

# Bibliometric analysis on retinoblastoma literatures in PubMed during 1929 to 2010

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## Abstract

• **AIM:** To determine the growth rule and tendency of retinoblastoma (Rb) literature, and to provide the basis for research of diagnosis, treatment and on Rb.

• **METHODS:** Bibliometric analyses were carried out on Rb literatures which contain the descriptors of Rb in their titles or texts from 1929 to 2010 in PubMed database (www.ncbi.nlm.nih.gov/pubmed). The biomedical journals referring to Rb by using bibliometric indicators were calculated. The principal bibliometric indicators, *i.e.*, Price's and Bradford's laws to the increase or distribution of scientific literature, the participation index of languages and the journals were applied. By means of manual coding, Rb documents were classified according to documents studied and to statistical analysis.

• **RESULTS:** During 1929-2010, there were 16162 literatures in the PubMed database including the word Rb. According to the literature type, it includes Review ( $n=2026$ ), Randomized Controlled Trial ( $n=7$ ), Practice guideline ( $n=3$ ), meta-analysis ( $n=4$ ), letter ( $n=215$ ), editorial ( $n=98$ ), clinical trial ( $n=115$ ) and others ( $n=13694$ ). By the statistical analysis, its equation is near power index ( $\chi^2=3.0477$ ,  $\chi^2_{2,6088}$ ,  $R^2=$

0.9666). From 1929 to 2010, Rb literatures in English were primarily dominant (90.71%) and the amount of the literature in Chinese ranked the fourth (1.37%). By searching PubMed, 1420 (8.8%) literatures covered were from 41 of 48 ophthalmological, and 406 (2.5%) literatures from 44 of 86 pediatrics journals that correlated with retinoblastoma (SCI-indexed). The data showed that the literatures of Rb were gradually increasing year by year and were approximate near power index during 1929-2010, and the document publishes published mainly in ophthalmological journals, and in English (90.71%), and showing that the study on Rb is a popular subject in the last half century.

• **CONCLUSION:** The literatures of Rb are gradually increasing, mainly English in ophthalmologic journals.

• **KEYWORDS:** bibliometric analysis; biomedical publications; retinoblastoma; journal; literature

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## INTRODUCTION

Retinoblastoma (Rb) is the most common eye cancer in children and it can be inherited. The therapeutic goal for Rb is early detection to maximize the visual outcome and the quality of life of the affected child. The study of scientific literature growth law and its application are very important in the area of bibliometrics. Factors affecting literature are complex, and in addition to inherent laws of the subject, and there are disciplinary contexts<sup>[1-3]</sup>. Statistics of Rb literature growth carried out in a specific period and drawing of the correspondent growth curve are of primary importance in evaluating the subject's stage and forecasting its future development<sup>[2-5]</sup>.

The Internet has rapidly become a global publishing platform, and journals covering a wide range of subject areas are now available. Information science is no exception, and we now find a significant portion of Rb literature appearing in PubMed since 1929<sup>[6]</sup>. This article presents some bibliometric data on the currently available

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journals in this field and the articles appearing in them<sup>[7-10]</sup>. PubMed comprises more than 19 million citations for biomedical articles from MEDLINE and life science journals. Citations may include links to full-text articles from PubMed Central or publisher web sites. PubMed database platform can be used to study Rb related literature for bibliometric analysis, so as to determine the increase regularity of Rb literature and its trend, and to provide the basis for related researches on ophthalmology, pediatrics and oncology.

### MATERIALS AND METHODS

**Database** PubMed database (www.ncbi.nlm.nih.gov/pubmed) was used to select literatures that contained the descriptors of Rb in their titles or texts from 1929 to 2010. By bibliometric indicators of Rb, the biomedical journals referring to Rb were calculated. The principal bibliometric indicators, *i.e.*, Price's and Bradford's laws to the increase or distribution of scientific literature, the participation index of languages and the journals were applied. By means of manual coding, documents were classified according to documents studied and to the statistical analysis.

