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AUTHORSHIP AND COLLABORATION PATTERN IN INDIAN JOURNAL OF ANAESTHESIA DURING 2010-2019: AN EVALUATIVE STUDY

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Abstract

This evaluative study analyses the authorship and collaborative research activity in Indian Journal of Anaesthesia for the period of 2010-2019.The collected data are examined with the help of Collaboration Coefficient, Authorship Pattern and Activity Index. Total 2274 articles published during the study period, out of which four authored articles are highest, which is 661.During the 10 years' period, the multi- authorship articles are gradually increased than solo research. The study reveals that the researcher in Anaesthesia are more fond of team research than individual research. In the study it has been found that the average collaboration index is 3.37, average collaboration coefficient is 0.61, average degree of collaboration is 0.88, average relative growth rate is 0.61 and average doubling time is 3.96 during the study period 2010-2019. The highest activity index is found for Indian articles is 198.00 for the year 2010. The highest world activity index is observed for the year 2019and it is 199.23 and lowest is found for two consecutive years 2010 and 2011 which is 89.12.

Keyword: Collaboration Index, Collaboration coefficient, Modified collaboration coefficient, Relative Growth Rate, Authorship Pattern, Activity Index, Doubling Time, Indian Journal of Anaesthesia.

Introduction

Collaboration is a way to provide co-authorship and giving formal acknowledgement for jointly published research article. From the very beginning of science, collaboration exist in scientific discipline. But recently, with the development of ICT collaboration gets more momentum among various stream of science and technology. Today, collaborative research activity and participating authorship for sharing resources, ideas, and expertise among researcher in organization or individual become a popular strategy. Collaboration is also considered as an opportunity to intensify the capability, to produce more produc tive and quality output. However, the extent of collaboration and their growth pattern is varied from one discipline to another and one country to another country. In recent time, collaboration become a smart practice among expert in various disciplines who contributed together for interdisciplinary research activity.

Indian Journal of Anaesthesia (IJA)

The Indian Journal of Anaesthesia (IJA**)** was first founded in the year 1953 by Dr. M.C Gungly. Dr. M.C. Ganguly was the first editor of this journal. IJA is the official scientific journal of the Indian Society of Anaesthesiologists. This journal is peer-reviewed and published scholarly articles in the field of Anaesthesia. Up to 2014 it was published six volumes per year but from 2015 I IJA published monthly. In the beginning its scope was limited only to Indian author but today its' scope cover international contributors. The primary goal of IJA is to provide a platform to exchange ideas, views, and information.

Literature Review

Savanur & Srikanth (2010) devised modified collaborative coefficient which is considered a new method to measure degree of collaboration in the field of research. In his study, the researcher presents a simple modified collaboration coefficient and discusses many mathematical measurements for collaboration coefficient. The author mention that if modified collaborative coefficient tends to 1 then the degree of collaboration become maximum and collaboration is 100%.

Heydari & Safavi (2012) conducted a study to determine the collaborative coefficient of authors of articles in "Journal of Research in Medical Sciences" published from 2007 to 2011. The study was cross-sectional. The society of research included all articles published in the "Journal of Research in Medical Sciences" from 2007 to 2011. Total 250 nos of articles written by 1020 authors were collected and found that average nos of authors for each was 4.08±1.94. Among all the authors 35.39% were female and average collaborative coefficient was 0.71.

Heydari & Safavi (2013) conducted a research to define collaborative coefficient of articles published in Iranian Journal of Pathology during 2006-2012. For this study, the researcher collected total 288 articles with 1078 authors published during the study period. The average no of author was 3.75±1.65 and among all articles published in the stipulated period three authored articles were maximum. The study revealed that in the year 2008 average collaborative coefficient was found and it was 0.69 and collaboration pattern was also high during this period.

