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Scientometric methods for the evaluation of hemophilia research

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Abstract

This article attempts to highlight quantitatively the growth and development of world literature on hemophilia in terms of publications output as per SCOPUS database (2003-2017). During 2003-2017 a total of 13503 papers were published by the scientists in the field of hemophilia. The average number of publications published per year was 900. The highest number of publications 1095 was published in 2012. Out of 13503 contributions, only 18.48% (2495 papers) of single authored and rest of 11008 papers (81.52%) were multi authored. The study identifies active institutions and country-wise distributions of hemophilia research output. The yearly analysis of data shows that there is a rapid growth of literature from 2011 onwards. There were 126 countries involved in the research in this field. USA is the top producing country with 3986 authorships (29.52%) followed by United Kingdom with 1438 authorships (10.65%). Still, in an international sense, relative productivity of India is low and requires more focused research and development.

Keywords: Literature Growth, Relative Growth Rate, Doubling Time, Degree of Collaboration and Authorship Pattern.

Introduction

Haemophilia is an inherited bleeding disorder caused by deficiency or dysfunction of the coagulation proteins factor VIII, leading to haemophilia A, and factor IX, leading to haemophilia B. Since these plasma glycoproteins have an essential role in coagulation, faults cause decreased and delayed generation of thrombin, giving rise to defects in clot formation that lead to haemorrhagic diathesis. These defects are associated with bleeding episodes affecting soft tissue, joints, and muscles. Repeated haemorrhages result in chronic

arthropathy, with loss of joint movement. Hemophilia is quite rare. About 1 in 10,000 people are born with it. The most common type of hemophilia is called hemophilia A. This means the person does not have enough clotting factor VIII (factor eight). Hemophilia B is less common. A person with hemophilia B does not have enough factor IX (factor nine). The result is the same for people with hemophilia A and B; that is, they bleed for a longer time than normal. In those with severe haemophilia, gene therapy may reduce symptoms to those that a mild or moderate person with haemophilia might have. The best results have been found in haemophilia B. In 2016 early stage human research was ongoing with a few sites recruiting participants. In 2017 a gene therapy trial on nine people with haemophilia A reported that high doses did better than low doses. It is not currently an accepted treatment for haemophilia.

Scientometrics empirically describes the constantly changing relationship between science, technology and the research productivity. According to Beck (1978) scientometrics is defined as the quantitative evaluation and inter- comparison of scientific activity, productivity and progress. The rational of this study was to analyze the quantity and quality of global research output in hemophilia research, its patterns of collaborative research, patterns of research communications in most productive journals and evaluating the research output of different institutional groups, as reflected in their publications output during 2003–2017.

Literature Review

No scientometric study had been published on hemophilia literature both at national and international level. However, few scientometric studies have been published on other diseases. For example, **Barboza and Ghisi (2018)** conducted a scientometric study on Huntington disease. The study found that United States was the world leader in terms of the number of studies published on Huntington disease, with 2700 articles, accounting for more than one quarter of the world's publications on this disorder (28.12%). England ranks second (10%) and Germany ranks third (7%). Emerging countries, such as India, only appear after the 15th position. The study also pointed that half of the published articles fell within the field of neuroscience and neurology (41%), while 10% of publications were published in psychiatry and 8% in hereditary genetics.

Gupta and Bala (2013) analyzed 20 most productive countries in Parkinson's disease, India ranks 16th (with 458 papers) with a global publication share of 1.47% and an annual average publication growth rate of 26.05% during 2002-2011. Its global publication share has increased over the years, rising from 1.08% during 2002-2006 to 1.74% during 2007-2011. Subject-wise analysis shows that the highest research output (191 papers) comes from Biochemistry, Genetics, and Molecular Biology with 41.70% publications share and Immunology and Microbiology had scored the highest impact of 7.92 citations per paper during 2002-2011.

A bibliometric study conducted by **Vellaichamy and Jeyshankar (2014)** analyzed the research activities of India in Anemia disease during 1993-2013. The results found that Indian scientists together have contributed 5085 research papers and International collaboration of India accounts for 15.75% during 1993-2013.

