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Original article

Asthma in children: mapping the literature by bibliometric analysis

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Abstract

***Aim.* –** To evaluate the publication output associated with research on asthma in children.

***Methods.* –** The data encompassed the period from 1991 to 2002 and were extracted from the Science Citation Index online version. Selected documents included 'asthmatic children' and 'asthma children' as a part of its title, abstract, or keyword from. Parameters analyzed included language, type of document, page count, publication output, country of publication, authorship, publication pattern, and the most frequently cited paper.

***Results.* –** The yearly publications have increased from 1991 to 2002. The seven industrialized countries have high productivity in this research field. English was the dominant language, and four or five authors were the moot common number of co-author. The US was the world leader and dominated most of the publications, followed by the UK.

***Conclusions.* –** The most important functions of scientific publications are to communicate and exchange research findings and results. The results of the study not only offer a comprehensive picture of asthma in children by bibliometric research, but also demonstrate the performance of research workers, institutions, and even countries.

Keywords: Asthmatic; Children; SCI; Scientometrics

1. Introduction

Asthma is a serious and complex disease involving broncho constriction, airway inflammation, hyper-responsiveness, and remodeling, all of which can lead to pulmonary dysfunction and even death [1]. The onset of asthma symptoms at less than 5 years of age occurs 80% of the time [2]. Children aged 0–4 years have the largest increase in prevalence and greater health care use [3]. Asthma resulted in more than US$5.3 billion in indirect costs, $1.1 billion in lost school days, $1.5 billion in lost workdays, $840 million in caregiver/housekeeping costs, and $1.8 billion in mortality costs in the US in 1998 [4]. Both of industrialized and developing countries have spent lots of money and worked hard on studying asthma to lower the financial costs incurred by the entire society.

Bibliometric studies carried out in recent years have provided an accurate and presumably objective method of measuring the contribution of a paper to the advancement of knowledge. Recently, numerous research on medical topics has been analyzed using the bibliometric method, such as the severe acute respiratory syndrome (SARS) [5], patent ductus arteriosus [6], geography of clinical cancer research publications [7], orthodontics [8], ophthalmology [9], cancer, cardiovascular, and malaria research [10], AIDS [11], neuropediatry and other pediatric subspecialities [12], rheumatology [13], homeopathy [14]. It is necessary to evaluate the performance of each topic in order to indicate the impact and contribution of each paper to its respective fields.

The most important functions of scientific publications are to communicate and exchange research findings and results. One method of assessing the productivity of scientific researchers is to evaluate their output. To a certain extent, the number of research papers reflects the activity and academic level of a scientist. Also, the annual number of research papers of an institute is often used as a quantitative indicator for evaluating the level of its basic research. Using the bibliometric technique, we are able to evaluate for both researchers

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and institutions. The results of the study not only offer a comprehensive picture of asthma in children by bibliometric research, but also demonstrate the performance of research workers, institutions, and even countries. In the following analysis, we attempt to provide an exhaustive inventory of all papers concerning asthma in children published during 1991–2002.

2. Methods

The data were based on the database of the *Science Citation Index* (*SCI*) published by the subscribed from Institute for Scientific Information (ISI) Web of Science, Philadelphia, PA, USA. The analysis of publication papers was extracted upon a literature search using the online version of *SCI*. 'Asthmatic children' and 'asthma children' were used as keywords to search parts of titles, abstracts, or keywords. Articles, meeting abstracts, reviews, letters, editorial materials, notes, corrections and additions, and corrections were obtained from the search results for document types. Articles originating from England, Scotland, Northern Ireland, and Wales were grouped under the UK heading. The impact factor (IF) of a journal was determined for each document as reported in the year 2002 Institute for Scientific Information (ISI), *Journal Citation Reports* (*JCR*). Collaboration type was determined by the address of each entry, where 'independent' was assigned if no collaboration was presented. 'International collaboration' was assigned if it was cosigned with researchers from other countries abroad.