Garg& Dwiedi (2014) inspect the collaboration pattern in the discipline of Japanese Encephalitis, The researchers took 2074 articles indexed in Science Citation Index published by various countries in the said discipline during 1991-2010. The study stated that Japanese Encephalitis is a highly collaborative discipline as judged by the values of co-authorship index and the collaborative coefficient for different countries and different sub-fields. Of the total published papers, about two-third were written in collaboration. Among all articles considered for study,214 (10 %) were written with local collaboration, 700 (34 %) with domestic collaboration and 478 (23 %) with international collaboration. Among all the countries, USA is the most important partner country for all the collaborating countries. The study indicates that the share of collaborative papers increased almost four times in 2001-2010 as compared to 1991-2000. USA, Japan, Taiwan and India produced about 70 % of domestically co-authored papers. USA also had the largest number (21 %) of the internationally co-authored articles. Among 17 highly collaborative institutions, the highest (six) are from India, and Liverpool University (UK) had the highest number of internationally collaborative papers, followed by Centre of Disease Control and Prevention (USA).

Singh (2017) scrutinize the trends of authorship and collaboration research activity in Biotechnology in IBSA (India, Brazil, and South Africa) countries. The researcher collected 24888 articles from Scopus database for the year 2007-2016 and analysed. The author applied different scientometric tools among which: collaboration coefficient, Authorship pattern and Activity Index was main. During the study, the researcher found that, multi-authored articles are higher than single authored article. In terms of Activity Index, it is found that South Africa occupy 1st position among India and Brazil. It is followed by India as 2nd and Brazil 3rd position in activity index. The study reveals that average number of authors per articles for India was 4.92. The collaboration coefficient was 0.63 for India during the stipulated study period. The

relative growth rate was found decreasing but corresponding doubling time was increasing during the study period. The study also states the fact that majority of the researcher published articles in collaboration than individual. In terms of analysing Activity Index, the researcher found that Highest activity Index found for the year 2009 with107.04 while lowest activity index was found for the year 2013 with 84.42.

Mondal & Jana (2018) studied the authorship pattern & collaborative trends in published articles in leading Indian LIS journals during 2012-2017 in LIS domain of India.The author study the collaborative authorship trend by using different parameters like journal wise pattern, year wise collaboration, co-authorship index, ranked list of most productive authors and the level of collaboration. The author also applies Lotka's law on author productivity to confirm the applicability of the law to the present data set. The study reveals that two-authored papers are predominant (48%) in LIS publications and the collaborated articles of multi-authorships received greater average citations. Besides, in Indian LIS discipline, maximum collaboration occurs in intra-institutional level and inter-institutions within state level. Therefore, it is recommended that the LIS schools across the country should also consider interdepartmental collaboration to produce more quality works on emerging and innovative research areas.

Objectives of the Study

The main objectives of the study is to:

1. know the year wise publication distribution pattern.
2. measure the collaborative index, collaboration coefficient, degree of collaboration and modified collaboration coefficient in IJA.
3. measure the activity Index.
4. find out authorship pattern.
5. know the relative growth rate and doubling time.

Methodology

The current study based on 2,274 articles published in Indian Journal of Anaesthesia (IJA)between the year 2010 -2019. To collect the data print form of IJA is collected and some volumes are downloaded from IJA website. Then the extracted data are processed and analysed using MS -Excel. The extracted data were administered to know different aspects such as collaboration Index (CI),Collaboration Coefficient(CC), Modified Collaboration Coefficient(MCC), Degree of Collaboration(DC) and relative growth rate etc with the help of respected equations.

Analysis of Data

Year wise Distribution of Publication

Table 1 and Figure 1 shows the year wise distribution of Indian Journal of Anaesthesia during the period of 2010-2019. The data reveals that there are total 2,247 articles published during the study period. Maximum 263(11.70%) no of articles published in the year 2010,it is followed by 253(11.24%) articles in the year 2016 which is the second highest publications, 3rd highest publication of article is seen in the year2019 which is 247(10.99%). The lowest publication of article is counted for the year 2012 which is 179(7.96%).