Lung cancer is the leading cause of cancer deaths for men in developing countries. Lung Cancer history shows that about a century and a half ago, lung cancer was an extremely rare disease. **Jeyshankar and Vellaichamy** scientometrically assess the Indian lung cancer research productivity during 1984-2013 and focused on the Compound Annual Growth Rate, rank and global publications share, citation impact, share of international collaborative papers, contribution of major collaborative partner countries and contribution of various subject fields. It also analyzes the characteristics of most productive institutions and authors.

Gupta and Adarsh Bala (2013) studied research output of India in Alzheimer's disease research during 2002-11. The study indicates that India ranks at 16th position (with 900 papers) among top 20 top countries with a global publication share of 1.33% (rising from 0.39% in 2002 to 2.36% during 2011) and an annual average publication growth rate of 31.92% during 2002-11.

The study done by **Patra and Bhattacharya (2005)** showed that cancer research in India is increasing, with a marginal decrease in 1991, 1993, 1995, 1997 and 2003. Authorship patterns showed that 58.59 per cent of Indian authors published one article, 14.97 per cent published two articles and 7.72 per cent published three articles.

In another study conducted by **Jeyshankar and Vellaichamy** indicated that India ranks 17th among the other countries in Autism research with a global publications share of

1.01% during 2007- 11. In depth, this study analyzed that majority of the publications are published in the form of Article (64.76%) and majority (79%) of the scientists preferred to publish their research papers in joint authorship.

Research questions

The study explored the following questions:

1. What is the overall performance in India for hemophilia research during 2003-2017?
2. What is the nature of those publications?
3. What is the nature of collaboration?
4. Which institutions/organizations are behind hemophilia research in global level? And,
5. Which is the predominant source of information on hemophilia research?

Materials and Methods

Scientometric study involves studying the number of publications in a given field, or productivity of literature in the field, with the aim of comparing ''the amount of research in different countries, the amount produced during different periods, or the amount produced in different subdivisions of the field'' (Hertzel, 1987, p. 156). Using that technique, the study reported here compares the hemophilia research in the world. Data was collected from the SCOPUS database (2003 –2017) which contains abstracts and citations for academic journal articles. It covers nearly 21,000 titles from 5,000 publishers of which 20,000 are peer reviewed journals in the scientific, technical, medical and social sciences. By using suitable search strategy (TITLE-ABS-KEY ("HEMOPHILIA" or HAEMOPHILIA) records on the subject 'hemophilia' were downloaded 13503 records for the years 2003-2017. The papers were then categorized according to the language in which they were written, as well as by the country, year, and field of study. These data were included in a spreadsheet, thus enabling the analysis by a comparative graph and various tables.

Analysis and Interpretation

Growth of literature

Literature growth occupies an important place in the field of bibliometrics/scientometrics. Table 1 display the growth of scientific productivity on hemophilia. 2012 is the most productive year with 1095 (8.11%) publications followed by 2016 with 10.10 (7.48%) publications. The research on this subject area may consider as the emerging area of research. The least number of 690 documents were published in 2005 (5.11%) which was the period the subject area was pioneering. While in the middle years (2006-2012) contributed 47.45% (6407) of documents, the last five years were published 4905 records (36.33%). We can witness an increasing trend during 2006-2012 and degreasing the 2013 to 2015, while fluctuation is visible in other periods of study.

