A Scientometric Analysis of Genetics Research on Glaucoma

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Abstract

Analyses the Genetic research in Glaucoma during 2006-15 on several parameters including contribution & citation impact of top most productive countries, its growth pattern , productivity and impact of leading institutions and authorship pattern, types of communication, output in most productive journals.Methods: The PubmedDatabase has been used to retrieve the data for 10 years (2006-15) bysearching the keywords "glaucoma AND Gene [Mesh] " in combined Title, Abstract and Keywordsfield.Results: The total number of published articles that were retrieved for the years 2006 to 2015 was 555. During the ten-year period studied the annual output of research articles steadily increased .Multiple authorship (96.6%) was predominant in genetic research in Glaucoma, Two-thirds of articles were published in Ophthalmology Journals .Fifty present of the publications came from three countries where as USA , China and India . Original articles were (76%) good in number , thecase reports and other type whereas the least.

Keywords

Glaucoma research; Publications; Scientometrics; Ocular Genetics.

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Introduction

The Genetics of Glaucoma
Glaucoma is the term used for a group of diseases that irreversibly damage the optic nerve, leading to vision loss and ultimately, if untreated, blindness. Genetic factors are considered to play a key role in all major forms of glaucoma. [1,2]

Primary open-angle glaucoma*.(POAG)* is the most common type of glaucoma, Affecting 33 million people worldwide[1] and has no obvious abnormality in the eye that points to a cause. Although mutations in several genes, including myocilin, optineurin, and CYP1B1, have been reported to cause POAG. In the past 2 years, large scale of genetic studies that have examined the blood samples of thousands of glaucoma patients have been instrumental in the discovery of more common genetic risk factors for POAG.[2]

Pseudoexfoliation(also termed exfoliation) syndrome (XFS) is the most common form of secondary OAG throughout the world. It is inherited as a complex and late-onset disorder with a higher prevalence among females and increasing age.Glaucoma is often thought of as a disease of middle age or older adults. However there are many inherited forms of glaucoma that affect young children. [3]

Primary congenital glaucoma *(PCG)* is the most common childhood glaucoma affecting children from birth to age 3 and is a major cause of blindness in this young population. Primary congenital glaucoma (PCG) is a rare form of glaucoma that is commonly referred to as infantile or congenital glaucoma. It is the most common form of glaucoma in infants and more than 80% of cases manifest within the first year of life.[4]Mutations in the CYP1B1 gene have been found to cause PCG in children worldwide and are the dominant genetic cause for glaucoma in children in the Middle East and central Europe.

Exfoliation glaucoma *(XFG),* also called pseudo exfoliation glaucoma, affects millions and is the most common identifiable form of open-angle glaucoma in the world. It is inherited as a complex and late-onset disorder with a higher prevalence among females and increasing age.[4] XFG results from exfoliation syndrome, a common condition characterized by the deposit of white protein-like material that forms on the lens and within the fluid drainage system of the eye, as well as tissues throughout the body. Genetic

variants of LOXL1 and CNTNAP2 genes have been associated with XFG.

Pigmentary Glaucoma

Pigment dispersion syndrome is considered to be a secondary glaucoma.Pigmentary glaucoma is a type of inherited open-angle glaucoma which develops more frequently in men than in women.pigment dispersion syndrome is considered to be a secondary glaucoma, identification of the genes causing this condition may have a direct relationship with the pathogenesis of POAG[5]

Literature review

Several scientometric studies were conducted on world, regional and country distribution of ophthalmology and visual science literature. Among these a bibliometric analysis of publications from 1998 to 2002 by Ohba[7] the top 10 countries in terms of total number of articles published in the ophthalmic literature were the United States, the United Kingdom, Japan, Germany, Canada, Australia, Italy, Netherlands, Sweden, and France. In a study by Mandal it was found that researchers in the developing world contributed only 5.47% of the literature, compared to 92% from the developed world. [6], [8].Kumaragurupari, Sieving & Lalitha studied 2163 Indian publications in ophthalmology & vision science during 2001-06 to assess publications productivity, trends in journal choice, publication types, research funding and collaborative research [9] .In Glaucomatwo sceintometricstudies were conducted ,Consoli and Ramgoplan analysed 9361 world glaucoma papers from ISI Thompson database from 1973-2003.[11]Second one conducted by Guta and Bala[10]analysed Glaucoma Research: A Scientometric Study of Indian Publications Output, 2002-11. Authors suggested the need to develop eye care facilities in every district, to develop human resources for providing eye care services.

Objectives

The main objective of this study is to analyse Genetic research in Glaucoma output during 2006 – 2015.

1. To identify the pattern of distribution of articles in Genetic research in Glaucoma
2. To identify the rate of growth of Literature by calculating relative growth rate and doubling time of research articles.
3. To identify the scientific productivity of authors and authorship Pattern of research output
4. To identify the proportion of single and multi-author papers and degree of collaboration in Genetic Research on Glaucoma
5. To test the applicability of Lotka's law to the scientific productivity of
6. The distribution of research output journals confirms the implication of Bradford's law
7. To identify the geographical distribution

Methodology

Genetics research on glaucoma publication retrieved from the pubmed form 2006 to 2015.Data downloaded in XML format .Then the bibliographical data converted into xml format using pubmed into excel .Overall 555 records retrieved for analysing the present study.