Table:1 Year wise Distribution of Publication

Sl. No	Year	No of Total Articles	%
1	2010	263	11.70
2	2011	200	8.90
3	2012	179	7.96
4	2013	186	8.27
5	2014	231	10.28
6	2015	238	10.59
7	2016	253	11.25
8	2017	233	10.36
9	2018	244	10.85
10	2019	247	10.99
	Total	2,274	100.00

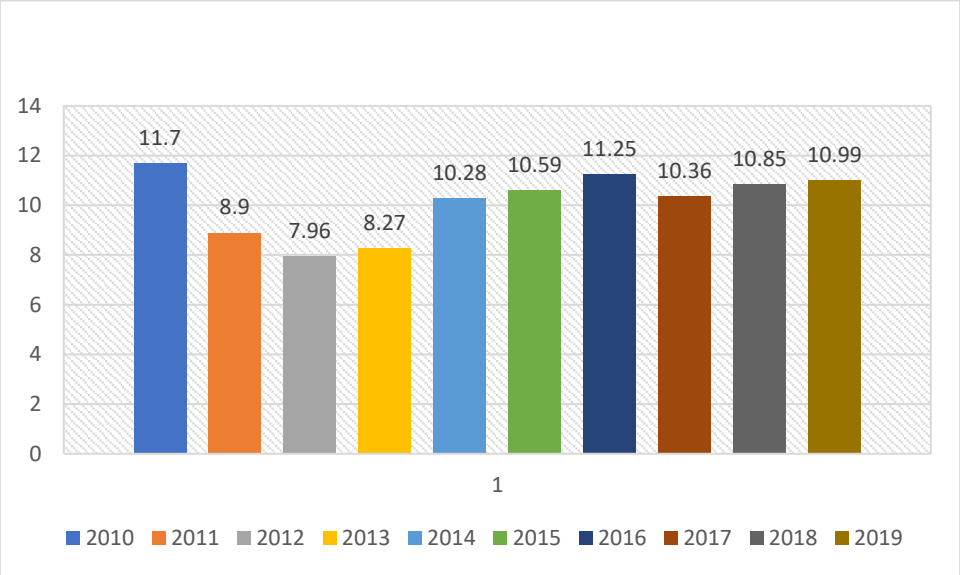


Fig: 1 Year wise distribution of publication

Year wise Authorship distribution of Publication

Table 2 depicts the year wise authorship distribution of publication published in IJA during the period of study and reveals that highest 95 articles published in the year 2015 by four authors, highest 52 articles published in the year 2010 by two authors, highest 39 articles published in the year 2010 by single authors, highest 62 articles published in the year 2010 and 2014 by three authors, Highest 35 articles published in the year 2014 by five authors, highest 21 articles published in the year 2019 by six authors, highest 6 articles published in the year 2018 by seven authors,

Table:2 Year wise Authorship distribution of Publication

Year	Authored article	

	single	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
2010	39	52	62	69	25	14	0	2	0	0	0	0	0	0	0	263
2011	33	32	48	54	22	10	1	0	0	0	1	0	0	0	0	200
2012	33	38	40	34	20	6	4	2	1	1	0	0	0	0	0	179
2013	26	44	29	51	23	11	1	0	1	0	0	0	0	0	0	186
2014	22	48	62	53	35	10	1	0	0	0	0	0	0	0	0	231
2015	24	41	56	95	10	10	1	1	0	0	0	0	0	0	0	238
2016	21	46	58	78	25	17	2	2	0	0	0	0	1	2	1	253
2017	24	40	46	63	29	22	2	4	1	1	0	0	0	0	0	233
2018	27	39	55	75	25	15	6	2	0	0	0	0	0	0	0	244
2019	26	22	52	90	30	21	3	1	1	0	0	0	1	0	0	247
Total	274	402	508	661	244	136	21	14	4	2	1	0	2	2	1	2274

Collaboration Index (CI)

Table 3 shows the collaboration index of publications published during the study period. The average collaboration Index is 3.37 has been counted for the study period 2010-2019. The highest CI is found for the year 2019 which is 3.69 and the lowest CI 3.15 is found for the year 2010.

