International Journal of Scientometrics, Informetrics and Bibliometrics
ISSN 1137-5019

VOLUME 8 (2004): ISSUE 1. PAPER 1

Evolution Of Bibliometric Indicators And His Websites Evaluation Approaches In Relation To The Foremost Respiratory Journal In Spanish

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Abstract

The aim of this study was to examine the evolution of bibliometric indicators from 1970 to 2000 in relation to the foremost journal on the respiratory system published in Spanish, *Archivos de Bronconeumología* (Arch Bronconeumol). The evolution of these indicators over this three-decade period and the origin and specialties of the authors are reported. All issues of the journal from 1970 to 2000 (inclusive) were reviewed manually. In addition, we make a websites evaluation and a search was made in Pub-Med to evaluate the dissemination of the journal and in SCISEARCH to find citations of articles published in *Archivos de Bronconeumología*. We conclude that there has been a notable increase in scientific output in the field of respiratory research in Spain, as indicated by the articles published in the journal *Archivos de Bronconeumología*. Production and consumption indicators have stabilized in this 30-year period. A maximum circulation index has been achieved and the citation rate has increased considerably in the last three decades. *Archivos de Bronconeumología* has a discrete estimated impact factor.

Keywords

Bibliometrics, Web-metrics, Webometrics, Respiratory System, Scientific Documentation, Statistics

Introduction

The journal Archivos de Bronconeumología, first published in 1964, has acquired a scientific stature that has been consolidated by its presence in international biomedical databases[1]. At present, Archivos de Bronconeumología, the official publication of the Sociedad Española de Patología Respiratoria (SEPAR, Spanish Society of Respiratory Pathology) and Asociación Latinoamericana del Tórax (ALAT, Latin American Chest Association), is a prestigious publication in pneumology and thoracic surgery. It is certainly the most important publication of its type in Spanish, and is indexed by the best known international indexing services. Archivos de Bronconeumología is recently available at **http://www.doyma.es**.

Bibliometrics is used to process and study quantitative data from scientific publications, meaning that it attempts to quantify scientific activity. Consequently, "bibliometrics" designates the science that studies the nature and evolution of a discipline (that leads to publications) by calculating and analyzing various facets of written communication[2]. Bibliometric studies offer an interesting view of the scientific activity of a country, being basic research to obtain information for decision-making by those responsible for scientific policy. The fundamental objectives of bibliometrics are the study of the size, growth, and distribution of scientific documents, as well as investigation of the structure and dynamics of the groups that produce and use these scientific documents and information[2]. Bibliometric studies differentiate between citing publications (mentions of earlier publications in later publications) and cited publications, or references (the list of earlier publications mentioned by in later publications). The reason why citations and references are studied is to analyze the consumption of scientific information, in order to determine the effect or impact that scientific output has on certain scientific communities. Therefore, the study of the production, circulation, consumption, and impact of publications, essentially, the behavior of scientific information, is the focus of bibliometrics[3].

The objectives of this study were to determine the bibliometric indicators of Archivos de Bronconeumología from 1970 to 2000, analyze their evolution over this 30-year period, and describe the origin and specialties of the authors of articles published in Archivos de Bronconeumología.

Material and Methods

A) Data compilation and variables analyzed

1) Manual review. All the numbers of Archivos de Bronconeumología published from 1970 to 2000 (inclusively) were analyzed. All the manuscripts published in the sections "Editorials," "Original Papers," "Reviews," "Clinical Notes," and "Letters to the Editor" were included in the analysis. Monographic issues, special issues, and congress abstracts were not included in the study. We also counted the number of papers in Archivos de Bronconeumología found in the PubMed database[4].

The following variables were recorded for each article: a) year of publication; b) topic: all articles were classified by topic (bronchial asthma, smoking, respiratory failure and sleep disturbances, diagnostic and therapeutic techniques (DTT), tuberculosis, non-tuberculous respiratory infections, oncology, pulmonary circulation, pleura, pulmonary function testing, and interstitial diseases); c) type of document (editorial, original paper, review, clinical note, letter to the editor); d) number of authors; e) first author; f) institutional affiliation of authors; g) province of residence of authors based in Spain and country of residence of other authors; h) specialty or specialties of authors; i) time from reception to acceptance of article, in days; j) time from acceptance to publication, in days; k) key words; l) total number of bibliographic references; m) distribution of references by journal cited. Because of the potentially infinite number of journals that could appear in the references of Archivos de Bronconeumología, 24 periodical publications that had been cited most frequently in the references of the journal in previous

studies were selected[5,6]. In addition, Archivos de Bronconeumología was included to assess self citations. Other variables were n) the number of references per article and year from 1970 to 2000; o) self citations of the journal; p) self citations of the first author; q) self citations of the research team.

2) Search for citations. The citations received by the articles published in Archivos de Bronconeumología between 1995 and 1999 were compiled by searching SCISEARCH (IS90, Institute for Scientific Information, Philadelphia, Pennsylvania, U.S). Documents were selected using the term "ARCH BRON" in the "Referred Journal" (RJ) field and the search period was limited to 1995-2000 (when it was most likely that Archivos de Bronconeumología would be mentioned, since it was listed in the Index Medicus in 1994). The accuracy of all citations of Archivos de Bronconeumología was verified by manual review of the source documents.