**Methods** We logged on the PubMed database (http://www.ncbi.nlm.nih.gov/pubmed) and searched literatures including "retinoblastoma" from 1929/01/01 to 2010/12/31, *e.g.*, search ("1" [Publication Date]: "2010/12/31" [Publication Date]) AND (retinoblastoma), language distribution of the literature and amount of the literatures published mainly in periodicals of ophthalmology and pediatrics. Based on this, literatures of the following period, *i.e.*, 1929/01/01-1945/12/31, 1946/01/01-1950/12/31, 2001/01/01-2005/12/31, 2006/01/01-2010/12/31, and literatures published in Chinese were retrieved. Literatures published in 2010 had not been completely covered in PubMed database because of time lag, and thus the amount of retrieved literature might be lower than that of actual one in the time of searching (Dec.31.2010).

### RESULTS

**Year Distribution of Retinoblastoma Literatures** Before 1945, there were 5 Rb documents in PubMed database (2 in 1929 and 3 in 1944). From 1945, the Rb literatures increased with the year and by the end of 2010 the literature reached up to 16162, including review ( $n=2026$ ), randomized controlled trial ( $n=7$ ), practice guideline ( $n=3$ ), meta-analysis ( $n=4$ ), letter ( $n=215$ ), editorial ( $n=98$ ), clinical trial ( $n=115$ ) and others ( $n=13694$ ). The rise of Rb literatures in every 5 years was shown in Figure 1, *i.e.*, 1929-1945, 5; 1946-1950, 23; 1951-1955, 42; 1956-1960, 64; 1961-1965, 164; 1966-1970, 302; 1971-1975, 403; 1976-1980, 460; 1981-1985, 666; 1986-1990, 1070; 1991-1995, 2232; 1996-2000, 3943; 2001-2005, 3734;

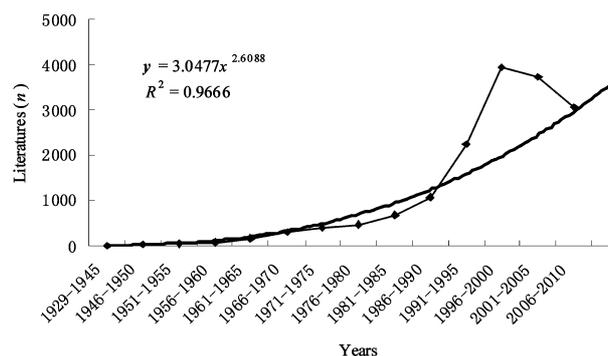


Figure 1 Rb literatures in every 5 years from 1929 to 2010

Table 1 Language distribution of Rb literatures in PubMed from 1929 to 2010 [n (%)]

Languages	Rb	PubMed literatures
English	14708 (90.71)	16365497 (80.48)
French	339 (2.09)	651295 (3.20)
Japanese	226 (1.39)	381577 (1.88)
Chinese	222 (1.37)	191680 (0.94)
German	214 (1.32)	782313 (3.85)
Russian	123 (0.76)	647606 (3.18)
Spanish	87 (0.54)	271736 (1.34)
Italian	38 (0.23)	288785 (1.42)
Others	257 (1.59)	753515(3.70)
Total	16162 (100)	20334004(100)

2006-2010, 3106; 1929-2010, 16162. It is revealed that there are three stages of yearly cumulative amount of the literatures. The amount of literatures before 1960 was very low, the literature increased slowly from 1961 to 1985, and rose quickly from 1986 to 2010 (Figure 1). By the statistical analysis, its equation is near power index ( $y=3.0477x^{2.6088}$ ,  $R^2=0.9666$ ). According to the calculation of equation, it is predicted that there will be 4220 Rb literatures from 2011 to 2015, and 4943 from 2016 to 2020.