Table – 1: Growth of Research output on hemophilia

Sl. no	Year	No. of Records	Cumulative No. of Records	% age	Cumulative % age
1.	2003	725	725	5.37	5.37
2.	2004	776	1501	5.75	11.12
3.	2005	690	2191	5.11	16.23
4.	2006	778	2969	5.76	21.99
5.	2007	855	3824	6.33	28.32
6.	2008	930	4754	6.89	35.21
7.	2009	869	5623	6.44	41.65
8.	2010	908	6531	6.72	48.37
9.	2011	972	7503	7.20	55.57
10.	2012	1095	8598	8.11	63.68
11	2013	998	9596	7.39	71.07
12	2014	950	10546	7.04	78.11
13	2015	998	11544	7.39	85.5
14	2016	1010	12554	7.48	92.98
15	2017	949	13503	7.02	100.00
Total		**13503**		**100.00**	
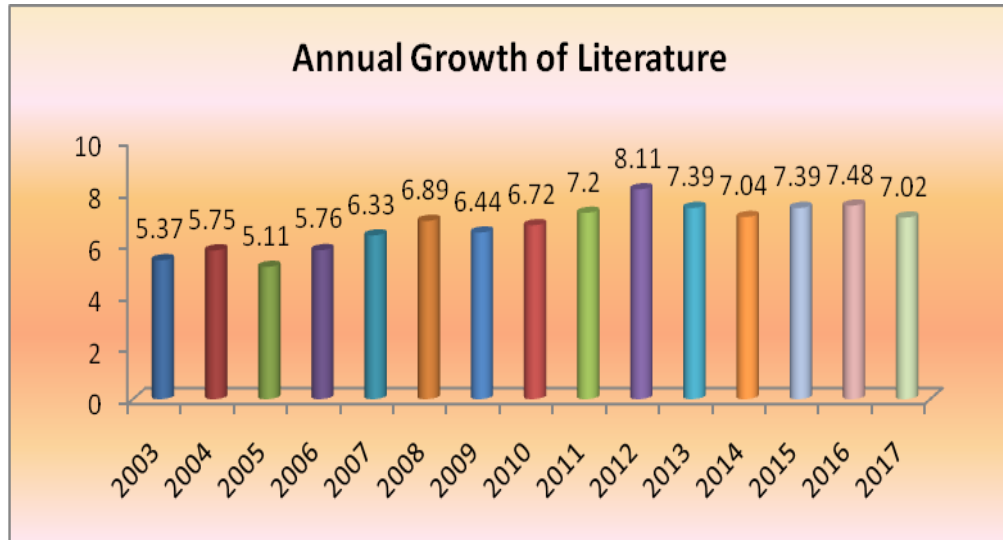
Figure 1: Annual growth of Hemophilia literature

Relative Growth Rate

Relative growth rate is a tool to measure the information growth when the growth rate of a function is always proportional to the function's current size. Such growth is said to follow an exponential law. The growth of publications was analyzed by using two parameters Relative Growth Rate and Doubling time (Mahapatra, 1985). RGR was measure to study the increase in number of articles of time. It is calculated as

$$\text{Relative Growth Rate (RGR)} = \frac{\text{Log}_{e\,2}W - \text{Log}_{e\,1}W}{2^T - 1^T}$$

Doubling Time

Doubling time is the amount of time it takes for a given quantity to double in size or value at a constant growth rate. There exists a direct equivalence between the relative growth rate and the doubling time. If the number of articles of a subject doubles during a given period then the difference between the logarithms of numbers at the beginning and end of this period must be the logarithms of number 2. If natural logarithm is used this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval can be calculated by the following formula:

$$\text{Doubling time (Dt)} = \frac{0.693}{R}$$

Table 2 displays the relative growth rate and doubling time of hemophilia literature output from 2003-2017. The lowest relative growth rate (RGR) for hemophilia literature was in 2006 with RGR of 0.07 and the highest was in 2013 with RGR of 7.47. The RGR shows an increasing trend throughout the study period except few years which had a fluctuating trend.

Table – 2: Relative Growth Rate and Doubling Time

Year	No. of Records	Cumulative	W1	W2	RGR	Doubling Time
2003	725	725	0	6.59	0	0
2004	776	1501	6.59	7.31	0.73	0.95
2005	690	2191	7.31	7.69	0.38	1.83
2006	778	2969	7.69	8.00	0.30	2.28
2007	855	3824	8.00	8.25	0.25	2.74
2008	930	4754	1.00	8.47	7.47	0.09
2009	869	5623	8.47	8.63	0.17	4.13
2010	908	6531	8.63	8.78	0.15	4.63
2011	972	7503	8.78	8.92	0.14	4.99
2012	1095	8598	8.92	9.06	0.14	5.09
2013	998	9596	2.00	9.17	7.17	0.10
2014	950	10546	9.17	9.26	0.09	7.34
2015	998	11544	9.26	9.35	0.09	7.66
2016	1010	12554	9.35	9.44	0.08	8.26
2017	949	13503	9.44	9.51	0.07	9.51
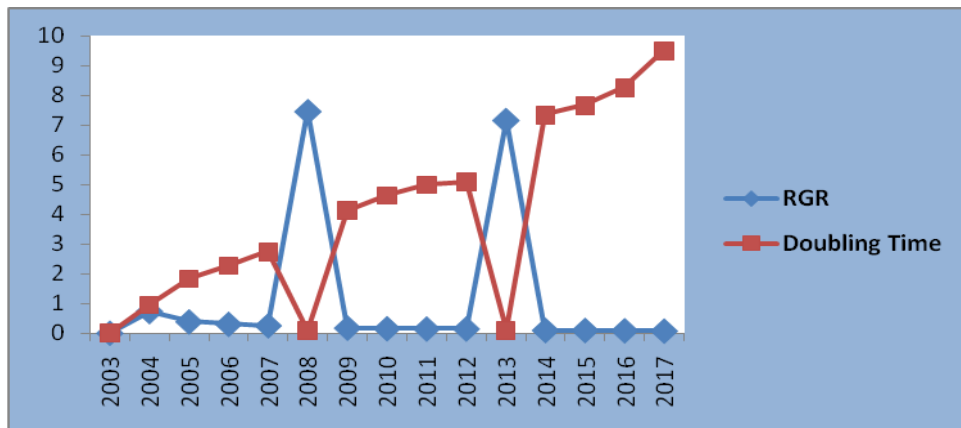
Figure-2: Relative Growth Rate and Doubling Time