3) Search in SCISEARCH. The following variables were recorded for each article of Archivos de Bronconeumología cited: year of publication, authors, country of publication, language, specialty or specialties of authors, and place of residence of the first author. All the articles of Archivos de Bronconeumología cited were classified according to the topics mentioned earlier. The first author of the articles cited was recorded and, when at least one author was common to the citing and cited documents, the citation was classified as a self citation.

B) Calculation of bibliometric indicators

The bibliometric indicators of production were calculated (productivity index [logarithm of the number of articles], cooperation index [number of authors per article], and number of references per article). Other indicators found were circulation, consumption (for the 1995-2000 period of references [median distribution of references], Price index [percentage of references less than five years old], insularity index [the percentage of references from the same country as the journal in which they were cited], distribution of references by source journal, and self citations), and repercussion (estimated impact factor[7] and weighted estimated impact factor, which was obtained by dividing the impact factor of the journal by the highest impact factor of journals in the "respiratory system" area, which corresponded every year to the American Journal of Respiratory and Critical Care Medicine[8]..

C) Archivos de Bronconeumología websites evaluation.

Archivos de Bronconeumología was recently (January 2003) available at Doyma´s websites. Because of the little life of his website we only made a descriptive analysis that include daily visits and inbound links.

D) Statistical analysis

The statistical analysis was carried out with the "Statistical Package for the Social Sciences" (SPSS), version 8.0.

The statistical analysis was descriptive and results were expressed with quantitative variables like the arithmetical mean (± standard deviation) of the variable. The Chi-square test for qualitative variables for independent data was used to compare proportions and a binomial distribution was used for group-to-group comparisons of percentages . The Student t test was used to compare the means of two groups for a continuous quantitative variable, after confirming the fit to a normal distribution using the Kolmogorov-Smirnov test. The strength of the association between two variables was measured with the Pearson linear correlation because the distribution was normal. The means of

a continuous quantitative variable for more than two groups were compared by analysis of the variance (ANOVA). Multiple comparison of means were made with the Bonferroni test to manage multiple inferences from the same data. A level of significance of $P < 0.05$ (95% confidence interval) was accepted as significant.

Results

General description

A total of 2198 articles published in Archivos de Bronconeumología from 1970 to 2000 were analyzed. The distribution of articles by year of publication and type of document is shown in Figure 1 and Figure 2.