Once retrieved, records were analyzed by the year of publication, total number of authors, institutions and country, type of publications, language, page count, impact factor of a journal in which the papers were published, and their total citations also included from 1991 to 2002. This effort will provide a current view of the mainstream research on asthmatic children all over the world, as well as clues to the impacts of the topic.

3. Results and discussion

The documents were analyzed according to their language, type of document, page count, publication output, country of publication, authorship, publication patterns, and the most frequently cited paper.

3.1. Language of publication

Language analysis showed that 1617 papers (94.9%) were published in English with French (61; 3.58%), German (17; 1.00%), Italian (5; 0.29%), Spanish (3; 0.18%), and Russian (1; 0.06%) accounting for the remaining share.

3.2. Type of document

The distribution of the document type identified by ISI was analyzed. From this analysis, eight document types were found. In the period from 1991 to 2002, the distribution of document types was developed (Fig. 1). Articles, meeting abstracts, and reviews rose significantly. Other types still remained in low. Evaluating the distribution of types shows that out of the 1704 research documents on asthma in children, 1337 (78.5%) were original articles, distantly followed by meeting abstracts (216; 12.7%), reviews (68; 3.99%), letters (42; 2.46%), editorial materials (24; 1.41%), notes (14; 0.82%), corrections and additions (2; 0.12%), and corrections (1; 0.06%).

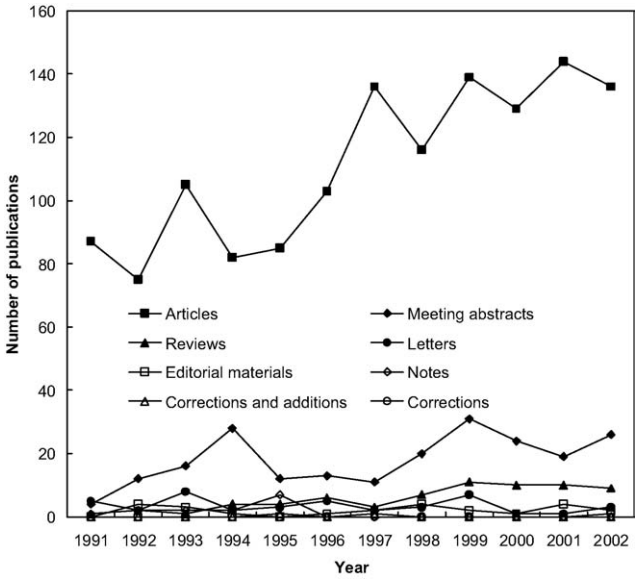

Fig. 1. Pattern of the distribution of document types in the period from 1991 to 2002.

3.3. Page count

There were 9590 pages in the total 1704 papers. Among these papers, 238 or 13.8% consisted of only one page including 207 meeting abstracts. Four- to seven-page papers comprised 54.2%. However, six-page papers (272; 16.0%) were dominant. This was followed by five (251; 14.7%), one (236; 13.8%), and seven pages (211; 12.4%). At the other end of the scale, there were 32 or 1.3% of all papers had more than 15 pages including 20 review papers.

3.4. Publication output

The production trend has steadily increased in the past decade (Fig. 2). More than 50% of the records were published during the period 1998–2002. The total paper production showed two obvious peaks in 1993 and 1999. An increasing trend of the top 10 countries producing publications also showed the same peaks in the same years. The contribution of the publication peak was affected by Italy, France, the Netherlands, Germany, and Canada in 1993 as well as by UK, France, Japan, and Sweden in 1999. The overall article production showed a growth pattern, in which the number papers per year increased by about two times in the following decade