The collaboration Index (CI) counted by the formula which is suggested by the Lawani (1980) as

$$\text{CI:}\frac{\sum_{j=1}^{A} jfj}{N}$$

Where,

j = the number authors in an article i.e. 1, 2, 3 ……

fj = the number of j authored articles

N = the total number of articles published in a year, and

A = the total number of authors per articles

Hence, table 3 is calculated by the using above formula thus:

CI for 2010 is

$$\text{CI}=\frac{\sum_{j=1}^{A} jfj}{N}$$

$$=\frac{(1\times39)+(2\times52)+(3\times62)+(4\times69)+(5\times25)+(6\times14)+(8\times2)}{263}$$

$$=\frac{830}{263}$$

$$= 3.15$$

In the similar way we calculate the CI for the corresponding years.

Table 3: Collaboration Index(CI)

Year	Authored article															Total	CI
	Single	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
2010	39	52	62	69	25	14	0	2	0	0	0	0	0	0	0	263	3.15
2011	33	32	48	54	22	10	1	0	0	0	1	0	0	0	0	200	3.22
2012	33	38	40	34	20	6	4	2	1	1	0	0	0	0	0	179	3.15
2013	26	44	29	51	23	11	1	0	1	0	0	0	0	0	0	186	3.23
2014	22	48	62	53	35	10	1	0	0	0	0	0	0	0	0	231	3.28

2015	24	41	56	95	10	10	1	1	0	0	0	0	0	0	0	238	3.27
2016	21	46	58	78	25	17	2	2	0	0	0	0	1	2	1	253	3.60
2017	24	40	46	63	29	22	2	4	1	1	0	0	0	0	0	233	3.63
2018	27	39	55	75	25	15	6	2	0	0	0	0	0	0	0	244	3.45
2019	26	22	52	90	30	21	3	1	1	0	0	0	1	0	0	247	3.69
Total	274	402	508	661	244	136	21	14	4	2	1	0	2	2	1	2274	3.37

Degree of Collaboration (DC)

Table 4 reveals the degree of collaboration during the study period. The average degree of collaboration 0.88 has been counted during the study period. The maximum average degree of collaboration is found for the year 2016 which is 0.91, it is followed by 0.90 for the year 2014. The lowest average degree of collaboration is found for the year 2012 is 0.81.

To count degree of collaboration (DC) we are using the following formula suggested by the Subramanyam (1983) :

$DC=1-\frac{f1}{N}$

In the above formula, f1=the number of single authored article

N= the number of total articles published in a year

Hence, $DC=1-\frac{f1}{N}$

$=1-\frac{39}{263}$

$=1-.14$

$=0.86$

In the similar way, the value of Degree of Collaboration (DC) is calculated for all corresponding years,

Table: 4 Degree of collaboration

Year	Single Authored article	Multiple authored article	Total	Degree of Collaboration
2010	39	224	263	0.86
2011	33	167	200	0.83
2012	33	146	179	0.81
2013	26	160	186	0.86
2014	22	209	231	0.90
2015	24	214	234	0.90
2016	21	232	253	0.91
2017	24	209	233	0.89
2018	27	217	244	0.89
2019	26	221	247	0.89
Total	274	2000	2274	0.88

Collaboration Coefficient (CC)

Table 5 is tabulated to give a clear understanding of collaboration coefficient during the study period. The average collaboration coefficient is found 0.61 for the study period 2010 -2019. Highest

collaboration coefficient is found for three consecutive years 2016,2017, and 2019 which is 0.64, and it is followed by 0.62 for two consecutive years 2014 and 2015 and lowest coefficient collaboration is found for the year 2012 with 0.56.

