

Development of biomedical publications on ametropia research in PubMed from 1845 to 2010: a bibliometric analysis

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Foundation item: National Science Foundation of China (No. 39580683)

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Received:2010-12-02 Accepted:2011-01-15

Abstract

• **AIM:** We have carried out a bibliometric analysis on the development of ametropia literature to determine its growth rule and tendency, and to provide the basis for the problems related to ametropia research.

• **METHODS:** Literatures that contained the descriptors of ametropia in title or paper published before Nov. 10, 2010 in PubMed databases (www.ncbi.nlm.nih.gov/pubmed) were selected. As bibliometric indicators of ametropia, biomedical journals referring to ophthalmology by ISSN were calculated. The principal bibliometric indicators: Price's and Bradford's laws were applied on the increase or dispersion of scientific literature, the participation index of languages and the journals. By means of manual coding, literatures were classified according to documents study and statistical analysis.

• **RESULTS:** The literatures cited in ametropia, astigmatism, myopia and hypermetropia had accumulated to 26475, which

consists of Review($n=1560$), Randomized Controlled Trial($n=776$), Practice Guideline ($n=10$), Meta-Analysis ($n=23$), Letter ($n=1222$), Editorial ($n=328$), Clinical Trial ($n=1726$) and Others($n=20830$), and Humans($n=23073$), Animals($n=1434$) and others ($n=1968$). 1136 literatures were included in PubMed Central, 22384 in MEDLINE and 2955 in others. The ametropia literatures rose every 5 years which of the ametropia-year cumulated amount of the literatures had three periods: before 1900, slowly increasing from 1901 to 1950, rapidly rising from 1951 to 2010 (increased approximate exponentiation exponent). Sixty kinds of languages listed in PubMed databases, of which English is dominant for aborting to ametropia research documents before 2010 (77.32% , 20471/26475). The document languages of top eight account for 95.58% (English, German, French, Japanese, Russian, Italian, Spanish, Chinese), and others for 4.42% (1171/26475). The SCI database includes 48 ophthalmologic journals and the impact factor of 39 journals is ≥ 1 on Thomson-Reuters in 2010. Of 48 ophthalmologic journals, there were 14785 documents (55.85%) of ametropia, astigmatism, myopia, and hypermetropia. Others were without exception.

• **CONCLUSION:** The bibliometric analysis results show that ametropia literature are increased progressively, approximate exponentiation exponent during 1951-2010. In addition, ametropia research has become more popular since nearly half century.

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

DOI:10.3980/j.issn.2222-3959.2011.01.01

Xu CT, Li SQ, Lü YG, Pan BR. Development of biomedical publications on ametropia research in PubMed from 1845 to 2010: a bibliometric analysis. *Int J Ophthalmol* 2011;4(1):1-7

INTRODUCTION

Yes flexor optical (ametropia, nearsightedness, farsightedness and astigmatism) began to eliminate the pain of surgery for the patient. General ametropia implies

loss of consciousness and protective reflexes. The biological mechanism of the action of general flexor optical has not been well understood. Eyes flexor optical is using drugs or non-drug to all or part of the body's vision, in order to achieve the purpose, used for corrected visual acuity. The corrected visual acuity is a safety for patient's impaired vision. The first information of ametropia literature appeared in PubMed databases in 1845^[1]. The scientific literature growth of bibliometrics and application is an important subject area. The factor affecting literature is complex, in addition to the subjects inherent laws, there are disciplinary environment conditions^[3-5]. On the subject of ophthalmology at a specific period, literature growth statistics, drawing the appropriate growth curve, on evaluation of the subject is in a stage, and forecast its future development are important^[4-6].

The Internet has rapidly become a global publishing platform, and the journals covering a wide range of subject areas are now available. Information science is no exception, and we now find a significant portion of ametropia literature appearing in PubMed. This article presents some bibliometric data on the currently available journals in the field and the articles appearing in them^[7-10]. PubMed comprises more than 19 million citations for biomedical articles from MEDLINE and life science journals. Citations may include links to full-text from PubMed Central or publisher web sites. PubMed database platform is used to study the ametropia-related literature for econometric analysis, to determine the growth rule and tendency of ametropia literature, and to provide the basis for the problems related to ametropia research.