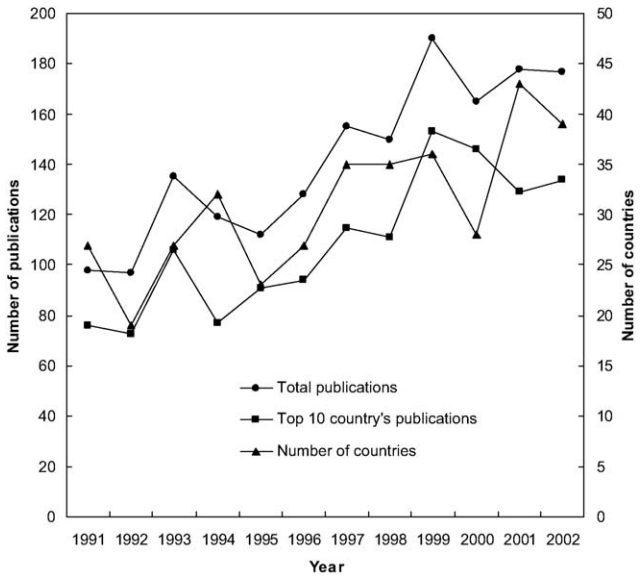

Fig. 2. Annual publication output.

since 1991. A similar increasing trend in the number of countries is also apparent in Fig. 2. In addition, a significant correlation between yearly cumulative number of publications and the year was also made (Fig. 3). For the period from 1991 to 2002, the cumulative number of publications on relative research on asthma in children has increased. Ninety-eight papers were published in 1991, while in 2002 the cumulative number of publications was 1704. The relationship between yearly cumulative number of publications and year was analyzed by using linear, logistic, and exponential equations. Linear and logistic equations had high coefficient of determinations of 0.992 and 0.998 respectively. Linear fitting suggested that yearly publications were constantly sustained in each year. The logistic curve fitting, however, showed that yearly publications had a constant growth rate. It can be concluded that the number of publications on research on the topic of asthma in children is still growing by a small rate.

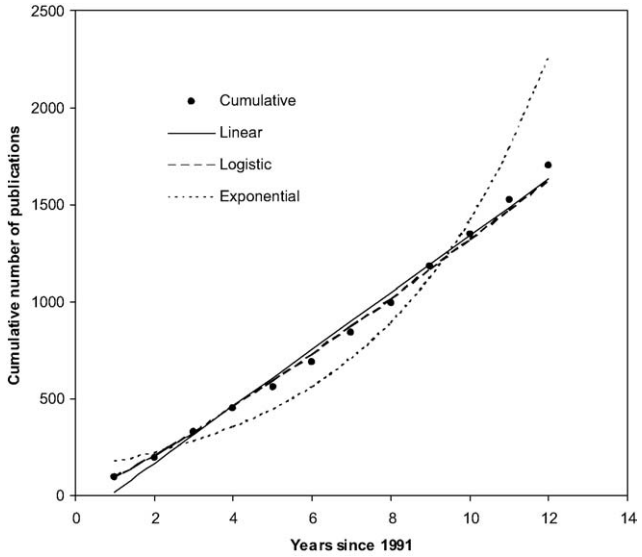

Fig. 3. Relationship between cumulative number of publications and year.

3.5. Country of publication

Table 1 shows that asthma in children is an international research issue. There were 64 papers without author address information on the ISI Web of Science. For this reason, not all of the 1704 papers were included in the analyses of this section. Of 1640 papers, there was great diversity including 59 different countries, with the US producing the most papers (22.7%). Of the 1640 papers, 1463 (89.2%) were independent publications and 177 (10.8%) were international collaborative publications. Developed countries, such as the Netherlands, Denmark, Sweden, and the seven major industrial countries (G7: Canada, France, Germany, Italy, Japan, the UK, and the US), were ranked in the top 10 of publications. Among these countries, the G7 published 69.7% of the 1640 papers. Moreover, G7 had high productivity in this topic, which included 861 (52.5% of 1640 papers) independent publications. The UK (71) and US (70) produced the most international collaborative papers followed by Sweden (28), Germany (26), and Australia (19). Costa Rica, Bulgaria, Kenya, and the United Arab Emirates only had publications done through international collaboration. Ecuador, Indonesia, Lebanon, Libya, Mauritius, Morocco, Nigeria, Pakistan, Peru, Slovenia, Qatar, Tunisia, Venezuela, Malaysia, Kuwait, Egypt, Saudi Arabia, and Turkey had no internationally collaborative publications. In addition, the top 10 countries ranked by number of publications in Table 1 were compared by the mean IF per paper. The UK ranked first with a mean IF of 3.598 followed by the Netherlands (3.533), the US (3.460), Sweden (3.242), Denmark (3.224), Italy (3.157), Canada (2.984), Japan (2.906), Germany (2.296), and France (1.587). One hundred four papers from 33 countries considered were published in journals with no IF. The world IF for asthma in children papers was 3.025. The mean IF has also been analyzed for the geography of clinical cancer research publications. Canada ranked first with a mean IF of 3.95 [5].