The collaboration coefficient (CC) counted by using the following formula suggested by Ajiferuke et al. (1998) :

$$CC=1-\frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}$$

In the above formula,

j=the number of authors in an article i.e.1,2,3…..

fj=the number of j authored articles

N=the total number of articles published in a year, and

A= the total number of authors per articles

Thus, Collaboration coefficient (CC) is calculated for table 5 by using the above formula:

CC for 2010 is

$$CC=1-\frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}$$

$$=1-\frac{\left(\frac{1}{1}\times 39\right)+\left(\frac{1}{2}\times 52\right)+\left(\frac{1}{3}\times 62\right)+\left(\frac{1}{4}\times 69\right)+\left(\frac{1}{5}\times 25\right)+\left(\frac{1}{6}\times 14\right)+\left(\frac{1}{8}\times 2\right)}{263}$$

$$=1-\frac{(39)+(26)+(20.67)+(17.25)+(5)+(2.33)+(.25)}{263}$$

$$=1-\frac{110.5}{263}$$

$$= 1- 0.42$$

$$= 0.58$$

In the similar way, the value of CC is calculated for all corresponding years.

Table:5 Collaboration Coefficient (CC)

Year	Authored article															Total	Collaboration coefficient(CC)
	single	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
2010	39	52	62	69	25	14	0	2	0	0	0	0	0	0	0	263	0.58
2011	33	32	48	54	22	10	1	0	0	0	1	0	0	0	0	200	0.58
2012	33	38	40	34	20	6	4	2	1	1	0	0	0	0	0	179	0 .56
2013	26	44	29	51	23	11	1	0	1	0	0	0	0	0	0	186	0.59
2014	22	48	62	53	35	10	1	0	0	0	0	0	0	0	0	231	0.62
2015	24	41	56	95	10	10	1	1	0	0	0	0	0	0	0	238	0.62
2016	21	46	58	78	25	17	2	2	0	0	0	0	1	2	1	253	0.64
2017	24	40	46	63	29	22	2	4	1	1	0	0	0	0	0	233	0.64
2018	27	39	55	75	25	15	6	2	0	0	0	0	0	0	0	244	0.63
2019	26	22	52	90	30	21	3	1	1	0	0	0	1	0	0	247	0.64
Total	274	402	508	661	244	136	21	14	4	2	1	0	2	2	1	2274	0.61

Modified Collaboration Coefficient (MCC)

Table 6 has been created to give a clear understanding of of modified collaboration coefficient during the study period. The average modified collaboration coefficient is 0.61 has been counted during the year 2010-2019. The highest modified collaboration is counted for the year 2016, it is followed by the year 2017 and 2019 with 0.64 and the lowest modified collaboration coefficient is found for the year 2012 with 0.56.

Modified collaborative coefficient(MCC) is calculated by using the following formula suggested by Savanur and Srikanth (2010) :

$$MCC=\left(\frac{N}{N-1}\right)\left\{1-\frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}\right\}$$

Thus, the table 6 is calculated by using the above formula

$$MCC=\left(\frac{N}{N-1}\right)\left\{1-\frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}\right\}$$

$$=\left(\frac{263}{262}\right)\left\{1-\frac{\left(\frac{1}{1}\times 39\right)+\left(\frac{1}{2}\times 52\right)+\left(\frac{1}{3}\times 62\right)+\left(\frac{1}{4}\times 69\right)+\left(\frac{1}{5}\times 25\right)+\left(\frac{1}{6}\times 14\right)+\left(\frac{1}{8}\times 2\right)}{263}\right\}$$

$$=(1.00)\left\{1-\frac{110.5}{263}\right\}$$

$$=(1.00)\{1-0.42\}$$

$$=1.00\times 0.58$$

$$=0.58$$

Similarly, the value of MCC is calculated for all corresponding years.