MATERIALS AND METHODS

Materials Literatures that contained the descriptors of ametropia in title or paper from 1845 to 2010 in PubMed databases (www.ncbi.nlm.nih.gov/pubmed) were selected. As bibliometric indicators of ametropia, the biomedical journals referring to ophthalmology by ISSN were calculated. The principal bibliometric indicators: Price's and Bradford's laws were applied on the increase or dispersion of scientific literature, the participation index of languages and the journals. By means of manual coding, literatures were classified according to documents study and statistical analysis.

Methods We logged on the PubMed databases, searched the literatures including ametropia, astigmatism, myopia or hypermetropia from Jan. 1, 1845 to Nov. 10, 2010, *e.g.* ("1" [Publication Date]: "2010/11/10" [Publication Date]) AND (ametropia, astigmatism, myopia or hypermetropia). The literature language distribution and ametropia main periodicals published in the literature, on the basis of individually each period literatures, and published the literatures during $\leq 1900/12/31$, 1901/01/01-1950/12/31,

1951/01/01-1955/12/31, 1956/01/01-1960-12-31, ... 2001/01/01-2005/12/31, 2006/01/01-2010/11/10 are included. Because the published literatures cited in PubMed databases before Nov. 10, 2010 are not complete, the quantity of literature may lower than actual.

RESULTS

Year Distribution of Ametropia Literatures Before 1900, PubMed databases embodied 25 ametropia (or astigmatism or myopia or hypermetropia) literatures including 1 literature in 1845, 1866, 1879, 1884, 1889, 1899, respectively, 2 in 1870, 1887, 1899, 3 in 1871, 1890, and 4 in 1868, 1894, respectively. From 1845 to Nov. 10, 2010, the literatures cited in ametropia, astigmatism, myopia and hypermetropia had accumulated to 26475, consisting of Review ($n=1560$), Randomized Controlled Trial ($n=776$), Practice Guideline ($n=10$), Meta-Analysis ($n=23$), Letter ($n=1222$), Editorial ($n=328$), Clinical Trial ($n=1726$) and Others ($n=20830$); Humans ($n=23073$), Animals ($n=1434$) and Others ($n=1968$). 1136 literatures were included in PubMed Central, 22384 in MEDLINE and 2955 in others.

The ametropia literatures rose every 5 years which of the ametropia-year cumulated amount of the literatures had three periods: before 1900, slowly increasing from 1901 to 1950, rapidly rising from 1951 to 2010 (increased approximate exponentiation exponent). The ametropia literatures were included since 1971 and significantly increased in 1971 (Table 1). With statistical analysis, its equation near exponentiation index (Figure 1).

Literature Language Sixty kinds of languages listed in PubMed databases, of which English is dominant for aborting to the ametropia research documents before 2010 (77.32%, 20471/26475). The document languages of top eight accounted for 95.58% (English, German, French, Japanese, Russian, Italian, Spanish, Chinese). And others accounted for 4.42% (1171/26475) (Afrikaans, Albanian, Arabic, Armenian, Azerbaijani, Bosnian, Bulgarian, Catalan, Croatian, Czech, Danish, Dutch, Esperanto, Estonian, Finnish, Georgian, Greek, Modern, Hebrew, Hindi, Hungarian, Icelandic, Indonesian, Kinyarwanda, Korean, Latin, Latvian, Lithuanian, Macedonian, Malay, Malayalam, Maori, Multiple, Languages, Norwegian, Persian, Polish, Portuguese, Pushto, Romanian, Sanskrit, Scottish gaelic, Serbian, Slovak, Slovenian, Swedish, Thai, Turkish, Ukrainian, Undetermined, Vietnamese). During the same period, the basic language distribution of papers was consistent in PubMed (Table 2).

