th</sup> position among these top 23 countries in asthma research by contributing 1.27% of the publications share in world asthma research during 1999-2008. India's global publication share rose from 0.89% in 1999 to 1.79% in 2008 and its world ranking improved from 14<sup>th</sup> to 13<sup>th</sup> during the same period [Table 1].

**Table 1: Ranking of top 23 countries in asthma research (years 1999 and 2008)**

Country	No. of papers			% Share of papers			Publication rank of countries		
	1999	2008	1999-2008	1999	2008	1999-2008	1999	2008	1999-2008
United States	1392	2130	17,788	24.35	28.02	26.12	1	1	1
UK	739	779	7742	12.93	10.25	11.37	2	2	2
Germany	259	409	3737	4.53	5.38	5.49	6	3	3
Japan	299	359	3003	5.23	4.72	4.41	3	6	4
Canada	269	406	2974	4.71	5.34	4.37	5	4	5
France	274	301	2923	4.79	3.96	4.29	4	8	6
Italy	170	362	2809	2.97	4.76	4.13	10	5	7
Australia	248	301	2531	4.34	3.96	3.72	7	7	8
The Netherlands	179	232	2045	3.13	3.05	3.00	8	10	9
Spain	171	234	1975	2.99	3.08	2.90	9	9	10
Sweden	162	189	1660	2.83	2.49	2.44	11	12	11
China	33	213	1283	0.58	2.80	1.88	21	11	12
Poland	50	105	1017	0.87	1.38	1.49	15	18	13
Switzerland	93	108	998	1.63	1.42	1.47	12	17	14
India	51	136	862	0.89	1.79	1.27	14	13	15
Belgium	72	109	859	1.26	1.43	1.26	13	16	16
Turkey	42	101	795	0.73	1.33	1.17	17	19	17
Brazil	43	135	770	0.75	1.78	1.13	16	14	18
South Korea	37	133	762	0.35	1.75	1.12	18	15	19
Israel	35	62	585	0.61	0.82	0.86	19	21	20
Taiwan	34	69	555	0.59	0.91	0.82	20	20	21
South Africa	15	43	286	0.26	0.57	0.42	23	22	22
Russia	16	24	201	0.28	0.32	0.30	22	23	23
World*	5717	7602	68,091						

\*Note: Publication output of world means that it combines publications output of all the publishing countries

On comparing the asthma publications output *vis-à-vis* the population of the leading countries, India's publications output per thousand publications was the lowest among the 23 countries considered in the study as seen from Table 2.

#### Research profile of Indian asthma research, 1999-2008

The Indian research output, its impact in terms of average citation per paper and the percentage share of international collaborative papers on asthma during the 10 years from 1999 to 2008 is presented in Figure 1. The cumulative research output consists of 862 papers during 1999-2008, with an average number of 86.2 papers per year, rising from 333 papers during 1999-2003 to 529 papers during 2004-2008, showing a growth rate of 58.86% and registering an h-index of 33. This cumulative Indian publications output in asthma received 2959 citations, registering an average of 3.43 citations per paper. The citation impact per paper of total Indian publications rose from 2.87 during 1999-2003 to 3.79 during 2004-2008 [Table 3a] However, the citation impact of Indian research in asthma was much lower than the citation impact of select developed and developing countries' publications [Table 3b]. The share of international collaborative output accounted for 10.09% share (87 collaborative papers) in the cumulative research output of India in asthma research during 1999-2008. India's share of international collaborative papers in its total research output in asthma research showed a significant increase, rising from 6.01% during 1999-2003 to 12.67% during 2004-2008 [Table 3a].