Document Type

An analysis of data according to the publication type indicates that there were eleven types of Publications, namely, articles, reviews, Letters, Note, Book chapters, conference papers, Editorial, short surveys, Erratum, article in press and books. The document type of the published and cited documents with their citations is depicted in Table 3. It is found that the most popular document type in Hemophilia Research literature is articles 7753 (57.42%) followed by Reviews 2587 (19.1%), Letter 1123 (8.32%), Note 503 (3.73%), Book chapter 43 (3.23%), conference paper 400 (2.96%), Editorials 393 (2.91%), and Short Survey 183 (1.36%). Other types of documents like Erratum, article in press, erratum, and book series were all below 1% of total publications.

Table – 3: Distribution of literature by document types

Sl. No	Channels of Communication	No. of Records	Cumulative No. of Records	% age	Cumulative % age
1.	Articles	7753	7753	57.42	57.42
2.	Reviews	2587	10340	19.16	76.58
3.	Letters	1123	11463	8.32	84.9
4.	Note	503	11966	3.73	88.63
5.	Book Chapters	436	12402	3.23	91.86
6.	Conference Papers	400	12802	2.96	94.82
7.	Editorial	393	13195	2.91	97.73
8.	Short Surveys	183	13378	1.36	99.09
9.	Erratum	61	13439	0.45	99.54
10.	Article in Press	42	13481	0.31	99.85
11.	Books	22	13503	0.15	100.00
Total		**13503**		**100.00**	

Authorship pattern

Table 4 shows that highest number of papers is collaborative research in the field of hemophilia disease for the period of 2003-2017. The analysis shows that majority of the publications were more than six authors, followed by single authored papers (2495), two authored papers (1956), three authored papers (1654), four authored papers (1650), five

authored papers (1377). The least number of publications (1187) were published by six authors.

Table – 4:Year-wise Productivity Pattern of Authors in hemophilia, 2003-2017

Year	No. of Docs with Single Author	No. of Docs with Double Authors	No. of Docs with Three Authors	No. of Docs with Four Authors	No. of Docs with Five Authors	No. of Docs with Six Authors	No. of Docs with More than Six Authors	Total
2003	224	91	83	81	67	54	125	**725**
2004	207	112	87	108	76	51	135	**776**
2005	174	109	80	69	64	56	137	**690**
2006	188	131	97	83	65	53	161	**778**
2007	177	132	119	111	91	66	159	**855**
2008	189	157	115	109	96	77	187	**930**
2009	145	126	107	109	104	80	198	**869**
2010	180	169	116	112	79	72	180	**908**
2011	128	144	126	108	115	88	253	**972**
2012	202	159	147	151	94	107	235	**1095**
2013	151	130	112	125	104	108	268	**998**
2014	152	107	131	124	103	95	238	**950**
2015	141	135	122	121	95	109	275	**998**
2016	133	136	126	130	107	92	286	**1010**
2017	104	118	116	109	117	79	306	**949**
Total	**2495**	**1956**	**1684**	**1650**	**1377**	**1187**	**3143**	**13503**

Degree of Collaboration

In order to determine the strength of Collaboration (DC), the following formula Suggested by **Subramanyam** (1984) has been employed. The degree of collaboration in different years calculated as per the equation proposed by Subramanyam is presented in Table 5 and it shows that the degree of collaboration ranges from 0691 to 0.96. The mean value is found to be 0.810.