Journals Distribution of Ametropia Study Up to 2010, in number of 8542 journals were recorded in PubMed databases (including 60 kinds of languages), 50% documents came from USA, 85% were written in English, and English

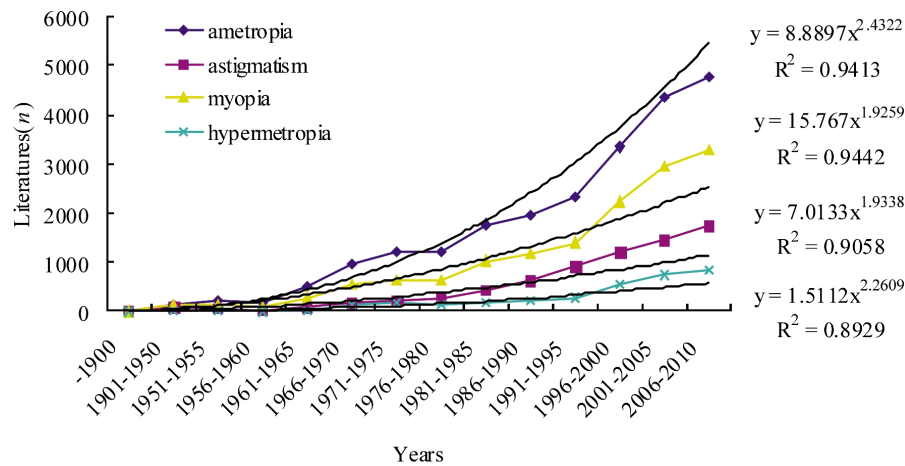


Figure 1 Distribution curve for literatures of ametropia

abstracts accounted for 79% (www.ncbi.nlm.nih.gov/pubmed). Forty-eight ophthalmologic journals were included in citation index (SCI) databases and impact factor of 39 journals was ≥ 1 on Thomson-Reuters in 2010. Of 48 ophthalmologic journals, there were 14785 documents (55.85%) of ametropia, astigmatism, myopia or hypermetropia (Table 2), others were without exception (Table 3).

DISCUSSION

After studying the ametropia documents in PubMed database, we concluded that the study of document amounts on the international plane to ametropia was always assumed slow ascending. From 1971 to 2010 documents among them measure increasing similar rectilinear trend (approximate exponentiation exponent), the obviously up and down phenomenon does not appear. The research explained that in almost half centuries, ametropia is always at the comparatively popular stage. The simultaneous ametropia learns document a bit and ametropia progress and development are consistent in the world. In this study, the ametropia documents in English are 77.32% before 2010/11/10, followed with German, Russian, French, Japanese, Italian, Spanish, Chinese and Polish. Documents written in Chinese accounted for 2.03% only. This exceptional pass, stoppage has taken in Chinese journal mainly with PubMed takes in 111 journals in 2010. The distribution of these journals is: 93 in Mainland China, 13 in Taiwan, 4 in Hong Kong and 1 in Macao, respectively (shyyy.com/News_View.asp?NewsID=1666, 2010-11-25).

Research indicates the main body of a book, checking the ametropia research still is a hot spot in the world. The people who studied the document chronicle rose slowly, especially before 1966. The ametropia documents were included in PubMed from 1951, increased obviously after

Table 1 Literatures distribution of ametropia in PubMed during 1845-2010

Period	Ametropia	Astigmatism	Myopia	Hypermetropia	n
1845-1900	3	9	12	2	
1901-1950	134	74	153	17	
1951-1955	215	43	139	15	
1956-1960	213	42	122	6	
1961-1965	516	88	284	42	
1966-1970	984	173	536	131	
1971-1975	1207	240	630	175	
1976-1980	1218	294	640	135	
1981-1985	1776	438	1022	204	
1986-1990	1967	625	1161	236	
1991-1995	2338	912	1407	276	
1996-2000	3356	1213	2238	541	
2001-2005	4351	1461	2944	736	
2006-2010	4779	1746	3283	837	
-2010/11/10	23057	7358	14571	3353	

Table 2 Language distribution of ametropia literatures [n(%)]

Language	Ametropia	PubMed
Chinese	536(2.03)	189341(0.94)
Spanish	156(0.59)	270958(1.33)
Russian	1181(4.46)	645398(3.13)
Japanese	385(1.45)	381108(1.87)
Italian	146(0.55)	288484(1.43)
French	1037(3.92)	781622(3.85)
German	1392(5.26)	650458(3.19)
English	20471(77.32)	16138899(79.23)
Other	1171(4.42)	1022892(5.03)
Total	26475(100)	20369160(100)