Among the collaborative partners of India, USA contributed the largest publications share of 51.72% share (45 papers) during 1999-2008, followed by UK with 25.29%

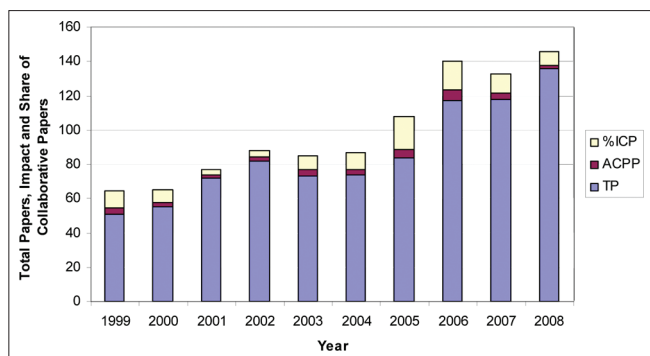
**Table 2: Asthma publications output during 1999-2008 and population density of leading countries**

Country	Total papers, 1999-2008	Population	Papers per thousand population
Sweden	1660	9,408,028	0.176
Switzerland	998	7,782,900	0.128
UK	7742	61,792,000	0.125
The Netherlands	2045	16,638,000	0.123
Australia	2531	22,575,000	0.112
Canada	2974	34,305,000	0.087
Belgium	859	10,827,519	0.079
Israel	585	7,670,500	0.076
United States	17,788	310,548,000	0.057
Germany	3737	81,802,000	0.046
Italy	2809	60,494,632	0.046
France	2923	65,447,374	0.045
Spain	1975	46,122,169	0.043
Poland	1017	38,092,000	0.027
Japan	3003	127,390,000	0.024
Taiwan	555	23,150,923	0.024
South Korea	762	48,501,000	0.016
Turkey	795	72,561,312	0.011
South Africa	286	49,991,300	0.006
Brazil	770	190,732,694	0.004
China	1283	1,341,470,000	0.001
India	862	1,192,110,000	0.001

publications share (22 papers), Germany with 9.20% publications share (8 papers), France and Australia with 8.05% publications share (7 papers), etc. [Table 4].

#### Contribution of various sub-fields in asthma research in India

Analysis of asthma research output in the context of different subjects revealed that 62.88% (542 papers) of



**Figure 1:** Indian research performance in Asthma Publications (period 1999-2008)

**Table 3a: Indian asthma research output during block years (1999-2003, 2004-2008 and 1999-2008)**

Block years	TP	TC	ACPP	ICP	%ICP	H-index
1999-2003	333	955	2.87	20	6.01	25
2004-2008	529	2004	3.79	67	12.67	25
1999-2008	862	2959	3.43	87	10.09	33

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

**Table 3b: Citations impact of select developed and developing country papers in asthma research, 1999-2008**

Country	TP	TC	ACPP
USA	17,788	223,977	12.59
Germany	3737	39,656	10.61
France	2923	24,742	8.46
China	1283	5081	3.96
Brazil	770	6801	8.83
South Korea	762	5333	7.00
India	862	2959	3.43

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

**Table 4: India's international linkages with major countries in asthma research (period 1999-2008)**

Collaborating country	No. of collaborative papers during		
	1999-2003	2004-2008	1999-2008
USA	10	35	45
UK	7	15	22
Germany	1	7	8
France	1	6	7
Australia	1	6	7
The Netherlands	0	6	6
Japan	0	4	4
Italy	0	4	4
Sweden	1	3	4
Switzerland	0	3	3
Canada	0	2	2
Belgium	0	2	2
South Korea	0	2	2
Malaysia	0	1	1
Turkey	1	0	1
Total	20	67	87

the total Indian research output have been in medicine, followed by pharmacology, toxicology and pharmaceuticals (23.20% share and 200 papers), biochemistry, genetics and molecular biology (15.66% share and 135 papers),

immunology and microbiology (8.12% share and 70 papers), chemistry (6.84% share and 59 papers) and agricultural and biological sciences (4.18% share and 36 papers). All these subject fields witnessed an increase in their publications share from 1999-2003 to 2004-2008 [Table 5].