**Language and Distributions** Fifty-seven kinds of languages are listed in the PubMed database. Rb literatures in English were primarily dominant before 2010 (14708/16162, 90.71%), and the amount of the literature in Chinese ranked the fourth place (222/16162, 1.37%). The first 8 languages accounted for 98.41%, while the other forty-nine languages occupied 1.59% (Table 1).

**Journal Distribution** By the end of 2010, more than 5 200 kinds of biomedical journals had been covered in PubMed, which involves 57 languages. Fifty percent of them were from USA and 90% were written in English, and English abstract accounted for 79%. There were 48 kinds of ophthalmological journals and 86 pediatric journals indexed in SCI database (Thomson-Reuters in 2010 for SCI indexed), which was covered by PubMed. By searching PubMed database, the literatures of Rb were found from

**Table 2 Rb literatures published in ophthalmologic and pediatric journals in PubMed (1929-2010)**

ISSN	Ophthalmologic Journals (n=41)	Literatures (n)	Impact Factor (IF)	ISSN	Pediatrics Journals (n=44)	Literatures (n)	Impact Factor (IF)
0003-9950	<i>Arch Ophthalmol-Chic</i>	178	3.859	0191-3913	<i>J Pediat Ophth Strab</i>	106	0.627
0002-9394	<i>Am J Ophthalmol</i>	166	3.833	1545-5009	<i>Pediatr Blood Cancer</i>	51	2.134
0146-0404	<i>Invest Ophth Vis Sci</i>	147	3.431	1077-4114	<i>J Pediat Hematol Onc</i>	33	1.022
0007-1161	<i>Br J Ophthalmol</i>	129	2.917	1091-8531	<i>J Aapos</i>	26	1.07
0161-6420	<i>Ophthalmology</i>	108	5.491	0888-0018	<i>Pediatr Hemat Oncol</i>	24	0.794
0191-3913	<i>J Pediat Ophth Strab</i>	106	0.627	0031-4005	<i>Pediatrics</i>	13	4.687
0023-2165	<i>Klin Monatsbl Augenh</i>	76	0.542	0003-9888	<i>Arch Dis Child</i>	13	2.657
0030-3755	<i>Ophthalmologica</i>	63	1.028	0301-0449	<i>Pediatr Radiol</i>	13	1.186
0275-004X	<i>Retina-J Ret Vit Dis</i>	45	2.932	0019-6061	<i>Indian Pediatr</i>	9	0.962
1381-6810	<i>Ophthalmic Genet</i>	43	1.406	0090-4481	<i>Pediatr Ann</i>	9	0.368
0181-5512	<i>J Fr Ophthalmol</i>	36	0.510	0022-3476	<i>J Pediatr</i>	8	4.092
0014-4835	<i>Exp Eye Res</i>	33	2.538	0009-9228	<i>Clin Pediatr</i>	8	0.977
0021-5155	<i>Jpn J Ophthalmol</i>	29	1.272	0929-693X	<i>Ardn Pediatric</i>	8	0.406
0039-6257	<i>Surv Ophthalmol</i>	29	2.347	0031-3955	<i>Pediatr Clin N Am</i>	7	1.587
1091-8531	<i>J Aapos</i>	26	1.070	0300-8630	<i>Klin Padiatr</i>	6	1.862