1971, but it was equation approaches exponentiation exponent ($y=8.8897x^{2.4322}$, $R^2=0.9413$ in ametropia; $y=15.767x^{1.9259}$, $R^2=0.9442$ in astigmatism; $y=7.0133x^{1.9338}$, $R^2=0.9058$ in myopia; $y=1.5112x^{2.2609}$, $R^2=0.8929$ in hypermetropia). From 1845/01/01 to 2010/11/10, the ametropia documents published mainly for ophthalmology

Table 3 Ophthalmological journals with ametropia literatures in PubMed from 1845 to 2010 (Thomson-Reuters in 2010 for SCI indexed)

ISSN	Journal	Literature(<i>n</i>)	Total citation	Impact factor
0886-3350	<i>J Cataract Refract Surg</i>	2266	9209	2.745
1081-597X	<i>J Refract Surg</i>	1440	2874	2.320
0161-6420	<i>Ophthalmology</i>	1161	22568	5.491
0002-9394	<i>Am J Ophthalmol</i>	1018	18083	3.833
1040-5488	<i>Optom Vis Sci</i>	831	2960	1.530
0007-1161	<i>Br J Ophthalmol</i>	713	12965	2.917
0023-2165	<i>Klin Monbl Augenheilkd</i>	693	1310	0.542
0275-004X	<i>Retina</i>	659	4659	2.932
0146-0404	<i>Invest Ophthalmol Vis Sci</i>	619	31564	3.431
0003-9950	<i>Arch Ophthalmol</i>	592	17277	3.859
0275-5408	<i>Ophthalmic Physiol Opt</i>	480	1510	1.148
0277-3740	<i>Cornea</i>	410	5364	2.106
0042-6989	<i>Vision Res</i>	349	16629	2.288
0181-5512	<i>J Fr Ophtalmol</i>	324	837	0.510
0950-222X	<i>Eye</i>	305	3487	1.974
0941-293X	<i>Ophthalmologe</i>	292	1143	1.000
0030-3755	<i>Ophthalmologica</i>	222	1388	1.028
0721-832X	<i>Graefes Arch Clin Exp Ophthalmol</i>	221	4732	2.102
0191-3913	<i>J Pediatr Ophthalmol Strabismus</i>	207	1086	0.627
1040-8738	<i>Curr Opin Ophthalmol</i>	188	1756	2.490
1120-6721	<i>Eur J Ophthalmol</i>	188	1166	0.887
1091-8531	<i>J AAPOS</i>	156	1268	1.070
1442-6404	<i>Clin Experiment Ophthalmol</i>	141	1544	1.755
0008-4182	<i>Can J Ophthalmol</i>	133	1131	1.443
0039-6257	<i>Surv Ophthalmol</i>	128	3478	2.347
0012-4486	<i>Doc Ophthalmol</i>	127	1338	1.837
0816-4622	<i>Clin Exp Optom</i>	127	570	1.236
0014-4835	<i>Exp Eye Res</i>	99	7613	2.538
0021-5155	<i>Jpn J Ophthalmol</i>	99	1248	1.272
0271-3683	<i>Curr Eye Res</i>	92	3221	1.513
0928-6586	<i>Ophthalmic Epidemiol</i>	71	817	1.927
1090-0535	<i>Mol Vis</i>	67	3434	2.541
1755-375X	<i>Acta Ophthalmol</i>	66	4035	2.441
1542-8877	<i>Ophthalmic Surg Lasers Imaging</i>	50	1131	0.615
1057-0829	<i>J Glaucoma</i>	49	1959	1.744
1534-7362	<i>J Vis</i>	40	3613	3.022
1381-6810	<i>Ophthalmic Genet</i>	39	399	1.406
0030-3747	<i>Ophthalmic Res</i>	28	977	1.288
0952-5238	<i>Vis Neurosci</i>	23	2622	1.273
1080-7683	<i>J Ocul Pharmacol Ther</i>	18	1092	1.457
0740-9303	<i>Ophthal Plast Reconstr Surg</i>	16	1294	0.690
1530-4086	<i>Ann Ophthalmol</i>	16	576	0.157
1350-9462	<i>Prog Retin Eye Res</i>	8	2661	7.755
1070-8022	<i>J Neuroophthalmol</i>	7	700	1.089
1542-0124	<i>Ocul Surf</i>	3	363	4.222
1556-9527	<i>Cutan Ocul Toxicol</i>	2	101	1.061

relevance publications, the papers were more than one thousand on *J Cataract Refract Surg*, *J Refract Surg*, *Ophthalmology* and *Am J Ophthalmol*