Considering the citation impact and quality, the research output under immunology and microbiology registered the highest impact of 6.70 citations per paper, followed by pharmacology, toxicology and pharmaceuticals (5.05 citations per paper), chemistry (4.46 citations per paper), biochemistry, genetics and molecular biology (3.91 citations per paper), medicine (2.85 citations per paper) and agricultural and biological sciences (1.44 citations per paper). Except immunology and microbiology, all other subjects witnessed an increase in their citation quality and impact in terms of average citations per paper from 1999-2003 to 2004-2008. The research output under medicine scored the highest h-index value of 22, followed by pharmacology, toxicology and pharmaceuticals (20), immunology and microbiology (14), biochemistry, genetics and molecular biology and chemistry (13 each) and agricultural and biological sciences (5) [Table 5].

**Patterns of research output among various types of asthma and its prevalence in different age groups of population**

Among the various types of asthma (with their respective publication share in Indian and world output), the largest emphasis had been on allergic asthma (27.49% and 35.25% share), followed by occupational asthma (4.18% and 5.08% share), seasonal asthma (4.18% and 3.69% share), exercise-induced asthma (2.55% and 4.03% share) and nocturnal asthma (1.97% and 0.95%) during 1999-2008. However, in terms of India's global publications share, the largest emphasis (2.62% publications share) had been on nocturnal asthma, followed by seasonal asthma (1.43% share), occupational asthma (1.02% share), allergic asthma (0.99% share) and exercise-induced asthma (0.80% share) during 1999-2008. India's global publications share had increased in allergic asthma (from 0.75 to 1.16%), occupational asthma (from 0.93 to 1.11%) and seasonal asthma (from 0.97 to 1.75%), as against a decrease in exercise-induced asthma (from 0.88 to 0.74%) and nocturnal asthma (from 2.71 to 2.53%) from 1999-2003 to 2004-2008 [Table 6].

On analyzing the research output published as per asthma prevalence in different age groups of population as reflected in asthma studies (with their respective publication share in Indian and world output), the largest emphasis had been on infant, adolescent and child (31.32% and 30.26% share), followed by adult and middle-aged (29.58% and 30.24% share) and aged and elderly (6.15% and 10.22% share) during 1999-2008. However, in terms of India's global publications share, the largest emphasis had again been on infant, adolescent and child (with 1.31% publications share), followed by adult and middle-aged (1.24% share) and aged and elderly (0.76% share) during 1999-2008.

**Table 5: India: Sub-fields distribution of papers in asthma research, 1999-2008**

Sub-fields	No. of papers			Number of citations			Average citations per paper			H-index
	1999-2003	2004-2008	1999-2008	1999-2003	2004-2008	1999-2008	1999-2003	2004-2008	1999-2008	1999-2008
Medicine	207	335	542	545	998	1543	2.63	2.98	2.85	22
Pharmacology, toxicology and pharmaceuticals	79	121	200	271	738	1009	3.43	6.10	5.05	20
Biochemistry, genetics and molecular biology	46	89	135	144	384	528	3.13	4.31	3.91	13
Immunology and microbiology	18	52	70	212	257	469	11.78	4.94	6.70	14
Chemistry	21	38	59	89	174	263	4.24	4.58	4.46	13
Agricultural and biological sciences	12	24	36	10	42	52	0.83	1.75	1.44	5

**Table 6: Classification of Indian and world publication output by type of asthma, 1999-2008**

Type of asthma by symptoms	No. of Indian papers			No. of world papers			India's global publications share		
	1999-2003	2004-2008	1999-2008	1999-2003	2004-2008	1999-2008	1999-2003	2004-2008	1999-2008
Allergic asthma	75	162	237	10,032	13,973	24,005	0.75	1.16	0.99
Occupational asthma	16	20	36	1721	1803	3524	0.93	1.11	1.02
Exercise-induced asthma	11	11	22	1253	1489	2742	0.88	0.74	0.80
Nocturnal asthma	9	8	17	332	316	648	2.71	2.53	2.62
Seasonal asthma	10	26	36	1028	1484	2512	0.97	1.75	1.43
Total	333	529	862	30,546	37,545	68,091	1.09	1.41	1.27

India's global publications share had increased in infant, adolescent and child (from 1.28 to 1.34%), adult and middle-aged (from 0.82 to 1.61%) and aged and elderly (from 0.54 to 0.95%) from 1999-2003 to 2004-2008 [Table 7].