The analysis related to the statistical analysis with respect to growth of literature, absolute growth rate and relative growth rate, doubling time , Type of articles, authorship pattern, Journal wise distribution, country wise research output. Further this study is exploratory in nature by identifying the genetics research performance in Glaucoma

Data analysis and Discussions

Year wise Analysis

Table 1 indicates year wise analysis of Genetic research in Glaucoma during from 2006 to 2015. The output of articles in the years 2006 was 59 whereas in the succeeding years contribution has decreased up to 2010 then increased. As a result of the doubling time for publication of articles in journals has increased form 1.05 in 2007 to 5.7 in 2015. The mean doubling time for publications in the journals for the period 2006-2010 to 2001-2015 are 2.3 years and 4.9 years respectively. In general the relative growth rate of publications of all sources in research out output has shown an increasing trend.

Table 1: Year wise Analysis Productivity

Year	No of Output	Cumulative output	%	w1	w2	R(P)	Mean	Doubling time	Mean Dt(a)
2006	59	59	10.6	-	4.0775	-	0.3737	-	2.3073
2007	55	114	9.9	4.0775	4.7362	0.6587		1.0524	
2008	55	169	9.9	4.7362	5.1299	0.3937		1.7606	
2009	49	218	8.8	5.1299	5.3845	0.2546		2.7225	
2010	45	263	8.1	5.3845	5.5722	0.1877		3.6937	
2011	65	328	11.7	5.5722	5.7930	0.2209	0.1494	3.1384	4.986
2012	63	391	11.4	5.7930	5.9687	0.1757		3.9452	
2013	50	441	9.0	5.9687	6.0890	0.1203		5.7600	
2014	51	492	9.2	6.0890	6.1985	0.1094		6.3339	
2015	63	555	11.4	6.1985	6.3190	0.1205		5.7528	
Total	555								

R(P) = W2 - W1
Doubling time = LN(2)/R(P), where LN(2) = 0.693147,
Mean=0.3737 (R(P), Average of year 2006 - 2010)
Mean=0.1494 (R(P), Average of year 2011 - 2015)
MeanDt(a)=2.3073 Average of Doubling time(2006 - 2010)
MeanDt(a)=4.9860 Average of Doubling time(2011 - 2015)

Authorship Pattern in Genetic Research in Glaucoma

The present study brings papers under analysis contributed by one author to seven authors and above Fig 1. Table 2 Indicates that the single author is low priorityIt is noticed that seven and above authors papers has more in number.Out of 555 publication 536 (96.6%) contributed by Multiple authors , whereas single author contributions were 19 (3.4%)

Table 2: Authorship Pattern in Genetic Research in Glaucoma

Sl . No	Authroship Pattern	Publication	%
1	Single Author	19	3.4
2	Multiple Author	536	96.6

Table 3: Most productive authors in Genetic research in glaucoma

Sl.No.	Author	No. of articles	%
1	Liu, Y	27	4.9
2	Craig, JE	23	4.1
3	Mackey, DA	20	3.6
4	Allingham, RR	16	2.9
5	Hewitt, AW	15	2.7
6	Abu-Amero, KK	15	2.7
7	Escribano, J	15	2.7
8	Hauser, MA	15	2.7
9	Burdon, KP	12	2.2
10	John, SW	11	2.0
11	Pang, CP	11	2.0
12	Ray, K	10	1.8
		190	34.2

Table 3 shows the most productive authors in Genetic research in glaucoma. There were 3970 authors were contributed 555 publications. Out of which, Liu Y contributed 27 (5%) and score first, Grig JE

contributed 23 (4.1%) publication . As of table 3 one third of the publication (34.2%) contributed by just 12 authors. Average number of authors per publication was 13.9

Degree of Collaboration

The degree of collaboration (DC) is measured by proportion of multiple authored papers derived by Subramanian (1983)

$Dc= N_m/Nm+ N_s$

Dc= 555/55+69

= 0.9

The degree of collaboration was 0.9 .Multiple authorship was predominant in genetic research in Glaucoma.

Lotka's Law in relation to Author productivity

Table-3b reveals that, the implication of Lotka's law in relation to author productivity. It explains that a number of authors making 'n' contribution are about 1/n2 of those making a single contribution and the proportion of the contribution that make a single contribution is about 60 percent. In the present study ocular Genetic researcher productivity is examined the Lotka's findings that the proportion of all contribution that makes a single contribution is less than 60 present. Further, Lotka's dx2 model confirms the same fact. It explains the fact that the calculated dx2 value of 285.91 is much less than the table valuein 16 degree of freedom at 0.05 level of significance. Thus the present analysis clearly invalidates Lotka's findings.