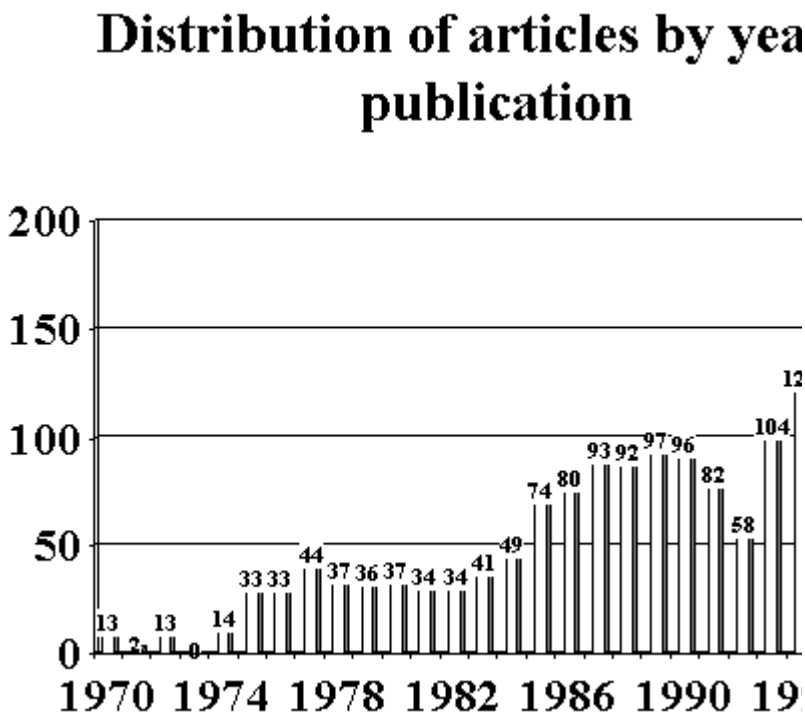

Figure 1: Distribution of articles by year of publication

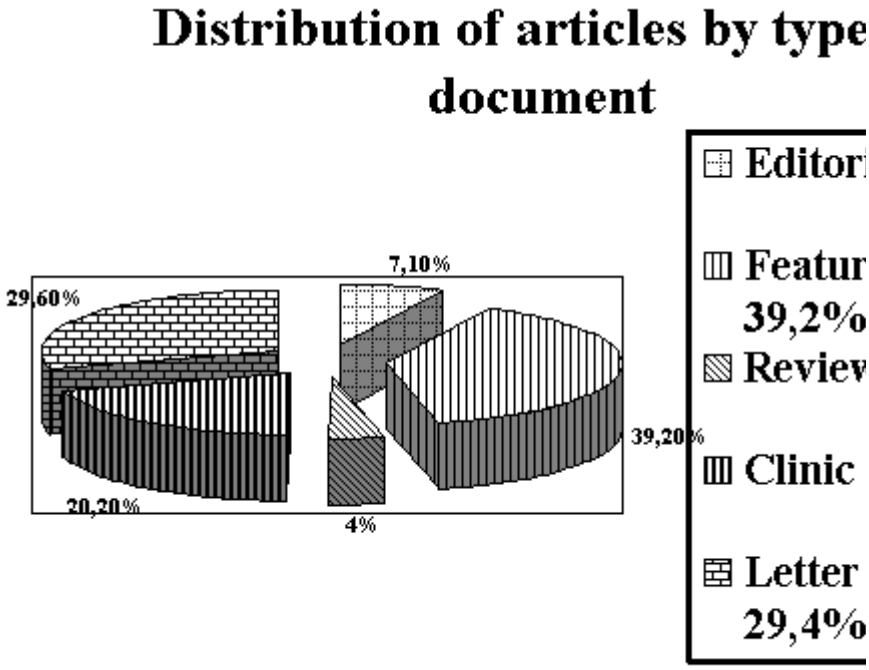

Figure 2: Distribution of articles by type of document

By nationality of the authors, 2134 (97.1%) of the articles published in the journal were by Spanish authors and 63 (2.8%) were by foreign authors. The most frequent contributors of articles to the Archivos de Bronconeumología from outside of Spain were from Holland, the United States, and Argentina-France, with 10, 9, and 8 articles, respectively. Figure 3 shows the distribution of articles from the six most productive Spanish provinces. Although there was a large dispersion in the findings, 48% of the articles came from three provinces (Barcelona, Madrid, and Valencia).

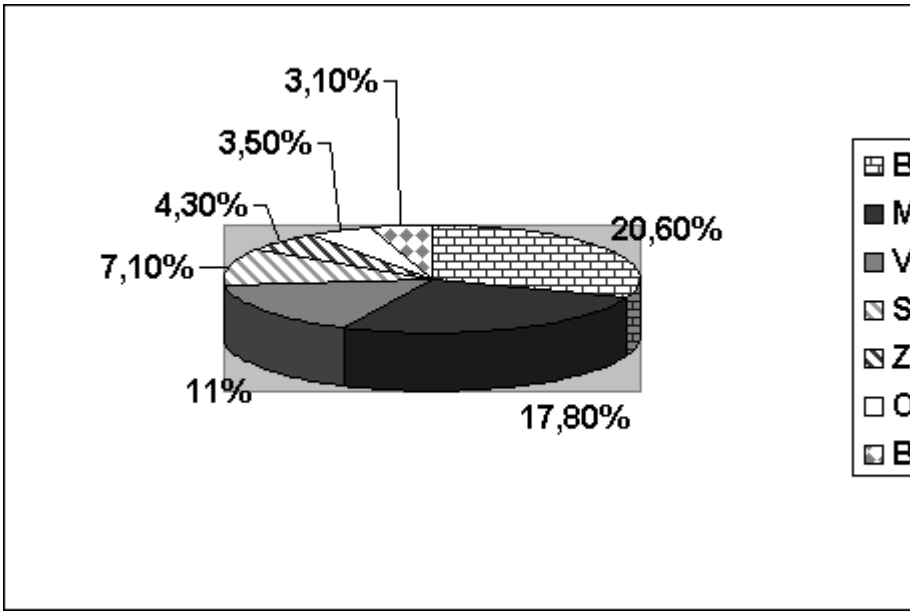

Figure 3: Distribution of articles contributed by the six most productive provinces

The mean (± SD) number of authors per article for all the articles published in

the study period was 4 ± 2 (range: 1 to 18). The mean time to acceptance of the articles was 104 ± 84 days (range: 1 to 683 days) and the mean time from acceptance to publication was 167 ± 55 days (range: 9 to 395 days). The mean number of references for all articles was 18 ± 20.

Although the authors of the articles published in Archivos de Bronconeumología belonged to 42 different specialties and 88 did not indicate their specialties, there was a clear predominance of articles by respiratory system specialists (1460 documents, 49%). The second and third most frequent specialties were thoracic surgery, with 402 articles (13.5%), and internal medicine, with 246 articles (8.3%).

The distribution of articles by the institutional affiliation of authors also showed a wide dispersion. In Figure 4 are listed the five centers that produced the largest number of articles in Archivos de Bronconeumología.