#### Research profile of major Indian institutions engaged in asthma research

The research profile of 13 most productive Indian institutions engaged in asthma research is presented in Table 8. The cumulative publications output of these 13 productive institutions together contributed 45.94% share (396 papers) in the total publications output in asthma research during 1999-2008, with an average of 30.46 papers per institute. Only four institutions, Postgraduate Institute of Medical Education and Research, Chandigarh (91 papers), All India Institute of Medical Sciences, New Delhi (80 papers), Institute of Genomics and Integrated Biology, Delhi (66 papers), and Vallabhbhai Patel Chest Institute, New Delhi (64 papers), have registered higher number of papers than the group's average. The average citation received per paper by the total papers published by these 13 productive institutions is 3.75. Four institutions registered higher impact than the average impact (3.75) of all 13 productive institutions. These are University Institute of Pharmaceutical Sciences, Panjab University (8.80 citations), Institute of Genomics and Integrated Biology (5.71 citations), KEM Hospital (4.25 citations), and Vallabhbhai Patel Chest Institute, New Delhi (4.06 citations). Only 5 out of 13 institutions registered higher h-index value than the average h-index value (6.69) of all 13 productive institutions [Table 8].

#### Research profile of prolific Indian authors engaged in asthma research

Top 14 authors, who had published 12 and more papers in asthma research during 1999-2008, have been identified as the most productive and their research performance profile is presented in Table 9. The combined contribution of these

14 authors accounts for 31.90% share (275 papers) in the country's output in asthma, with average productivity of 19.64 papers per author. Seven authors have contributed higher publications than the group's average. These are B. Ghosh with 33 papers, followed by D. Gupta, S. K. Kabra, S. K. Chhabra (26 papers each) and A. Shah, R. Lodha, M. Singh (20 papers each). The average citation impact as measured by average citations per paper registered by these 14 authors for all of their publications is 4.18 citations per paper. Six authors have recorded higher impact than the group's average. These are B. Ghosh with 6.76 citations per paper, followed by J. Batra (6.08 citations), A. Shah (5.45 citations), S. K. Jindal (5.344 citations), S. K. Chhabra (5.15 citations) and A. N. Aggarwal (4.61 citations). These authors together have achieved average h-index value of 6.14. Seven authors registered higher h-index value than the group's average [Table 9].

#### Patterns of research communication

The Asthma research output published in 20 productive journals is presented in Table 10. Of these 20 journals, 5 are of international origin and 15 are of Indian origin. The cumulative publications output of these 20 most productive journals contributes 37.70% share (325 papers) in the country's total output during 1999-2008, witnessing a decrease in publication share from 51.35% during 1999-2003 to 29.11% during 2004-2008.

#### High-cited papers

This section analyzes the characteristics of top 100 most high-cited papers of India in asthma research [Tables 11a-b]. These 100 high-cited papers have received citations (since their publication till 11.07.2010) varying from 14 to 373 during 1999-2008. The cumulative citations received by these high-cited papers were 3372, with an average of 33.72 citations per paper. Of the 100 papers, 69 appeared as articles, 29 as reviews, 1 each as conference paper and short survey. Of these high-cited papers, 45 involve

**Table 7: Publication distribution by prevalence of asthma in different age levels of population, 1999-2008**

Asthma papers emphasis by age groups	No. of Indian papers			No. of world papers			India's global publications share		
	1999-2003	2004-2008	1999-2008	1999-2003	2004-2008	1999-2008	1999-2003	2004-2008	1999-2008
Infant, adolescent and child	121	149	270	9450	11,156	20,606	1.28	1.34	1.31
Adult and middle-aged	79	176	255	9635	10,954	20,589	0.82	1.61	1.24
Aged and elderly	17	36	53	3157	3800	6957	0.54	0.95	0.76
Total country's output	333	529	862	30546	37,545	68,091	1.09	1.41	1.27