3.6. Authorship

The most frequent number of authors was five with 230 (13.5%) papers; 1455 (85.4%) papers were published by one

Table 1
Top 10 countries of authors (first authors and co-authors) of documents with their impact factor (estimated in 2002)

Country	IP	CP	TP	%TP	TIF	MIF	WIF	%WIF
USA	302	70	372	22.7	1162.636	3.460	36	9.68
UK	148	71	219	13.4	777.24	3.598	3	1.37
Italy	110	16	126	7.7	385.19	3.157	4	3.17
France	99	10	109	6.65	160.305	1.587	8	7.34
Japan	93	3	96	5.85	249.92	2.906	10	10.4
Netherlands	77	13	90	5.49	307.334	3.533	3	3.33
Germany	62	26	88	5.37	185.976	2.296	7	7.95
Denmark	69	16	85	5.18	264.382	3.224	3	3.53
Sweden	33	28	61	3.72	197.783	3.242	0	0
Canada	47	12	59	3.60	158.149	2.984	6	10.2

IP, independent publication; CP, international collaborative publication; TP, total publication; TIF, total impact factor; MIF, mean impact factor; WIF, papers without an impact factor.

to six authors. Further analysis was carried out on the corresponding author of the papers. There were 62 cases for which the corresponding author address information was missing in the ISI. The G7 had high productivity in this research with the corresponding author including 952 (55.9%) publications. The most productive country was the US (325, 19.1%), while 65.1% of 1642 papers were published by the top 10 productive countries, including the G7, the Netherlands, Denmark, and Finland.

3.7. Publication pattern

In total, 1704 papers were published in a wide range of 276 journals distributed across 28 countries during the time span from 1991 to 2002. Thirty journals had no impact factor in the ISI. The top five journal countries were the US, which published 96 (34.8%) journals, the UK with 55 (19.9%), Germany with 16 (5.80%), and Switzerland and the Netherlands with 11 each (3.99%). The US and the UK published 54.7% of the Journals including 1205 (70.7%) publications.

Table 2 lists the 20 journals with the greatest number of published papers on asthma in children, their journal country, number of publication, and corresponding percentage and impact factor indexed in the 2002 edition of the *Journal Citation Reports* (*JCR*) published by the ISI. The *Journal of Allergy and Clinical Immunology*, which is published in the US was first and published 196 (11.5%) of all papers. Second on the list is *Pediatric Pulmonology*, which is also published in the US and it was responsible for 108 (6.34%) of all papers. The third is the *European Respiratory Journal*. It is produced in the UK and published 104 (6.10%) of all papers. With regard to these journals covering the scope of asthma in children, four journals had an impact factor of > 10. Sixteen papers were published by them. Most of the journals had impact factors, which ranged from 0 to 3, accounting for 72.8% of all papers studied (Table 3). Journals with IFs of 1–2 published 475 (27.9%) papers, 300 (17.6%) were published by journals with IFs 6–10.

Table 3
Impact factor (estimated in 2002) in terms of productivity

Impact factor	Number of journals	Publications	Percent of publications
0 to < 1	86	253	14.8
1 to < 2	77	475	27.9
2 to < 3	38	249	14.6
3 to < 4	20	240	14.1
4 to < 6	13	67	3.93
6 to < 10	8	300	17.6
Greater than 10	4	16	0.939
NA	30	104	6.10
Total	276	1704	100

NA, no record in the *JCR*.