Bibliometrics and Impact Factor The impact factor (IF) is an artificially created indicator when applied separately does not achieve the value attributed to it. In its assessment

a number of different influences are projected which cause partial mistakes with a cumulative effect. It can have an even worse effect if the impact factor is incorrectly conceived or inadequately handled [7-10]. Only in a long-term review using specific correction, it can serve to determine really top class periodicals but only within the framework of a single scientific discipline. It is not suitable for comparison of interdisciplinary journals. It should be used very carefully in the evaluation of authors. However, it is still used in various types of administrative management. From the submitted paper, it may be seen that with a certain amount of overstatement it is personified and acts on its own [9-11]. In addition to the impact factor, the authors discuss also other indicators and some aspects of scientific measurement. Bibliometrics adopt the quantify means to take document of all kinds as marriage partner, the law studying the document exchanges the mathematics of all kinds that process there exists in middle makes scientific forecasting out in order to developing to discipline, establishes whose developing trend. Many experts and scholars in natural science literature growth rule this conducted extensive research and further exploration, some of these parameters determination method is improved, and some parameters or use by adding new methods to index curve and logical curve was revised, or to put forward new describe literature growth rule of mathematical model, and made some progress.

Discipline document increase sometimes several appear on meeting increasing the period and relatively stable several periods rapidly [11-15]. Some memorials of the scientific literature increase exponent law, some memorial logistic curves law, some then, assume the linearity law or increase a pattern other. Carry out quantitative analysis on the person from the country and language that the document stems from, may point out country room difference studying status, change trend. The exponent from scientific literature has increased since the law and the logic increase law put forward. Many experts and scholars have carried out the broad go into and thorough exploration on here. Some parameters face to face among them have ascertained method having done improvement, some method by increasing a parameter or adopt the new has carried out amendment on the exponent curve and the logistic curve, has been bound to progress having described that the document increases the law mathematic model or having brought forward the now's again, having got. Information carries out the analysis studying on ametropia document content, guide research method and know well much better to deepening the discipline professional knowledge, may carry out quantitative analysis on the person from up-level document content discipline or the special field and, know

whose hot spot studying and development^[16-19]. In this study, published the ametropia papers more four kinds of periodicals (*J Cataract Refract Surg*, *J Refract Surg*, *Ophthalmology* and *Am J Ophthalmol*) that its impact factors were higher, 2.32, 22.745 5.491 and 3.833, respectively.

The research to the law already having announced the thesis increase, ageing and being scattered already has been regarded as one of important basis of scientific and technological progress, is also the basics law that the document develops^[18-22]. Study ametropia bibliometrics can set off from quantitative angle in the field biomedicine, find out the growing regularity characteristic by the statistic analysis that the document measures year by year to ametropia, can go to probe going over, current situation that ametropia studies, and to forecast the developing trend that the person studies by these regularity characteristics. The document increases by is a complicated process, the different increase pattern all explain scientific literature quantity with time but increases by the process different. However, increase is different from speed, taking degree seriously if being negative growth is to indicate this one discipline research's is producing reduction. Scientific literature increase, and want to accept conditional various social environment restraints too not only according to theory pattern stipulated by science self's development law^[5-8, 23-26]. That besides, the scientific literature increase returns effect back to such as accepting the carrier technology, publishing the technology, electronic computer and modern information technology as well as the network develops, show as a result more for a random process, makes a document increase a law displaying the various pattern^[27-31].