Table-6: Modified Collaboration Coefficient (MCC)

Year	Authored article															Total	Modified Collaboration coefficient(MCC)
	single	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
2010	39	52	62	69	25	14	0	2	0	0	0	0	0	0	0	263	0.58
2011	33	32	48	54	22	10	1	0	0	0	1	0	0	0	0	200	0.58
2012	33	38	40	34	20	6	4	2	1	1	0	0	0	0	0	179	0 .56
2013	26	44	29	51	23	11	1	0	1	0	0	0	0	0	0	186	0.59
2014	22	48	62	53	35	10	1	0	0	0	0	0	0	0	0	231	0.62
2015	24	41	56	95	10	10	1	1	0	0	0	0	0	0	0	238	0.62
2016	21	46	58	78	25	17	2	2	0	0	0	0	1	2	1	253	0.65
2017	24	40	46	63	29	22	2	4	1	1	0	0	0	0	0	233	0.64
2018	27	39	55	75	25	15	6	2	0	0	0	0	0	0	0	244	0.63
2019	26	22	52	90	30	21	3	1	1	0	0	0	1	0	0	247	0.64
Total	274	402	508	661	244	136	21	14	4	2	1	0	2	2	1	2274	0.61

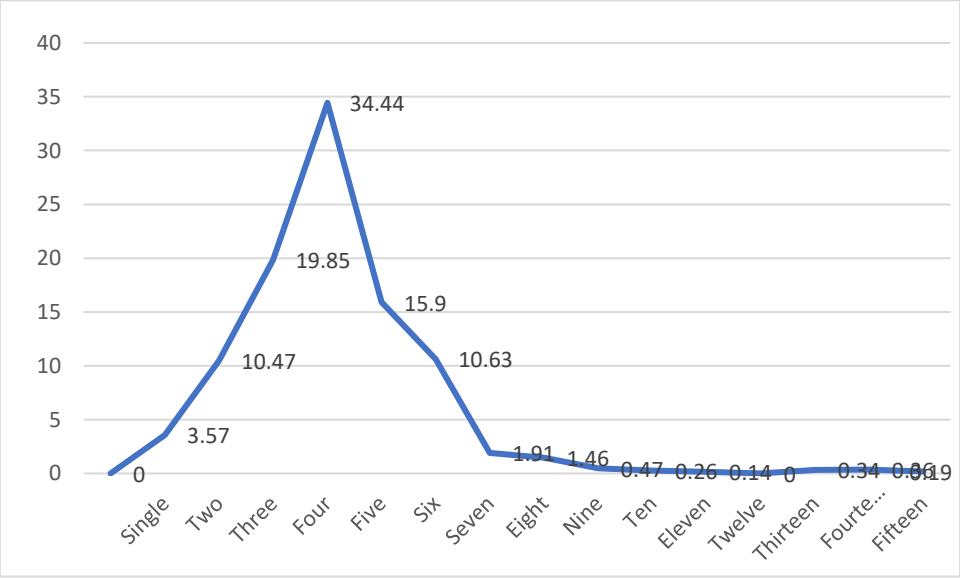
Authorship pattern

Table 7 and Graph 1 shows the authorship pattern of publication which is published during the study period. The authorship pattern shows that 274 (3.57%) singled authors published 274

(12.04%) articles while 2644(34.44%) four authors published 661(29.07%) articles which covers highest percent of the publication during the period 2010-2019. It reveals that four authorship pattern dominates on other authorship patterns. It also shows that multiple authorship pattern covers few authorship and articles during the study period.

Table7: Authorship pattern

Sl No	Number of authors	No. of articles	Total no of Authors	Percentage (%) of articles	Percentage of (%) of authors
1	Single	274	274	12.04	3.57
2	Two	402	804	17.68	10.47
3	Three	508	1524	22.34	19.85
4	Four	661	2644	29.07	34.44
5	Five	244	1220	10.73	15.9
6	Six	136	816	5.98	10.63
7	Seven	21	147	0.92	1.91
8	Eight	14	112	0.61	1.46
9	Nine	4	36	0.17	0.47
10	Ten	2	20	0.09	0.26
11	Eleven	1	11	0.04	0.14
12	Twelve	0	0	0	0
13	Thirteen	2	26	0.09	0.34
14	Fourteen	2	28	0.09	0.36
15	Fifteen	1	15	0.04	0.19
Total		2274	7677	100.00	100.00