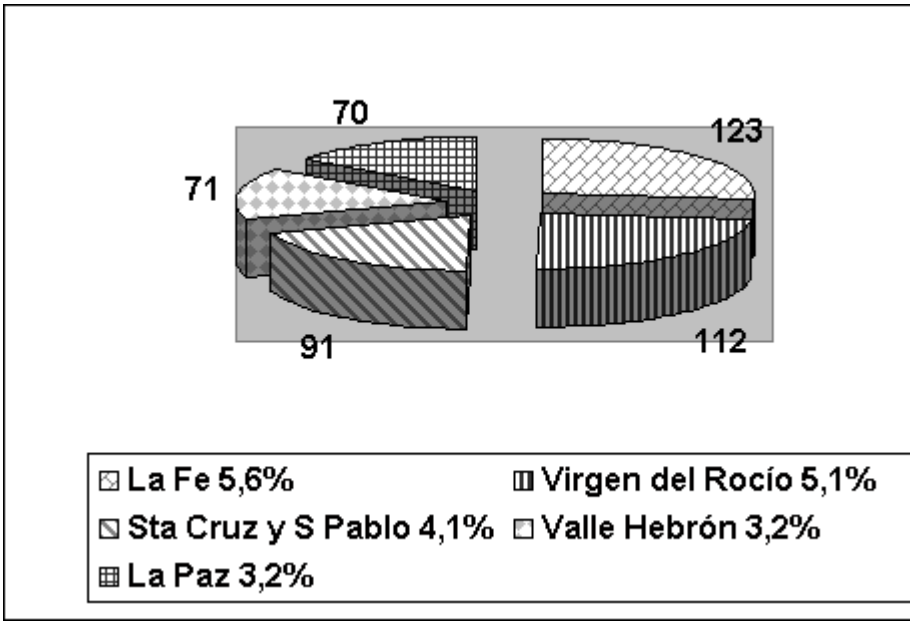

Figure 4: Representation of articles contributed by the five most productive centers

The evolution of the types of document per year of publication is shown in Figure 5.

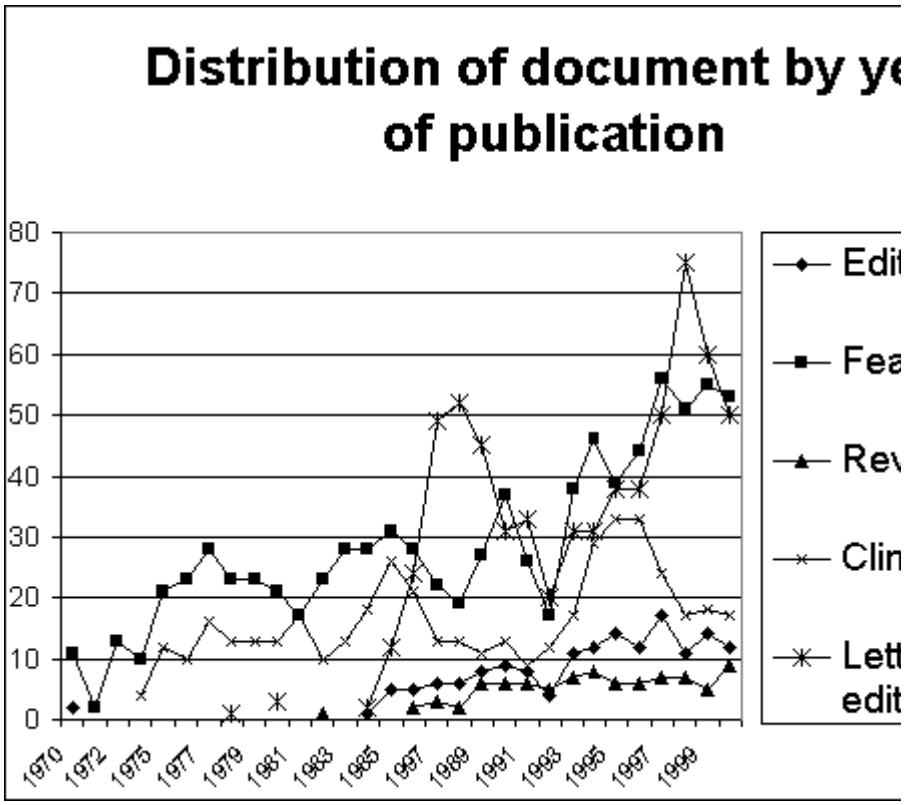

Figure 5: Evolution of the document types by year of publication

Examination of the chronological evolution of the number of articles per province disclosed an overall increment in the number of published articles. With respect to the evolution of articles by the specialties of the authors, there was also an increase in production over the 30-year study period (Table 1).

Table 1: Evolution of articles by decades in relation to the specialty of the first author

Specialty	**1970 – 79**	**1980 – 89**	**1990 –99**
Pneumology	137 (60.9%)	333 (53.4%)	793 (66.2%)
Thoracic surgery 27 (12%) 96 (15.4%) 177 (14.8%)			
Internal medicine 18 (8%) 79 (12.7%) 64 (5.3%)			
Allergology 4 (1.8%) 2 (0.3%) 11 (0.9%)			
Radiology 2 (0.9%) 23 (3.7%) 28 (2.3%)			
Pathology 3 (1.3%) 20 (3.2%) 17 (1.4%)			
Epidemiology		2 (0.3%)	3 (0.3%)
Primary care		2 (0.3%)	4 (0.3%)
Pediatric pneumology		1 (0.2%)	14 (1.2%)
Intensive care	8 (3.6%)	9 (1.4%)	12 (1%)
Pediatrics		1 (0.2%)	2 (0.2%)
Neurology	1 (0.4%)		