$$DC= \frac{Nm}{Nm + Ns}$$

Table – 5: Degree of Collaboration among Authors

Year	NS	NM	(NS+NM)	DC
2003	224	501	725	0.691
2004	207	569	776	0.733
2005	174	516	690	0.748
2006	188	590	778	0.758
2007	177	678	855	0.793
2008	189	741	930	0.797
2009	145	724	869	0.833
2010	180	728	908	0.802
2011	128	844	972	0.868
2012	202	893	1095	0.816
2013	151	847	998	0.849
2014	152	798	950	0.840
2015	141	857	998	0.859
2016	133	877	1010	0.868
2017	104	845	949	0.890

DC= Degree of Collaboration; **NM**= Number of Multi authored papers; **NS**= Number of Single authored papers; **NS**+**NM**= Number of Single authored papers+ Number of Multi authored papers

Co-Authorship Index (CAI)

Co-Authorship Index **(CAI)** is obtained by calculating proportionately the Publication by single, two and multi authored papers.

$$CAI = \frac{N_{ij}/N_{io}}{N_{oj}/N_{oo}} * 100$$

Where,

N_{ij} =Number of papers having authors in block I

N_{io} =Total output of block I

N_{oj} = Number of papers having J authors for all blocks.

N_{oo} =Total number of papers for all authors and all blocks

To calculating the co-authorship index for authors based on their publications. For this study, the authors have been classified into three blocks. *Vs* Single, Two and multiple authors and period of the study during the period 2003-2017.

Table – 6:Co-Authorship Index among Authors

Year	Single Author	CAI	Two Authors	CAI	More than Two Authors	CAI	Total
2003	224	167.21	91	86.65	410	84.36	**725**
2004	207	144.37	112	99.64	457	87.85	**776**
2005	174	136.48	109	109.05	406	87.77	**690**
2006	188	130.78	131	116.24	459	88.01	**778**
2007	177	112.04	132	106.58	546	95.26	**855**
2008	189	109.99	157	116.54	584	93.67	**930**
2009	145	90.30	126	100.09	598	102.65	**869**
2010	180	107.29	169	128.49	559	91.84	**908**
2011	128	71.27	144	102.27	690	105.89	**972**
2012	202	99.84	159	100.24	734	99.99	**1095**
2013	151	81.89	130	89.92	717	107.17	**998**
2014	152	86.59	107	77.75	691	108.50	**950**
2015	141	76.46	135	93.38	722	107.92	**998**
2016	133	71.27	136	92.96	741	109.44	**1010**
2017	104	59.31	118	85.84	727	114.28	**949**
Total	**2495**		**1956**		**9052**		**13503**

Most Productive Journals

Table 7 describes that the largest number of papers (2722 papers,) are published by "Haemophilia" followed by 631 papers in "Journal of Thrombosis And Haemostasis", 376

papers in "blood", 279 papers on Thrombosis And Haemostasis, 240 papers on Blood Coagulation And Fibrinolysis, 234 papers on Seminars In Thrombosis And Hemostasis, 225 papers on Hamostaseologie, 214 papers on the journal of Thrombosis Research, British Journal of Haematology (163 papers), Molecular Therapy (120 papers) and Blood Transfusion (113 papers).

Table- 7: List of Most productive global level journals on Hemophilia

Sl. no	Source Title	Total papers	Percentage	Impact Factor
1.	Haemophilia	2722	20.16	3.569
2.	Journal of Thrombosis And Haemostasis	631	4.67	5.287
3.	Blood	376	2.78	13.164
4.	Thrombosis And Haemostasis	279	2.07	5.760
5.	Blood Coagulation And Fibrinolysis	240	1.78	1.367
6.	Seminars In Thrombosis And Hemostasis	234	1.73	3.629
7.	Hamostaseologie	225	1.67	1.828
8.	Thrombosis Research	214	1.58	2.650
9.	British Journal of Haematology	163	1.21	5.67
10.	Molecular Therapy	120	0.89	6.688
11.	Blood Transfusion	113	0.84	1.607
12.	Haematologica	84	0.62	7.702
13.	Seminars In Hematology	80	0.59	4.042
14.	European Journal of Haematology	75	0.56	2.653
15.	American Journal of Hematology	73	0.54	5.275

Most Productive Authors

The authorship study determines data related to individual author productivity which is useful to determining the status of the author among his/her co-workers within a field. Fifteen authors have been identified as most productive authors who have published 88 or more research papers in Hemophilia (Table 8). These 15 authors together contributed 1849 papers with an average of 13.69 papers per author during 2003-2017. Eight authors

have published higher number of papers than the group average (13.69). They are: Oldenburg, J with 212 papers, followed by Franchini, M. (189 papers), Santagostino, E. (160 papers), Fischer, K. (159 papers), Berntorp, E. (152 papers), Mannucci, P.M. (137 papers), Morfini, M. (108 papers) and Lillicrap, D. has published 101 papers. Other authors were contributed less than hundred papers.