Graph 1: Authorship Pattern

Relative Growth Rate and Double Time of Publication

Table 8 and graph 2 depicts the picture of relative growth rate and doubling time of publications published in Indian Journal of Anaesthesia during 2010-201. "The growth rate of publication is counted on the basis of RGR(Relative Growth Rate) and Dt(Doubling Time) model which was introduced by Mahapatra in the year 1985." It is observed from the table that relative growth rate decrease from 0.57 to 0.12 from 2010 to 2019. The mean relative growth rate for first four years during 2010 -2013 is 0.37, it is followed by 0.29 for three years 2017-2019, and the least growth rate is seen for the years 2014-2016which is 0.21 only. From this observation it is clear that there is a difference in comparison to the 1st and 3rd block with the middle block. The corresponding doubling time(dt) for different years are gradually increasing from 1.21 to 5.78 from 2010 to 2019. The mean rate of doubling time(dt) for the first four years is 1.15. Remaining two blocks for three years has been considered within a three year time span and it increased from 1.15 to 3.96 from 2010 to 2019. The rate of relative growth rate is decreasing when corresponding doubling time is increasing during the stipulated study period.

Following formula is used to calculate the relative growth rate and doubling time

$$RGR=\frac{W2-W1}{T2-T1}$$

In this formula,

RGR= growth rate over the specific period of the interval.

W1= Loge (natural log of the initial number of contributions)

W2= Loge ((natural log of the final number of contributions)

T1= the unit of initial time

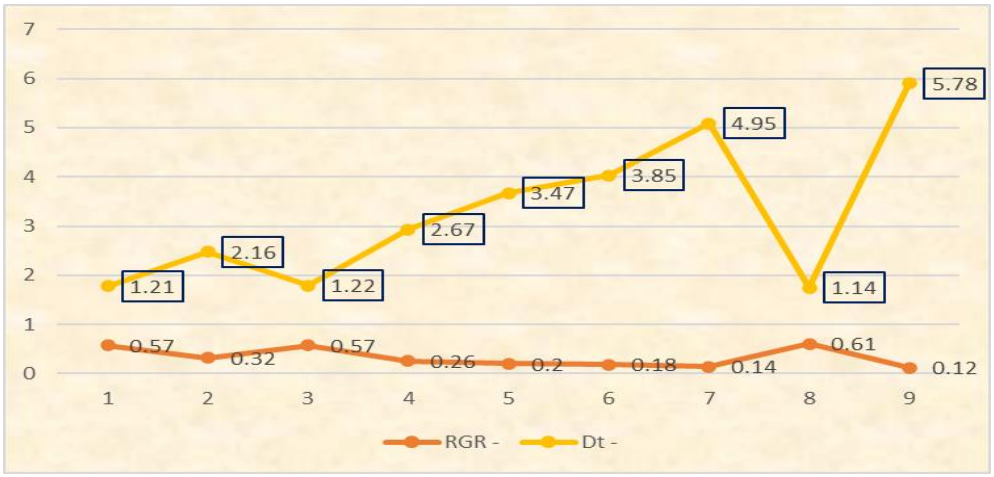
T2 = the unit of final time

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

Here, R= Growth Rate.

Table 8: Relative Growth Rate and Double Time of Publication

Year	No of articles	Cumulative no of articles	Log1e	Log2e	RGR	Mean RGR	Dt	Mean Dt
2010	263	263	0	5.57	-	-	-	1.15
2011	200	463	5.57	6.14	0.57		1.21	
2012	179	642	6.14	6.46	0.32	0.37	2.16	
2013	186	828	6.14	6.71	0.57		1.22	
2014	231	1059	6.71	6.97	0.26	0.21	2.67	3.33
2015	238	1297	6.97	7.17	0.20		3.47	
2016	253	1550	7.17	7.35	0.18		3.85	
2017	233	1783	7.35	7.49	0.14	0.29	4.95	3.96
2018	244	2027	7.49	7.61	0.61		1.14	
2019	247	2274	7.61	7.73	0.12		5.78	