3.8. Most frequently cited paper

The time dependence on a single article is called its history and may be viewed as the 'sales figure' of the article [15]. Among articles on asthma in children, the most frequently cited was 'Effects of long-term treatment with an inhaled corticosteroid on growth and pulmonary-function in asthmatic-children' [16]. This article, in 1994 by Agertoft and Pedersen, was published in *Respiratory Medicine* and was cited 347 times to 2002 since its publication. The citation history of this most frequently cited article is shown in Fig. 4. The citations slightly increased after it was published and reached a maximum after 4 years. However, a decrease appeared 5 years later.

Table 2
The 20 journals with the highest number of publication, including impact factor (estimated in 2002), journal country, number of publications, and corresponding percentage

Journal	IF	JC	P	P%
Journal of Allergy and Clinical Immunology	6.282	USA	196	11.50
Pediatric Pulmonology	1.739	USA	108	6.34
European Respiratory Journal	2.931	UK	104	6.10
Clinical and Experimental Allergy	3.721	UK	80	4.69
American Journal of Respiratory and Critical Care Medicine	6.567	USA	80	4.69
Journal of Child and Adolescent Psychopharmacology	1.02	USA	79	4.64
Allergy	3.666	Denmark	63	3.70
Annals of Allergy Asthma and Immunology	1.67	USA	52	3.05
Thorax	4.078	UK	48	2.82
Pediatric Allergy and Immunology	1.807	Denmark	39	2.29
Chest	2.969	USA	39	2.29
Respiratory Medicine	1.496	UK	33	1.94
Archives of Disease in Childhood	2.095	UK	33	1.94
Revue Francaise d Allergologie et d Immunologie Clinique	0.302	France	32	1.88
Annals of Allergy	NA	NA	27	1.58
Pediatric Research	3.382	USA	26	1.53
Acta Pediatrica	1.26	Norway	25	1.47
Pediatric Asthma Allergy and Immunology	NA	NA	22	1.29
Journal of Investigational Allergology and Clinical Immunology	0.604	Germany	21	1.23
Pediatrics	3.416	USA	21	1.23

NA, no record in the *JCR*, JC, journal country; P, publication.

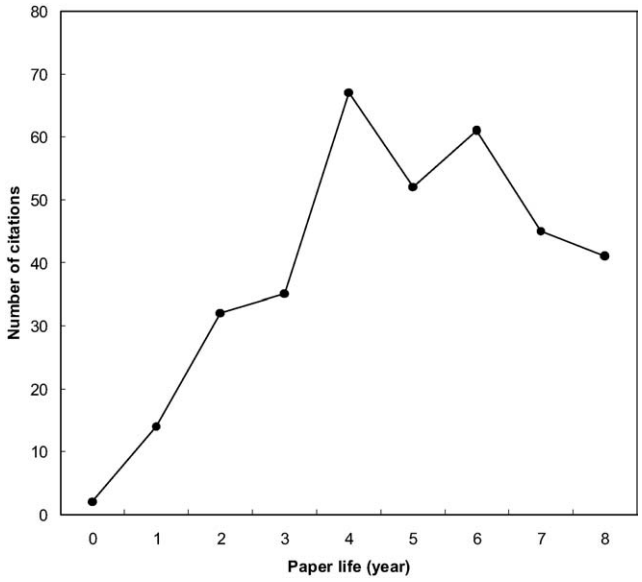

Fig. 4. Citation history of the most frequently cited article.

4. Conclusions

There were several findings of the study. Publications on asthma in children in the world indexed in the *SCI* increased over the decade from the period of 1991–2002. On this topic, the US was the world leader and dominated most of the publications, followed by the UK. The seven industrialized countries held the majority of the total production. English was the dominant language, and four or five authors were the moot common number of co-author.

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