**Table 8: Contribution and productivity of major Indian institutions in asthma research, 1999-2008**

Name	TP	TC	ACPP	H-index
Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	91	255	2.80	11
All India Institute of Medical Sciences (AIIMS), New Delhi	80	287	3.59	12
Institute of Genomics and Integrated Biology (IGIB), Delhi	66	377	5.71	14
Vallabhbhai Patel Chest Institute (VBPCI), Delhi	64	260	4.06	11
Maulana Azad Medical College (MAMC), Delhi	21	29	1.38	5
Punjab University, Institute of Pharmaceutical Sciences (UIPS), Chandigarh	15	132	8.80	9
Christian Medical College and Hospital (CMC), Vellore	10	35	3.5	3
Pandit Bhagwat Dayal Sharma Postgraduate Institute of Medical Sciences (PBDPGIMS), Rohtak	10	18	1.8	4
KEM Hospital, Bombay	8	34	4.25	3
Kalwari Saran Children's Hospital (KSCH), New Delhi	8	13	1.62	4
University of Pune, Pune	8	22	2.75	4
Bombay College of Pharmacy	8	8	1.0	3
SMS Medical College, Jaipur	7	16	2.28	4
Total	396	1486	3.75	87

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

**Table 9: Contribution and productivity of prolific Indian authors in asthma research, 1999-2008**

Author's name	Affiliation	TP	TC	ACPP	H-index
B. Ghosh	Institute of Genomics and Integrated Biology, Molecular Immunogenetics Laboratory, Delhi	33	223	6.76	11
D. Gupta	Postgraduate Institute of Medical Education and Research, Department Of Pulmonary Medicine, Chandigarh	26	94	3.61	8
S. K. Kabra	All India Institute of Medical Sciences, Department of Pediatrics, New Delhi	26	71	2.73	7
S. K. Chhabra	Vallabhbhai Patel Chest Institute, Department of Cardiorespiratory Physiology, Delhi	26	134	5.15	8
A. Shah	Vallabhbhai Patel Chest Institute, Department of Respiratory Medicine, Delhi	20	109	5.45	7
R. Lodha	All India Institute of Medical Sciences, Department of Pediatrics, New Delhi	20	59	2.95	6
M. Singh	Postgraduate Institute of Medical Education and Research, Advanced Pediatrics Center, Chandigarh	20	51	2.55	6
S. K. Jindal	Postgraduate Institute of Medical Education and Research, Department of Pulmonary Medicine, Chandigarh	19	98	5.44	7
A. N. Aggarwal	Postgraduate Institute of Medical Education and Research, Department of Pulmonary Medicine, Chandigarh	18	83	4.61	7
R. Agarwal	Postgraduate Institute of Medical Education and Research, Department Of Pulmonary Medicine, Chandigarh	17	42	2.47	3
S. N. Gaur	Vallabhbhai Patel Chest Institute, Delhi	14	45	3.21	4
J. Batra	Institute of Genomics and Integrated Biology, Molecular Immunogenetics Laboratory, Delhi	12	73	6.08	5
R. Kumar	Postgraduate Institute of Medical Education and Research, Department of Pediatrics, Advanced Pediatrics Centre, Chandigarh	12	33	2.75	3
N. Arora	Institute of Genomics and Integrated Biology, Delhi	12	35	2.92	4

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

the collaboration and 55 papers zero collaboration. The authors of these high-cited papers are affiliated to 44 Indian institutions and these papers have appeared in 76 journals.

## DISCUSSION

We conclude that Indian scientists had published 862 papers in asthma research during 1999-2008 and registered

an average citation per paper of 3.43. The cumulative Indian papers witnessed a growth rate of 58.86% for the papers from 1999-2003 to 2004-2008 and achieved the h-index as 33. India ranks 15<sup>th</sup> position among the top 23 countries in asthma research, with its global publication share of 1.27% and international collaborative publications share of 10.09% during 1999-2008. Among India's major collaborative partners during 1999-2008, USA contributed the largest publications share of 51.72%.