Table - 8: Most Productive Authors

Sl. No	Author Name	Address	Total Papers	Rank
1.	Oldenburg, J.	University Clinic Bonn, Germany	212	1
2.	Franchini, M.	Department of Hematology and Transfusion Medicine, Carlo Poma Hospital, Mantova, Italy	189	2
3.	Santagostino, E.	Maggiore Hospital Policlinico and University of Milan, Italy	160	3
4.	Fischer, K.	Julius Center for Health Sciences and Primary Care, Utrecht, Netherlands	159	4
5.	Berntorp, E.	Centre for Thrombosis and Haemostasis, Skane University Hospital, Sweden	152	5
6.	Mannucci, P.M.	Angelo Bianchi Bonomi Hemophilia and Thrombosis Center, Milan, Italy	137	6
7.	Morfini, M.	Italian Association of Haemophilia Centres (AICE), Florence, Italy	108	7
8.	Lillicrap, D.	Department of Pathology and Molecular Medicine, Queen's University, Kingston	101	8
9.	Peyvandi, F.	Angelo Bianchi Bonomi Hemophilia and Thrombosis Center, Milan, Italy	95	9
10.	Ghosh, K.	Surat Raktadan Kendra and Research Centre, Surat, India	91	10
11.	Iorio, A.	Department of Health Research, McMaster University, Hamilton, Canada	91	10
12.	Rodriguez-Merchan, E.C.	Department of Orthopedic Surgery, La Paz University Hospital, Madrid, Spain	89	12
13.	Valentino, L.A.	Rush University Medical Center, Chicago, United States	89	12
14.	Gringeri, A.	Baxalta Innovations GmbH, Vienna, Austria	88	14
15.	Hermans, C.	Haemophilia Clinic Saint-Luc University Hospital, Brussels, Belgium	88	14

Subject wise Research Output

Table 9 depicts that subject –wise distribution of research output in Hemophilia. It was observed that 11889 papers are published in the subject of Medicine, followed by 1770 papers Biochemistry, Genetics and Molecular Biology, Pharmacology, Toxicology and Pharmaceutics (864 papers), Immunology and Microbiology (789 papers), Nursing (146 papers), Health Professions (125 papers), Dentistry (124 papers), Agricultural and Biological Sciences (123 papers) and Engineering subjects have 103 papers.

Table-9: Distribution of Research Output Subject wise

Sl. No	Subject Areas	No. of Records	Percent
1.	Medicine	11889	71.26
2.	Biochemistry, Genetics and Molecular Biology	1770	10.61
3.	Pharmacology, Toxicology and Pharmaceutics	864	5.18
4.	Immunology and Microbiology	789	4.73
5.	Nursing	146	0.88
6.	Health Professions	125	0.75
7.	Dentistry	124	0.74
8.	Agricultural and Biological Sciences	123	0.74
9.	Engineering	103	0.62
10.	Chemical Engineering	94	0.56
11.	Social Sciences	84	0.50
12.	Multidisciplinary	83	0.50
13.	Neuroscience	68	0.41
14.	Chemistry	53	0.32
15.	Computer Science	50	0.30
16.	Mathematics	40	0.24
17.	Psychology	38	0.23
18.	Environmental Science	30	0.18
19.	Materials Science	30	0.18
20.	Arts and Humanities	19	0.11
21.	Physics and Astronomy	15	0.09
22.	Economics, Econometrics and Finance	14	0.08
23.	Business, Management and Accounting	13	0.08
24.	Decision Sciences	7	0.04
25.	Energy	1	0.01
26.	Veterinary	59	0.35
27.	Undefined	54	0.32
	Total	**16685**	**100.00**