0271-3683	<i>Curr Eye Res</i>	23	1.513	0026-9298	<i>Monatsschr Kinderh</i>	5	0.308
0008-4182	<i>Can J Ophthalmol</i>	19	1.443	1072-4710	<i>Arch Pediat Adol Med</i>	4	4.726
1090-0535	<i>Mol Vis</i>	19	2.541	0041-4301	<i>Turkish J Pediatr</i>	4	0.333
0740-9303	<i>Ophthal Plast Recons</i>	16	0.690	0022-3468	<i>J Pediatr Surg</i>	4	1.43
0950-222X	<i>Eye</i>	15	1.974	0256-7040	<i>Child Nerv Syst</i>	4	1.214
0721-832X	<i>Graef Arch Clin Exp</i>	15	2.102	0269-5022	<i>Paediatr Perinat Epidemiol</i>	4	1.797
1442-6404	<i>Clin Exp Ophthalmol</i>	13	1.755	0305-1862	<i>Child Care Hlth Dev</i>	4	1.137
0030-3747	<i>Ophthal Res</i>	13	1.288	0031-3998	<i>Pediatr Res</i>	3	2.607
1120-6721	<i>Eur J Ophthalmol</i>	11	0.887	0019-5456	<i>Indian J Pediatr</i>	3	0.539
1040-8738	<i>Curr Opin Ophthalmol</i>	10	2.490	1040-8703	<i>Curr Opin Pediatr</i>	3	2.215
0012-4486	<i>Doc Ophthalmol</i>	9	1.837	0272-4936	<i>Ann Trop Paediatr</i>	3	0.895
0941-293X	<i>Ophthalmologe</i>	8	1.000	0012-1622	<i>Dev Med Child Neurol</i>	3	3.019
1542-8877	<i>Ophthal Surg Lasers Imaging</i>	6	0.615	0191-9601	<i>Pediatr Rev</i>	3	0.840
0042-6989	<i>Vis Res</i>	5	2.288	0165-5876	<i>Int J Pediatr Otorhi</i>	3	1.148
0927-3948	<i>Ocul Immunol Inflamm</i>	5	0.718	0179-0358	<i>Pediatr Surg Int</i>	3	0.945
0928-6586	<i>Ophthal Epidemiol</i>	4	1.927	1016-2291	<i>Pediatr Neurosurg</i>	3	0.967
1080-7683	<i>J Ocul Pharmacol Ther</i>	3	1.457	0803-5253	<i>Acta Paediatr</i>	2	1.768
1755-375X	<i>Acta Ophthalmol</i>	2	2.441	0340-6199	<i>Eur J Pediatr</i>	2	1.634
0886-3350	<i>J Cataract Refr Surg</i>	2	2.745	1328-8067	<i>Pediatr Int</i>	2	0.707
0277-3740	<i>Cornea</i>	2	2.106	0891-3668	<i>Pediatr Infect Dis J</i>	1	2.854
1040-5488	<i>Optometry Vis Sci</i>	1	1.530	0931-041X	<i>Pediatr Nephrol</i>	1	2.425
0275-5408	<i>Ophthal Physl Opt</i>	1	1.148	0334-018X	<i>J Pediatr Endocr Met</i>	1	0.738
0816-4622	<i>Clin Exp Optom</i>	1	1.236	1034-4810	<i>J Paediatr Child Health</i>	1	1.138
0952-5238	<i>Vis Neurosci</i>	1	1.273	0142-6338	<i>J Trop Pediatrics</i>	1	1.224
1530-4086	<i>Ann Ophthalmol (Skokie)</i>	1	0.157	0378-3782	<i>Early Hum Dev</i>	1	2.122
1350-9462	<i>Prog Retin Eye Res</i>	1	7.755	1359-2998	<i>Arch Dis Child-Fetal</i>	1	2.493
				1155-5645	<i>Pediatr Anesth</i>	1	2.149
				1093-5266	<i>Pediatr Devel Pathol</i>	1	1.163
				0164-1263	<i>Pediatr Dent</i>	1	-