Hematology		1 (0.2%)	
Anesthesiology		1 (0.2%)	6 (0.5%)
Radiotherapy	1 (0.4%)	1 (0.2%)	
Prevention medicine		1 (0.2%)	5 (0.4%)
General surgery	2 (0.9%)	7 (1.1%)	7 (0.6%)
Microbiology	1 (0.4%)	4 (0.6%)	10 (0.8%)
Imnmunology	1 (0.4%)	1 (0.2%)	1 (0.1%)
Medical oncology		4 (0.6%)	3 (0.3%)
Pharmacy		3(0.5%)	3 (0.3%)
Cardiology		3 (0.5%)	1 (01%)
Digestive system	1 (0.4%)	2 (0.3%)	
Psychiatry		1 (0.2%)	1 (0.1%)
ENT			2 (0.2%)
Radiological oncology		2 (0.3%)	
Nephrology	1 (0.4%)		1 (0.1%)
Endocrinology			1 (0.1%)
Rehabilitation		1 (0.2%)	2 (0.2%)
Traumatology	1 (0.4%)		
Cardiovascular surgery		1 (0.2%)	
Geriatrics		1 (0.2%)	
Nursing			1 (0.1%)
Other	17 (7.6%)	22 (3.5%)	28 (2.3%)
Total	**225 (100%)**	**624 (100%)**	**1197 (100%)**

ENT: Ear, nose and throat specialist.

It must be remembered that an article may be signed by authors with different specialties, and that there were 17 articles in which the authors' specialty was not indicated in the 1970s, 22 in the 1980s, and 28 in the 1990s.

Evolution of bibliometric indicators:

The productivity indicators of the journal were grouped by decades for purposes of comparison (Table 2).

Table 2: Indicators of production

Year	Productivity index	Cooperation index	References/ Article	Time to acceptance	Standard deviation	Time to publication	St de
70-79	1.27±0.42	4.42±1.9	17.0±11.3				
80-89	1.76±0.19 #	4.47±2$	16.0±15.1	133.12	92.49	151.02	
90-99	2.06±0.14 *	4.07±2.1	19±21.2+	92.71	76.98+	175.73	
Total	1.71±0.41	4.23±2.0	17.8±18.6	103.69	83.4	169.02	

*: 1990-99 versus 1970-79 (p<0.001). #: 1980-89 versus 1970-79 (p<0,01). $: 1980-89 versus -1990-99 (p<0.001).

+: 1990-99 versus 1980-89 (p<0.001)

The mean productivity index increased in the 1980s (1.76 ± 0.19) with respect to the 1970s (1.27 ± 0.42; p< 0.01). In the 1990s (2.06 ± 0.14), the productivity index was clearly higher than in the 1970s (p<0.001). The productivity index was higher in 1990-99 than 1980-89, but the difference was not significant. The mean cooperation index compared by decades revealed significant differences between the 1980s and 1990s (p<0.001). In the 1990s, the cooperation index decreased, meaning that there were fewer authors per article. The time to acceptance and time to publication were first used in the journal in 1984. Consequently, only the means of the 1980s and 1990s can be compared. Comparison of these times for the 1980s and 1990s revealed a significantly shorter time to acceptance in the 1990s than in the 1980s (p<0.001), as well as a shorter time to publication in the 1990s than in the 1980s (p<0.001). The index of references per article showed a significant difference between the mean number of references per article in the 1990s and 1980s (p<0.001).

The circulation index was calculated from 1994, when the journal was first listed in the Index Medicus, and is currently one hundred percent. On the other hand, the index of circulating productivity remained stable, varying within a range of 2.16 in 1994 to 2.24 in 1997.

The indicators of journal consumption were calculated for every year of the study period and grouped by decades for purposes of comparison (Figure 6).