Graph 2: Relative growth rate and double time of publication

Activity Index

Table 9 shows the activity index of the publications during the study period 2010 -2019.Activity index is counted based on publications which published by Indian authored articles and world authored articles in Indian Journal of Anaesthesia during the study period. Activity Index describe the relative research efforts in each discipline of research. The highest activity index is found for Indian articles is 198.00 for the year 2010. The highest world activity index is observed for the year 2019and it is 199.23 and lowest is found for two consecutive years 2010 and 2011 which is 89.12

Braun (1986) suggested a formula to count activity index, which is used here to count activity index,

AI=$\{(Ii/Io)/(Wi/Wo)\} \times 100$

In this formula, Ii=Indian output in the year i

Io=Total Indian Output

Wi =World Output in the Year i

Wo= Total Output

Table 9: Activity Index

Year	No. of articles (India only)	No. of Articles world	Total no of Articles	Activity Index (India)	Activity Index(world)
2010	257	06	263	198.00	89.12
2011	194	06	200	76.89	89.12
2012	170	09	179	167.09	102.00
2013	174	12	186	98.00	193.00
2014	219	12	231	172.09	193.00
2015	231	07	238	176.23	90.00
2016	242	11	253	187.04	98.00
2017	221	12	233	170.87	193.00
2018	230	14	244	174.34	187.30
2019	219	28	247	172.09	199.23
Total	2157	117	2274	100.00	100.00

Major Findings:

The major findings and results found on the basis of data analysis and computation are as follows:

1. Total 2,247 articles published during the study period. Maximum 263(11.70%) no of articles published in the year 2010,it is followed by 253(11.24%) articles in the year 2016 which is the second highest publications, 3rd highest publication of article is seen in the year2019 which is 247(10.99%). The lowest publication of article is counted for the year 2012 which is 179(7.96%).
2. During the study period, highest 95 articles published in the year 2015 by four authors, highest 52 articles published in the year 2010 by two authors, highest 39 articles published in the year 2010 by single authors, highest 62 articles published in the year 2010 and 2014 by three authors, Highest 35 articles published in the year 2014 by five authors, highest 21 articles published in the year 2019 by six authors, highest 6 articles published in the year 2018 by seven authors,
3. The maximum average degree of collaboration is found for the year 2016 which is 0.91, it is followed by 0.90 for the year 2014. The lowest average degree of collaboration is found for the year 2012 is 0.81.
4. Highest collaboration coefficient is found for three consecutive years 2016,2017, and 2019 which is 0.64, and it is followed by 0.62 for two consecutive years 2014 and 2015 and lowest coefficient collaboration is found for the year 2012 with 0.56.
5. The highest modified collaboration is counted for the year 2016, it is followed by the year 2017 and 2019 with 0.64 and the lowest modified collaboration coefficient is found for the year 2012 with 0.56.
6. The authorship pattern shows that 274 (3.57%) singled authors published 274 (12.04%) articles while 2644(34.44%) four authors published 661(29.07%) articles which covers highest percent of the publication during the period 2010-2019. It reveals that four authorship pattern dominates on other authorship patterns.
7. The data reveals that relative growth rate decrease from 0.57 to 0.12 from 2010 to 2019. The mean relative growth rate for first four years during 2010 -2013 is 0.37, it is followed by 0.29 for three years 2017-2019, and the least growth rate is seen for the years 2014-2016which is 0.21.
8. The highest activity index is found for Indian articles is 198.00 for the year 2010. The highest world activity index is observed for the year 2019and it is 199.23 and lowest is found for two consecutive years 2010 and 2011 which is 89.12.

Conclusion

The main aim of present study is to investigate the authorship trend and collaboration pattern for the publication appeared in Indian Journal of Anaesthesia during 2010-2019.In recent time increasing global communication made possible in collaborative research activity. So many bibliometric and Scientometric studies conducted on collaboration and authorship pattern prevalent in various stream. The present study established the fact that researcher prefer collaborative productive activity than individual research.

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