1929 to 2010 (Table 2). The results showed that Rb literatures published in ophthalmologic journals (41 of 48 journals included a total of 1420 literatures), and in the pediatric journals (44 of 86 journals included a total of 406 literatures) and the number of documents had no correlation with impact factors (IF) of the journal included in PubMed.

#### DISCUSSION

From the above research, it is clear that the amount of Rb documents presents the tendency of slow increasing and reaches its highest from 1986 to 2005, revealing that Rb

researches have been in popular stage over the last half century. No large fluctuation appeared in the amount. During 2006-2010, the PubMed literature database was incomplete for including the literatures, so there are a relatively small number of Rb documents. Simultaneously, the amounts of retinoblastoma literatures are consistent with Rb progress and development in the world. Rb documents in English hold a leading part (90.71%) by the end of 2010 and the following is in French, Japanese, Chinese, German, Russian, Spanish etc. The documents in Chinese only

accounted for 1.37%, which resulted from fewer Chinese journals covered by PubMed (by the end of 2010). Among the 111 Chinese journals, 93 were edited and published by China Continent, 13 by Taiwan province, 4 by Hong Kong and 1 by Macao Special Administrative Region. Research indicated that the Rb research was still a hotspot in the international society. Rb document was covered by PubMed from 1929, rising obviously after 1986, but its equation is near power index ( $y=3.0477x^{2.6088}$ ,  $R^2=0.9666$ ). The research literatures on Rb were mainly published in ophthalmological and related pediatric periodicals. Rb is the most common eye cancer in children and it can be inherited. Despite being the most common eye cancer in children, Rb is quite rare and occurs in approximately 0.5 in every 100 000 births. Fortunately, the survival rate for affected children is 96%<sup>[3-5, 11, 12]</sup>.

Bibliometrics adopts the quantitative approach to study all kinds of documents and mathematic laws in their exchange in order to forecast the discipline development and ascertain its developing trend. Quantitative analysis can be used to aim at the study of discipline developing trend, document quantitative change law, and scientific management of information. It is important to analyze and forecast various characteristics of discipline documents and their change law based on the statistics, which is closely related to the research subject. Discipline documents increase drastically during some period and are relatively stable in some other period<sup>[11-13]</sup>. Some scientific literatures increase in exponent, some in logistic curves, some in linearity and some in other patterns. Carrying out quantitative analysis on the countries and languages that the documents originate from may reveal the status and change tendencies of the subject research between countries. Since the exponential and logic growth laws of scientific literatures were put forward, many experts and scholars have carried out the research and exploration on them widely and thoroughly. Some approaches in defining the parameters have been improved, exponential curve and the logistic curve have been modified by the use of adding parameters or new means, and new mathematic model in describing the document growth law has been suggested. Great achievements have been made. Conducting the analysis on information and contents of Rb document can give guidance to the research and deepen our professional knowledge. Quantitative analysis can also be carried out from the aspect of document content or its field to understand its research hotspots and progress<sup>[2, 14]</sup>. Research on the laws of growth, ageing and scattering of the published papers has been regarded as one of the important bases of scientific and technological progress, which are the basic laws of document development<sup>[8-10, 13-15]</sup>. In the field of

biomedicine, Rb bibliometric study can be conducted from quantitative aspect. Through statistic analysis on yearly Rb documents, their growing regularity can be found, and the past and current situation of studies can be explored, and its developing trend can be forecasted. Document increase is a complicated process. Our studies show that scientific literatures increase with time, but they increase in different speed and degrees. Negative grow indicates that this subject research is given less importance to in the social progress. Scientific literature increases not only according to the development law of itself, but it is restrained by various social conditions. In addition, the scientific literature increase is also influenced by media technology, publishing technology, electronic computer, modern information technology and the network development, etc; and therefore it presents a random process and makes the document increase in various patterns<sup>[16-18]</sup>.

The amount of scientific literature has a tendency of increase in pace with scientific knowledge, and their growth laws also share some similarities to a large degree. Changes of scientific literature increase can reflect technology development of some subject. The entire process and trend in the production and development of some scientific branch or technology may be of great help in selecting research project and determining technological development or technology introduction scheme. Study of scientific literature growth law is an information research conducted by scientific and informational staff, which aims at mastering developing trend of science and technology and giving theory guidance and reliable means to scientific forecast. The scientific literature growth law and scientific knowledge increase law are usually interrelated and mutually promoted. Findings of scientific literature increase law can provide a basis for the research on increase law of scientific knowledge amount. The increase law of scientific knowledge amount will in turn help deepen the cognition of document increase law. Therefore document increase law plays an important role in knowledge amount and administration and has wide application prospect<sup>[14-17]</sup>. It is the same in the study of Rb document. The document rise of Rb year by year indicates that the researchers give much importance to the subject, which is closely correlated with human beings.