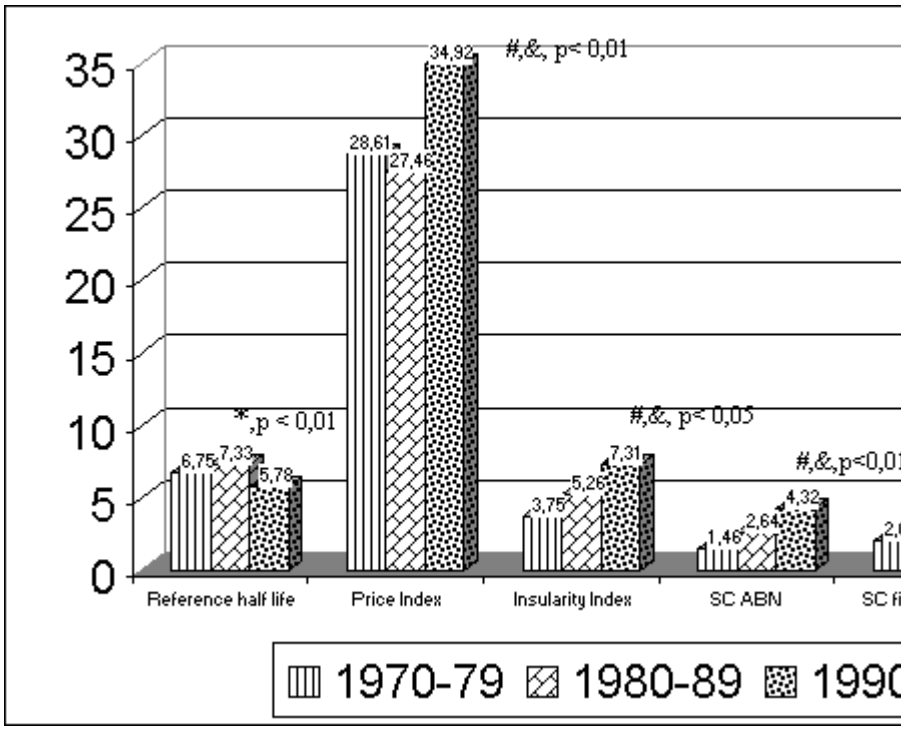

Figure 6: Evolution of consumption indicators by decade

The Price index remained more or less stable over the 30-year study period. The percentage of Spanish references corresponding to three journals (Medicina Clínica (Barcelona), Archivos de Bronconeumología, and the Revista Clínica Española) was about 9% in recent years, having increased in the last decade. On the other hand, self citations of the journal, first author, and group have increased over the study period.

The journals with the greatest impact factor were the sources of most of the references cited in Archivos de Bronconeumología. The five journals most often cited in the references of the Archivos were the American Journal of Respiratory and Critical Care Medicine, with 3446 references (8.63%), Chest,

with 2883 references (7.22%), Archivos de Bronconeumología, with 1642 references (4.11%), Thorax, with 1442 references (3.61%), and the New England Journal of Medicine, with 1023 references (2.56%).

The evolution of the consumption indicators, grouped by decades, showed significant differences in the reference half-life between the 1980s and 1990s ($p<0.01$). The Price index showed significant differences for the 1990s versus the 1980s ($p<0.01$) and 1970s ($p<0.001$). The insularity index also showed significant differences for the 1990s versus the 1980s ($p<0.05$) and 1970s ($p<0.001$). Self citations in the journal showed the same differences as the insularity index (1990s versus 1970s, $p<0.001$; 1990s versus 1980s, $p<0.01$). The number of self citations by the first author and group also differed significantly between the 1990s and 1970s ($p<0.01$, $p<0.05$, respectively).

The estimated impact of Archivos de Bronconeumología was analyzed using the Science Citation Index, 1995 to 2000, inclusively. The estimated impact factor varied from 0,097 to 0,109 in 2000 (0,081 in 1998, 0,096 in 1999) and weighted estimated impact factor varied from 0,021 in 1997 to 0,020 in 2000 (0,016 in 1998, 0,018 in 1999). The weighted estimated impact factor was calculated by dividing the impact factor of Archivos de Bronconeumología by the highest impact factor among the journals in the respiratory system section of Journal Citation Reports.

The more productivity topics were respiratory failure and sleep disturbances, and oncology.

The website of Archivos de Bronconeumología was analyzed using the URL **http://www.doyma.es**, and we found that the journal have 6,500 daily visits and 27,000 pages per month, the distribution of this visits were 35% from Spanish people, 50% from Latin American people and 15% from others.

Discussion

In the first place, we are aware that our work has a series of methodological limitations from a general point of view, such as the source of data acquisition and the bibliometric indicators[2,9-12].

Our study showed that scientific output in the field of respiratory research, as reflected by the articles published in the journal Archivos de Bronconeumología, has increased notably. The productivity index rose from 1.11 in 1970 to more than 2 in 2000. We know that the field of respiratory science occupies an intermediate position in the production of scientific research, although it is difficult to compare our field with other disciplines because of differences in size and, in some cases, the lack of previous data. Scientific output in the field of respiratory science in Europe is evolving favorably. This field ranked lower than the field of biomedicine between 1986 and 1989, then the two fields approached each other between 1990 and 1993, and then separated again in 1995[13]. Camí et al.[14] found that from 1986 to 1989 and from 1990 to 1993, the fields that experienced the greatest growth in scientific output were internal/general medicine and cancer/oncology, followed by gastroenterology/hepatology, genetics/heredity, immunology and cardiovascular medicine. The fields that grew least were microbiology, biochemistry/biology, and physiology. The same authors also remarked that in all the fields the mean impact factor was greater from 1990 to 1993 than from 1986 to 1989.

Over time, there was a slight increase in the number of original papers per year in the 1990s, to about 50 articles per year recently. The total number of original articles in the 1990s was practically twice as high as in the 1980s. The number of letters to the editor also increased in the 1990s to about 50 or 60 letters per year. The same trend was observed in Medicina Clínica, although

this journal is published weekly and thus has more articles. Original papers and letters were the most abundant documents, remaining stable in recent years[14,15]. In a recent article in which scientific output in the field of cardiovascular medicine was analyzed, the production of articles by type of document also showed a predominance of original papers, letters, and reviews[16].

The distribution of articles by the province of the first author showed considerable dispersion. It is easy to identify production nuclei because 48% of publications came from three provinces: Barcelona, Madrid, and Valencia. In this sense, the field of respiratory medicine, as reflected by the articles published in our journal, does not differ from scientific activity in other disciplines. In an article on the evolution of Spanish scientific output in the life sciences that grouped articles by autonomic communities, Madrid and Catalonia were responsible for almost 60% of all Spanish production, with Andalusia in third place. The other communities usually have less scientific output[14].