The Indian asthma research output under different subjects shows that the highest research output was from medicine

**Table 10: Number of asthma papers published in most productive journals\* during 1999-2008**

Name of the journal	Block periods		
	1999-2003	2004-2008	1999-2008
Indian Pediatrics	26	31	57
Indian Journal of Pediatrics	31	20	51
Indian Journal of Chest Diseases Allied Sciences	8	16	24
Journal of Association of Physicians of India	17	4	21
Journal of Ethnopharmacology	7	10	17
Indian Journal of Pharmacology	7	8	15
Journal of Asthma	11	4	15
Indian Journal of Pharmaceutical Sciences	4	10	14
Annals of Allergy Asthma and Immunology	4	8	12
Journal of Internal Medicine of India	8	2	10
Journal of the Indian Medical Association	6	4	10
Indian Journal of Occupational and Environmental Medicine	8	2	10
Indian Journal of Medical Research	3	7	10
Indian Journal of Physiology and Pharmacology	5	4	9
Medical Journal Armed Forces India	1	8	9
Indian Drugs	9	0	9
Indian Journal of Otolaryngology and Head and Neck Surgery	5	3	8
Chest	3	5	8
National Medical Journal of India	6	2	8
Journal of Allergy and Clinical Immunology	2	6	8

\*Productive journals-Journals receiving the largest number of papers

**Table 11a: Patterns of collaboration and citations received of Indian high-cited papers, 1999-2008**

Citation range	Total papers	Type of collaboration	Total papers
101-373	3	Multilateral collaboration	10
50-100	13	Bilateral collaboration	14
30-49	13	National collaboration	21
14-29	71	Zero collaboration	55

**Table 11b: Patterns of institutional affiliation and communication in journals of high-cited papers**

Institutional affiliation	Total papers	Communicated journals	Total papers
Institute of Genomics and Integrative Biology (IGIB), Delhi	13	Journal of Ethnopharmacology	7
Vallabhbhai Patel Chest Institute (VBPCI), Delhi	10	Journal of Asthma	4
Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh	10	Chest	3
All India Institute of Medical Sciences (AIIMS), Delhi	8	Journal of Allergy and clinical Immunology	3
University Institute of Pharmaceutical Sciences (UIPS), Chandigarh	6	Acta Paediatrica	3
National Institute of Pharmaceutical Education and Research (NIPER), Mohali	4	Bioorganic and Medicinal Chemistry	2
Jaslok Hospital and Research Centre, Mumbai	3	Clinical and Experimental Allergy	2
Dr. Ambedkar College, Nagpur	3	Drug Discovery Today	2
Ranbaxy Co. Ltd., Gurgaon	3	European Journal of Pharmacology	2
Madras Medical College, Madras	2	Indian Pediatrics	2
Christian Medical College and Hospital (CMC), Vellore	2	International Journal of Pharmaceutics	2
Tata Institute of Fundamental Research (TIFR), Mumbai	2	Pediatric Allergy and Immunology	2
Amrita Institute of Medical Sciences, Kerala	2	Thorax	2
H. S. Gaur University, Sagar	2	Indian Journal of Chest Diseases and Allied Sciences	2

with 62.88% publications share in cumulative Indian publications output during 1999-2008. In terms of impact, the sub-field immunology and microbiology registered the highest citation impact of 6.70 citations per paper during the same period.

The 396 cumulative publications from 13 most productive Indian institutions in asthma accounted for 45.94% share in India's total publications output and registered an average impact of 3.75 citations per paper and an average h-index value of 6.69 during 1999-2008. The 14 most productive Indian authors in asthma together accounted for 31.90% share in national output in asthma and registered an average citation impact of 4.18 citations per paper and an average h-index of 6.14 per author during 1999-2008. The top 100 most high-cited papers of India in asthma research are in citation range of 14-373 during 1999-2008 and have received 3372 citations, with an average of 33.72 citations per paper. The 100 high-cited papers involve 24 with international collaboration (14 bilateral and 10 multilateral) and 21 with national collaboration. The authors of these high-cited papers are affiliated to 44 Indian institutions and these papers have appeared in 76 journals.