Table-3b : Implication of Lotka's law in relation to author productivity

No of contrib. ution	Observed no.of authors	Observed percentage of authors	Expected number of authors	(1926) 100/n2	RANK
1	1969	100.0	1969.0	100.0	0.00
2	312	15.8	492.3	25.0	66.00
3	112	5.7	218.8	11.1	52.11
4	48	2.4	123.1	6.3	45.78
5	44	2.2	78.8	4.0	15.34
6	23	1.2	54.7	2.8	18.37
7	13	0.7	40.2	2.0	18.39
8	16	0.8	30.8	1.6	7.09
9	9	0.5	24.3	1.2	9.64
11	2	0.1	16.3	0.8	12.52
11	1	0.1	16.3	0.8	14.33
12	1	0.1	13.7	0.7	11.75
15	4	0.2	8.8	0.4	2.58
16	1	0.1	7.7	0.4	5.82
20	1	0.1	4.9	0.3	3.13
23	1	0.1	3.7	0.2	1.99
27	1	0.1	2.7	0.1	1.07

Degrees of Freedom = 16, Level of Significance = 0.0, Table Chi-square value = 26.30,Chi-square = 85.91

Table 4: Ranking of Journals according to Bradford's Distribution

No of Jouranls	Nof artilces		Total
1	20	20	20
1	28	28	48
1	29	29	77
1	45	45	122
1	128	128	250
2	14	28	278
3	4	12	290
5	3	15	305
6	1	6	311
7	3	21	332
8	3	24	356
9	4	36	392
12	3	36	428
25	2	50	478
77	1	77	555

Ranking of Journals

Journal is one of the primary sources of information are the vehicles of current output of knowledge. Fig 2 shows 356 (64%) of articles were published in ophthalmology journals and significant number of articles (35%) were published in non-ophthalmic journals.

Distribution of Bradford's Law

The Bradford's law was formulated in the year 1948. Table 4 indicates that the total number of 159 journals published 555 articles. These 159 journals are arranged in the increasing order of productivity.

Table-5: Ranking of Top-10 journals

Sl.No.	Top Ten Journals	Nos.
1	Molecular vision	128
2	Investigative ophthalmology & visual science	45
3	Ophthalmic Genetics	29
4	PloS one	28
5	Human molecular genetics	20
6	American journal of ophthalmology	14
7	Experimental eye research	14
8	Archives of ophthalmology (Chicago, Ill. : 1960)	12
9	Human genetics	12
10	Journal of glaucoma	12

Table-5 shows that ranking of Top-10 rank journals according to their productivity. According to productivity the Journal of Molecular Vision ranked first in order. It has published 128 (23%) of articles. An interesting to know that except American Journal of ophthalmology, Archives/Jama Ophthalmology and Journals of glaucoma, the remaining journals are research oriented journals.

Table 6: Disease Wise Distribution

Sl.No.	Diseases	No of publication
1	Primary open-angle glaucoma]	260
2	Congenital glaucoma	141
3	Myocilin Glaucoma	145
4	Exfoliation	38
5	Pigmentary Glaucoma	332

Table 6 indicates the diseases wise distribution the Pigmentary glaucoma 332 (59%) has highest number of publication, followed by congenital glaucoma 264 (47%) ranks second, primary open angle glaucoma 260 (49%) with third respectively. Some articles discussed more than one disease, hence the % to not add up to 100%

Table 7: Country wise Distribution

Sl.No.	Country wise Distribution		
1	Canada	13	2
2	Germany	18	3
3	Spain	19	3
4	Saudi Arabia	23	4
5	United Kingdom	24	4
6	Japan	32	6
7	Australia	35	6
8	India	51	9
9	China	75	14
10	Usa	138	25
11	Others	127	23

The country wise distribution of records has been shown in table 7. The maximum number number of records were form USA , (24%) , China (14%) and Indian (9%).

Major Findings

1. The Study identified a 555 publication has been published during the period from 2006- 2015. The Highest number of publication in 2015 was 63. The analysis of the growth of Genetic research in Glaucoma reveals that the relative growth rates of research output have shown a declined trend, contrastingly doubling the time for publications that have increased remarkably.

2 The findings of degree of collaboration analysis reveal the following facts that the case of single author contributed papers are less. Average number of authors per publication was 13.9. The findings of author productivity in terms of Lotka's law implications reveal the following facts that the analyzed data invalidate Lotka's finding. The proportion of all contributions that makes a single contribution is less than sixty present particularly in

the case of the number of authors contributed at various level of research output. Further, Lotka's dx2 confirms the same fact. Multiple authorship (96.6%) was predominant in genetic research in Glaucoma, It brings out clearly the high level prevalence of collaborative research in Genetic research in Glaucoma . It indicates that research activity; now-a-days relies mainly on group of researchers

3. The formulated of the applicability of Bradford's law of scattering in various journals is identified as invalidated. It is evident that from the classification of journals according to Bradford distributions reveal the facts that the first ten journals covered more than one third of the total articles published. the total number of 159 journals published 555 articles. The most productivity publication is Molecular Vision has 128 (23%) of articles.

4. The countries such as USA , China, and India have considerably recognized the research articles in Genetic research on Glaucoma

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