However, when the scientific output of different autonomic communities is adjusted for parameters like budgets for research and development, or the population of each autonomic community, the ranking of scientific output differed from the ranking obtained with absolute numbers[16]. It has been demonstrated that scientific output adjusted for gross regional product and population diluted the effects of absolute size, bringing provinces like Navarre, Cantabria, and Murcia into prominence. When scientific output was adjusted for the number of inhabitants of the province, Salamanca, Granada, and La Coruña acquired prominence[14]. However, in most studies the leading autonomic communities in absolute term are the same as those cited in this study[11,15,16,17-30], although they vary somewhat when data are adjusted for other relevant factors.

Another important aspect is the field of scientific research in relation to specific institutions. Large hospital complexes and universities are the main producers, although there has been considerable growth in every sector in hospital centers, which have seen more and faster growth, even in basic research[14]. It should be noted that with regard to the analysis of scientific output by centers, one must be cautious in establishing comparisons between centers because the list of centers does not necessarily reflect the quality of the research groups working at the centers. Therefore, as a general premise, larger centers or institutions with more resources would be expected to have more scientific output since quantity is fairly directly related to available resources.

Spain occupies a relatively high position with respect to scientific output in specific fields, like mathematics, engineering, chemistry, and physics[31]. The country ranked from ninth to eleventh place in the life sciences until 1995[32], and it continues to advance overall and in specific areas[33].

In our study, the cooperation index did not vary substantially over the three-decade study period, remaining at a mean of about 4 authors per article. An interesting finding is that in the 1990s there was a small, statistically significant decrease with respect to the 1980s, which apparently contradicts findings for other journals. In effect, the mean number of authors per article seems to have stabilized. In an article on the scientific output of Spanish primary care professionals through a MED-LINE (1990-1997) search, the mean number of authors per document was 4.6, with no significant differences over the 7-year study period[34]. In other areas of science, like psychiatry, gastroenterology, rheumatology, and cardiovascular medicine, the cooperation index increased in earlier decades, but has stabilized in recent years[16,18,23,35,36]. The same occurs in journals like The New England Journal of Medicine, where the number of authors has hardly changed since 1984[37,38]. Even in an analysis of the evolution of scientific output in the area of respiratory system research, there were no differences in the mean number

of authors per document (5.2) in the entire study period (1987–1998)[39]. Since the complexity of science has not varied in recent years, perhaps the guidelines for scientific authorship are being respected more, among other reasons, due to the decisive action of editorial committees. Our results suggest that the editors of the Archivos de Bronconeumología are acting effectively to limit the number of authors.

The time to acceptance and time to publication in the journal articles was made in 1984. Our results demonstrate that, in general, the number of days required for the acceptance and publication of a manuscript has tended to decrease, indicating more editorial agility. This is surely due to the introduction of corrective measures and editorial zeal, which keep manuscripts from accumulating[40]. The importance of these publishing intervals should be emphasized because they help to establish the priorities of discovery in the case of disputes, making it possible to know how recent a study is[41]. The mean time to publication of Medicina Clínica does not differ too much from our results, for the same period of time[42].

In a study by López Piñero and Terrada[43] on the consumption of national and foreign information in Spanish medical journals in 1990, the mean number of references in 24 source journals ranged from 10.19 (Atención Primaria) to 36.09 (Inmunología), with a mean of 20.91 references per study for the overall group. The mean number of references per article in Medicina Clínica and the Revista Clínica Española evolved from 21.1 and 23.95, respectively, in 1975 to 24.36 and 19.09 in 198444. Likewise, in the same period the evolution in the mean number of references per article in The New England Journal of Medicine and The Lancet was, respectively, from 20.26 and 15.41 in 1975 to 25.24 and 19.03 in 1984[44]. In the study by Solar Álvarez et al.[11], in which the bibliometric indicators of the research on epidemiology and healthcare published in Spain between 1988 and 1992 were analyzed, the mean number of references per article was 24.4.

The index of references per article found did not differ from that found in other scientific disciplines. It is very likely that the index of references per article will remain the same in the coming years, due to the influence of editorial committees, which systematically advise authors to restrict the reference section of any manuscript.

The bibliometric indicators of circulation are among the most trustworthy for analysis[3]. Circulation indicators have a solid foundation and are not affected by problems like the debate about the role of citations in scientific communications. In addition, there are several databases available that do not have the errors and limitations of the Science Citation Index and can be compared with each other[3]. However, the inclusion of a journal in an international database does not mean that all its articles are compiled in that database. In most cases, the publishers of international compilations select the articles that, in their opinion, will be of interest to their subscribers[3,7]. In this study, the index of circulation of Archivos de Bronconeumología since 1995 has been 1.0. That means that all the documents published in our journal have been included in the Pub-Med database. The index of circulating productivity has remained stable for the last seven years.