Affect Factor of the Ametropia Documents Affecting the major factor that the ametropia documents increases are that discipline self's inherence develops law. That PubMed includes the ametropia the first sheets document is that^[1,32-35], is in several 10 henceforth in 1866 until in 1951 which the amounts of document are equal every 5 years. During 1951-1971, the amounts of ametropia documents increase by obviously, every 5 years is in count thousand sheets without exception. Each ametropia for 5 years document amounts are over ten thousand before 1966, and this advanced development of science and technology, ametropia paying attention to going hand in hand. The Chinese ametropia documents are relatively comparatively few, but the Chinese journal to close has included in PubMed^[10-16]. The law that scientific literature quantity increases is the effect by objective process environment got along by law and science deciding, including science development of oneself inherence that science develops. Science oneself inherent

development law has own characteristic respectively. Every discipline growing up all possible go through of process is formation, development, relatively mature and different stage. The quantity that general amounts of ametropia documents increase newly every year is one fixed value basically. One aspect shows being discipline theory's turn not to have big breakthroughs, another aspect explains what the society personnel need to that special field and throw into manpower and material resources basic is constant, is that environment got along by discipline stabilizes relatively^[17-22]. That these bear fruits all is ametropia what the law studying document development of oneself inherence decides. Affecting oneself inherence law and social environment condition anaesthetizing the discipline mimicking a document increasing a law is two factor of complete diversity of character, correct but effective go along differentiates but, achieve neither easy to differentiate even if the index applying bibliometrics does a quantify^[1-3]. Because of very much, the environmental factor complicated, can entire field of science of big range effect, the document developing or not all too all discipline increases country political economy, culture, develop at top speed educating producing important effect. However, also not bad less range effect some special fields, if society moral concept, the simple pattern turn around to living things mentality society medical science pattern. These all affect ametropia studying the document increase, if the human gene forms the project working out and put into effect to will produce extremely far-reaching effect to life field of science document quantity. Country policy working out and alteration can weigh to different range discipline field. A lot of discipline increase law growing trend studying the amounts demonstrating a document finally equally assume a fleetness and country policy to the document going hand in hand, develop a period if every field is in high speed since China reforms and opens, medical science neither exception, scientific research invests, the brainpower and the technical journal quantity increase by rapidly, science and technology thesis quantity increases by also by a wide margin. That modern ametropia history does not go over 150 years, is that the medical science field is hit by a discipline new and developing. This discipline is with the development of medicine discipline, clinical job need, concentrate preclinical medicine, clinical medicine as well as other the discipline in relation to theory, science and technology achievement applying modern times clinical but building-up get up, become at present already the clinical medicine important component^[33-36].

Reflect ametropia studying what personnel's need and throw into manpower and material resources is comparatively

stable, still may display the sustained stable developing trend within future period of time^[13-15, 21-23]. Increase law theory according to the document, our statistics studies result synthetically, international ametropia studies document all quantity assumes a straight line mainly (equation can estimate out future almost annual ametropia document amounts according to the straight line), the document amounts increasing by newly every year fix relatively, be in third stages that discipline develops basically. Bibliometrics is a hit at present at home and abroad special field already by extensive use, such as, core journal admeasurements, reader study, scientific research law go into, talented person analyses, document law analyses estimating that and forecasting and so on studying optimization, and every field science that document intelligence manages in intelligence retrieval system, library information system is dynamic. But bibliometrics application in medical science field, follow development of time to increase a trend also in the memorial, since especially trans-century, the outgoing document amounts about this aspect have notable increase a trend, but thesis about medical science bibliometrics quantity in medical science thesis proportion is still pretty low^[1-3, 11-14, 24-27].

Affect the artificial factor that document intelligence streams many; the ametropia intelligence stream is also the same. Learn to study at present to the document still being difficult to quantitative-relation, bibliometrics is centering on several experiencing the law counting, its application is already very broad. Microcosmic application has the utilization ratio ascertaining the core document, appraising publication, inspecting a document, scientific management realizing the library information branch^[31-34]. Macroscopic application has designing that economy information system and network, improve intelligence more handling efficiency, seek document abuse and defect in serving, forecast the direction coming out, developing and perfecting intelligence basic theory and so on^[35-38]. We gain sufficient, effective information impossibly, come to announce to the document macroscopic view law especially because of document system altitude complexity and block of wood stability. Development of bibliometrics depends on mathematics implement and statistics technology support, transplant or make use of effective mathematics implement and statistics method, will be whose important development direction^[9-13].

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