It is concluded that the existing Indian research output on asthma is quite low in the global context as reflected from its publication output per thousand population (0.001) and its world publication share (1.27%) during 1999-2008. In addition, the impact and quality of Indian research is low compared to that of select developed and developing countries. Keeping in view the rise in asthma cases in the country, there is a need to increase the Indian research efforts in terms of R and D investments, deployment of more qualified manpower and increased international collaboration to reduce the toll of morbidity and mortality related to asthma disease. Health care system should be strengthened for people with asthma by identifying cost-effective interventions, and upgrading standards and accessibility of care at different levels. Government should invest much more on conducting various studies and clinical and scientific research on asthma. Strategies

should be formulated to educate the people about this disease as the appropriate management can only control this disease.

## REFERENCES

1. World Health Organisation; c2010. Available from: <http://www.who.int/features/qa/46/en/index.html>. [cited 2010 Jun 29].
2. The New York Times Company; c2010. Available from: [http://asthma.about.com/od/asthmabasics/a/art\\_typesofasthma.htm](http://asthma.about.com/od/asthmabasics/a/art_typesofasthma.htm). [cited 2010 Jun 29].
3. USA; Merck Sharp and Dohme Corp.: A subsidiary of Merck and Co., Inc.; c2010-11. Available from: <http://www.merckmanuals.com/professional/sec05/ch048/ch048a.html#sec05-ch048-ch048a-390>. [cited 2010 Jun 29].
4. Shabaraya RK, Vishnusharma A, Rajendran SD, Suresh B. Impact of patient education on pulmonary function outcomes in asthmatic patients. *Indian J Hosp Pharm* 2008;45:16-9.
5. World Health Organisation; c2010. Available from: <http://www.who.int/mediacentre/factsheets/fs307/en/index.html>. [cited 2010 Jun 29].
6. Aggarwal AN, Chaudhry K, Chhabra SK, D'Souza GA, Gupta D, Jindal SK, et al. Prevalence and risk factors for bronchial asthma in Indian adults: A multicentre study. *Indian J Chest Dis Allied Sci* 2006;48:13-22.
7. Jindal SK. Bronchial Asthma: The Indian Scene. *Curr Opin Pulm Med* 2007;13:8-12.
8. New Delhi; Ministry of Health and Family Welfare; c2009. Available from: <http://www.nfhsindia.org/data/india/indch6.pdf>. [cited 2010 Jun 29].
9. Global initiative for asthma/Who initiative. Available from: <http://www.ginasthma.com/index.asp?l1=1andl2=0>. [cited in 2010].
10. Klaewsongkram J, Reantragoon R. Asthma research performance in Asia-Pacific: A bibliometric analysis by searching pubmed database. *J Asthma* 2009;46:1013-20.
11. Chen SR, Chiu WT, Ho YS. Asthma in children: Mapping the literature by bibliometric analysis. *Revue Francaise d'Allergologie et d'Immunologie Clinique* 2005;45:442-6.
12. Groneberg-Kloft B, Scutaru C, Dinh QT, Welte T, Chung KF, Fischer A, et al. Inter-disease comparison of research quantity and quality: Bronchial asthma and chronic obstructive pulmonary disease. *J Asthma* 2009;46:147-52.
13. Poureslami IM, Rootman I, Balka E, Devarakonda R, Hatch J, FitzGerald JM. A systematic review of asthma and health literacy: A cultural-ethnic perspective in Canada. *Med Gen Med* 2007;9:40.
14. Wikimedia Foundation, Inc. Available from: [http://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_population](http://en.wikipedia.org/wiki/List_of_countries_by_population). [cited 2010 Jun 29].

**How to cite this article:** Gupta BM, Bala A. Mapping of asthma research in India: A scientometric analysis of publications output during 1999-2008. *Lung India* 2011;28:239-46.

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

Announcement

**Napcon 2011**

**13th Joint Conference of Indian Chest Society (ICS)  
& National College of Chest Physicians (India) (NCCP)**

**27<sup>th</sup> - 30<sup>th</sup> November 2011**  
**India Habitat Centre, New Delhi, India**