Bibliometric consumption indicators were used to analyze references. The evolution of the main indicators of obsolescence of Archivos de Bronconeumología showed no definite tendency in our study. In a study by Piñero and Terrada[43], in which the consumption of national and foreign scientific information by Spanish medical journals was analyzed, they found that the half-life of references for the overall group of source journals coincided fully with the usual half-life for international journals. This placed the consumption of information by medical journals in an intermediate position between the relatively low values seen in highly specialized disciplines like physics and engineering, and the relatively high values seen in mathematics and geology. They found that the three Spanish journals with

the shortest half-life were Atención Primaria, with 4.75 years, Inmunología, with 5.15 years, and Medicina Clínica, with 5.16 years. The evolution of Medicina Clínica in terms of reference half-life shows no definite tendency[42], which is the same result obtained from a bibliometric analysis of epidemiology and public health journals made for 1988 to 1992, which revealed no differences in the reference half-life and a Price index of 36.5%[11].

The overall insularity index of Spanish medical journals was 13.55%. The space dedicated to references in journal articles varies proportionally with the discipline. In this sense, the insularity index of Atención Primaria is 45.74%, which is consistent with the content of the journal, but much higher than that of Inmunología (4.03%) or Endocrinology (5.19%). The low degree of insularity that an overall index of 13.55% represents is consistent with a secondary level of scientific output, as is prevalent in Spain[43]. In the Revista Española de Enfermedades Digestivas, the insularity index found by the authors was 8.7% for 1998, with an important decrease from 1990[35]. In general, the insularity index of Spanish medical journals is 7% to 14%, which reflects the low insularity of Spanish authors. In Archivos de Bronconeumología, we observed a progressive, and statistically significant, increase in the insularity index from the 1970s to the 1990s.

As far as self citations are concerned, there was a statistically significant increase in the mean number of self citations in Archivos de Bronconeumología (4.3% in 1990-99), as well as citations by the first author (7% in the 1990s) and the research group (9.7% in the 1990s), from the 1970s to the 1990s. The low self citation index of our journal could be due to the number of occasional authors[5]. However, the above findings indicate a favorable evolution of Archivos de Bronconeumología, since a rise in the self citation index is the main pathway to improving the impact factor[45-47].

The references in Archivos de Bronconeumología center on a few journals. Five publications are the source of somewhat more than 25% of all journal references, the most frequently cited journals being specialized foreign journals and Archivos de Bronconeumología[40] It also should be noted that among the journals cited most frequently in the references of Archivos de Bronconeumología are Medicina Clínica and the Revista Clínica Española, with 790 and 360 references, respectively.

Among the bibliometric indicators, the most widely used and important are the indicators that refer to the impact of scientific activity. Of these indicators, the impact factor is predominant[12]. In this section, one of the most interesting results of our study was the historical description of the estimated impact factor of Archivos de Bronconeumología, which was 0.107 in 1997, 0.089 in 1998, 0.105 in 1999, and 0.119 in 2000. In addition, the citation pattern was characterized by the dispersion of source journals, with scant weight of the publications in the field of respiratory system listed in the Journal Citation Report (JCR), a strong predominance of citations by Spanish authors, including self citations, particularly to the following topics: tuberculosis, respiratory infections, and chronic obstructive pulmonary disease[1].

Health related websites are frequently accessed on the internet. Many adults regularly go on line for information about health care, however, we still have to learn to read the signs of quality relevant to our needs[48]. Archivos de Bronconeumología have recently available on the internet and in this time have a good number of daily visits and this can be considered usage indexes of the given web site, another problem is that visit counters were set to register every visit, instead of every distinct visitor[49]. On the other hand, quantification of links to the websites depends on the power of the search engine we employ, probably, it is necessary, to combine the databases from at least five large search engines to cover the most of the web[49]. Brunstein mentioned the possibility that the grownth of internet and on-line journal may spell the end of the impact factor or perhaps lead to its definition, Garfield

said that a new type of impact factor would we invented[46]. The citation analysis of biomedical journals has been a classic tool in the assessing their relative quality, similarly medical web resources could be ranked by a "webcite index" or " web impact factor"[49,50] . Other authors proposed another kind of quality control system like link based calculation or account the users opinion, or electronic publishing system[49,50]. In this moment is very soon to calculate some web metric indexes for Archivos de Bronconeumología because it is recently available on the internet.

Respiratory system in Spain shows an acceptable improvement last decade, it must be emphasized when looking at Spanish productivity in biomedical publication in the 1994 – 2000 period, that the respiratory system is currently among the clinical discipline with over 1000 citable document in Spain according to a superb recent analysis[51]. The reason of this improvement could be both by the increase of the productivity and more number of research groups.

By way of conclusion, we found that there was a notable increase in scientific output in the field of respiratory research between the 1970s and 1990s in Spain, as indicated by the publications in the journal Archivos de Bronconeumología, with consolidation of the number of articles. The cooperation index remained stable throughout the study period, and the times to acceptance and publication of the journal , and the index of references per article, stabilized. Since 1994, the journal has reached its maximum circulation index. The stabilization of the obsolescence indices indicates that the journal is in an intermediate situation between disciplines that are experiencing rapid scientific renovation and disciplines that are becoming obsolescent more rapidly. The self citation indices, although low, have increased considerably in the last three decades. Archivos de Bronconeumología has a discrete estimated impact factor that has remained stable in recent years.

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Received 18/October/2003
Accepted 4/February/2004