Institutional Affiliation of authors

The scientific research is carried out by different types of organisation. They include academic institutions like Universities, Colleges, and Others like research institute, industrial organisation, and R&D centers and so on. In order to ascertain the contributor from the different types of organisation or institution, the institutional affiliation of the author was examined and analyzed. Table 10 displays that Institution –wise distribution of research output in Hemophilia. It was observed from the table 10, "Ospedale Maggiore Policlinico Milano" contributed 359 papers, followed by "University Medical Center Utrecht" (339 papers), "UCL" (326 papers), "Universita degli Studi di Milano" (280 papers), Malmo University Hospital (276 papers), The University of North Carolina at Chapel Hill (255 papers) and IRCCS Foundation Rome (254 papers). Rest of the institutions was contributed less than 250 papers.

Table - 10: Distribution of Research Output on Institution-wise

Sl. No	Affiliation	No. of Records
1.	Ospedale Maggiore Policlinico Milano, Italy	359
2.	University Medical Center Utrecht, Netherlands	339
3.	UCL, London	326
4.	Universita degli Studi di Milano, Italy	280
5.	Malmo University Hospital, Sweden	276
6.	The University of North Carolina at Chapel Hill, USA	255
7.	IRCCS Foundation, Rome	254
8.	Van Creveld Haemophilia Clinic, Netherlands	238
9.	Hospital Universitario La Paz, Spain	229
10.	Novo Nordisk AS, Denmark	227
11.	Lunds Universitet, Sweden	222
12.	Hospital for Sick Children University of Toronto, Canada	208
13.	University of Toronto, Canada	203
14.	The Children's Hospital of Philadelphia, USA	199
15.	McMaster University, Canada	172

Language-wise distribution of publications

Table 11 depicts the language -wise distribution of publications. Scientists have contributed more predominantly in English than any other languages.

Table 11: Language-wise distribution of publications

Language	No. of papers	Percentage	Language	No. of papers	Percentage
English	12299	90.10	Korean	7	0.05
German	285	2.09	Slovenian	7	0.05
French	228	1.67	Slovak	6	0.04
Chinese	170	1.25	Arabic	4	0.03
Spanish	144	1.05	Bulgarian	4	0.03
Japanese	120	0.88	Norwegian	4	0.03
Russian	91	0.67	Swedish	4	0.03
Polish	79	0.58	Ukrainian	3	0.02
Italian	39	0.29	Lithuanian	2	0.01
Dutch	33	0.24	Serbian	2	0.01
Czech	32	0.23	Bosnian	1	0.01
Turkish	25	0.18	Danish	1	0.01
Croatian	18	0.13	Hebrew	1	0.01
Portuguese	18	0.13	Romanian	1	0.01
Persian	11	0.08	Catalan	1	0.01
Hungarian	10	0.07	**Total**	**13650**	**100.0**

Country-wise Research Output

Research publications are clearly one of the quantitative measures for the basic research activity in a country. It must be added, however, that what excites the common man as well as the scientific community, are the peaks of scientific and technological achievement, not just the statistics on publications. Table 12 shows the country-wise distribution of Hemophilia research productivity in the world. United States is the highly productive country in the world with 3986 papers followed by United Kingdom (1438 papers), Germany (1169 papers), Italy (1167 papers), Canada (798 papers), France (739 papers), Netherlands (677 papers), Spain (58 papers), Japan (521 papers) and India has contributed 505 papers and other countries have contributed less than five hundred.

Table-12: Research Output on Country – wise

Country	No. of Papers	Percentage	Country	No. of Papers	Percentage
United States	3986	29.52	Denmark	317	1.99
UK	1438	10.65	Iran	295	1.80
Germany	1169	8.66	Belgium	269	1.61
Italy	1167	8.64	Austria	243	1.58
Canada	798	5.91	Turkey	218	1.53
France	739	5.47	Brazil	214	1.44
Netherlands	677	5.01	Poland	207	1.14
Spain	568	4.21	Switzerland	195	0.90
Japan	521	3.86	Israel	154	0.83
India	*505*	*3.74*	South Korea	121	0.82
Sweden	499	3.70	Russian Federation	112	0.74
China	344	2.55	Greece	111	1.99
Australia	324	2.40	Taiwan	100	1.80