Major factors affecting the increase of Rb documents are inherent developing law of the discipline. Until 1945 there are only 5 Rb documents. The Rb literatures reach 129 documents in a total of 5 years (1956-1960). During 1961-1985, the literatures increase only a few hundred articles every five years. From 1986, the amount of Rb documents reached over a thousand every 5 years, which is

closely related with the development of medical science and technology. Rb documents in Chinese are relatively few mainly because PubMed indexed few Chinese journals. The growth law of scientific literature quantity is determined by objective process of science, including environment and inherent development law of science. Science inherent development law has its own characteristics. Every discipline grows through the different stages of birth, development, maturity, *etc*. If the total amount of newly increased Rb document every year is a fixed value, it shows that there is no big breakthrough in the discipline theory and that personnels and material resources in the field needed by the society are constant. Therefore the subject is in a relatively stable environment<sup>[12-15,18-20]</sup>.

All these results are determined by Rb inherent development law of its document. Inherent law and social environment are two completely different factors affecting the Rb document increase law. It is difficult for us to effectively and correctly differentiate them even if the bibliometric index is used. Environmental factors are very complicated and whether they affect the development speed of scientific field, national politics, economy, culture and education or not is of great importance to the document increase in all subjects. It can also influence some special fields, for example, society moral concept, the transformation of biomedical pattern to bio-psychological and social medical science pattern<sup>[21-23]</sup>. All these affect Rb document increases, *e.g.*, the establishment and implementation of human gene project will produce far-reaching effects on the amounts of science document. The establishment and alteration of country's policy may influence different fields of science. A lot of researches on discipline increase law demonstrate that the increasing trend of document parallels to the national policy. Since the reform and opening up proceeds in China, every field develops in high speed, and medical science is no exception. The investment in scientific research, the number of scientific and technological staff and periodicals increased rapidly. Accordingly, science and technology papers increase quickly. It gathers the theories of preclinical medicine, clinical medicine as well as other subjects and is established based on the achievements of science and technology used in the clinical practice. At present it has already become one of the important parts in clinical medicine<sup>[24-26]</sup>.

Stable demand for Rb researchers and investment of staff and material resources may reflect the sustained stable developing trend in the future<sup>[3,16-18]</sup>. According to the increase law theory of the document and our comprehensive statistical results, international Rb document presents a linear increase, and Rb document amount in the next few

years can be estimated by use of straight line equation. The amount of newly increased document every year is relatively fixed, and is in the third stage of the subject development. Bibliometrics is widely used in all kinds of fields both at home and abroad at present, such as, measurement of core journals, research of readers, research of scientific law, analysis of talented persons, document law analysis, information retrieving system, document query optimization, and estimation and forecast of scientific trend in every field, *etc*. Bibliometrics application in medical science field increases with the time going. Especially from the trans-century, the document amount in this field has a trend of increasing significantly, but bibliometrics on literatures related to medical science accounts for a lower percentage of medical papers<sup>[1-3,6,27-29]</sup>.

There are many artificial factors that affect the document flow and it is true of Rb. At present it is still difficult to quantify documentation research. Based on several statistical laws of experience, bibliometrics is widely used. Microcosmic application of bibliometrics can favor us to determine the core document, evaluate publications and examine the utilization ratio of document, and thus it realizes scientific management of library and information<sup>[30-32]</sup>. Macroscopic application of bibliometrics has the advantages of designing information system and network economically, improving information handling efficiency, finding malpractice and defects in document service, forecasting the trend of publications, developing and perfecting the basic theories of information, *etc*. Because of the complexity and unstability of document system, to get sufficient and effective information to uncover the macroscopic law of document is difficult. Development of bibliometrics depends on the support of mathematic implements and statistical technology. Transplanting or making use of effective mathematic instruments and statistical method is an important development direction of bibliometrics<sup>[33,34]</sup>.

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