Discussion and Conclusion

The scientific study on hemophilia based on SCOPUS database shows that USA is the major producer of scientific output with 3986 authorships to its credit in this field. Growth of the literature peaked during 2003-2017 indicates that the sudden impetus has been received for the research during this period. Ospedale Maggiore Policlinico Milano from Italy is in the forefront in this field with 359 authorships followed by University Medical Center Utrecht (Netherlands) with 339 authorships. More than half of the publications were published in the journals with high impact factors is suggestive of the publication behaviour of scientists who preferred to publish their papers in highly reputed journals. The identification of 7753 (57.42%) article documents has important implications for scientists, since a literature search in the field would be incomplete without considering this type of source. While English was the main language of publication (90.10%), documents published in German were visible with 2.09%. The subject content of the documents was mainly focused on Medicine, Biochemistry, Genetics & Molecular Biology

and Pharmacology, Toxicology & Pharmaceutics. In this study, corporate sources corresponded mainly to academic and government institutions. Overall, main institutions were easily concentrated among two or three per country; however, Canada, Netherlands, Sweden and USA had a more scattered distribution. An in-depth analysis of this situation may lead to the emergence of indicators needed by science policy analysts and researchers in the field. India's contribution to the global research output is just 3.74 percent. Given the growing incidence of the disease, it is necessary to enhance research on the hemophilia. Funding agencies should formulate policies to foster the research and developments between India and developing countries in this filed.

References

1. Barboza, L. A., & Ghisi, N. C. (2018). Evaluating the current state of the art of Huntington disease research: a scientometric analysis. *Brazilian Journal of Medical and Biological Research*, 51(3).

2. Gupta and Adarsh Bala (2013), "Alzheimer's disease Research in India: A Scientometric Analysis of Publications Output during 2002-11," *Research in Neurology: An International Journal*, Article ID 204542.

3. Gupta, B. M., & Bala, A. (2013). Parkinson's disease in India: an analysis of publications output during 2002-2011. *International Journal of Nutrition, Pharmacology, Neurological Diseases*, 3(3), 254.

4. Hertzel, D. H. (1987). History of the development of ideas in bibliometrics. Encyclopedia of library and information sciences, 42(Supplement 7), 144-219.

5. Jeyshankar R, and Vellaichamy A, (2016). Scientometric Analysis of Autism Research Output during 2007-2011. *SRELS Journal of Information Management*, 53(1), 55-63.

6. Jeyshankar, R., & Vellaichamy, A. (2015). Research Productivity of Lung Cancer by Indian Scientists during 1984-2013. *Productivity*, 56 (1), 24.

7. Mahapatra, M. (1985). On the validity of the theory of exponential growth of scientific literature. *IN: Proceedings of the 15th IASLIC Conference, Bangalore* (pp.61-70).

8. Nilsson, I. M. (1994). Haemophilia--then and now. *Sydsvenska medicinhistoriska sallskapets arsskrift,* 31, 33-52.

9. Patra, S.K. and Bhattacharya, P. (2005), Bibliometric study of cancer research in India. *DESIDOC Bulletin of Information Technology*, 25 (2), 11-18.

10. Peyvandi, F., Garagiola, I., & Young, G. (2016). The past and future of haemophilia: diagnosis, treatments, and its complications. *The Lancet,* 388(10040), 187-197.

11. Rangarajan, S., Walsh, L., Lester, W., Perry, D., Madan, B., Laffan, M., ... & Pasi, K. J. (2017). AAV5–factor VIII gene transfer in severe hemophilia *A. New England Journal of Medicine*, 377(26), 2519-2530.

12. Roosendaal, G., & Lafeber, F. (2007). Prophylactic treatment for prevention of joint disease in hemophilia-cost versus benefit. *New England Journal of Medicine*. 357 (6): 603–605.

13. Subramnyam K. (1983).Bibliometric studies of research collaboration: a review. *Journal of information Science*, 6 (1) 33-38.

14. Van den Berg, H. Marijke (2017-12-09). "A Cure for Hemophilia within Reach". *New England Journal of Medicine.* 2592-2593.

15. Vellaichamy, A & Jeyshankar R, (2014). Anemia Research in India: A bibliometric analysis of publications output during 1993–2013. *Library Philosophy and Practice (e-journal).* Paper 1058.

16. Vellaichamy, A., & Jeyshankar, R. (2015). Dengue research in India and China: A comparative study using bibliometrics. *International Journal of Library Science and Information Management*, 1(1), 1-9.