

Publication Pattern and Research Collaboration of Forensic Medicine During 1989-2016

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Abstract - The study examines the publication productivity of Forensic Medicine output during 1989-2016. The growth of the publications, RGR and Dt of the research output, Collaboration of authors, Collaborative co-efficient etc. in the study. The result of the study found that publications growth rate between 11 (0.26%) in 1989 and 447 (10.76%) in 201. The largest output in was found 447 publications in 2013. It is found the DC between 0.64 and 0.94 and overall DC measured to be 23.08 throughout study period. The study could be found DC was an increased and a decreased trend appeared in the whole study period. Value n in the field of Forensic Medicine is being analysed, it has calculated the exponential growth is $n = 4.4320914$ for author.

Keywords: Forensic Medicine, Relative Growth Rate (RGR), Doubling time (Dt), Degree of Collaboration (DC), Collaborative Co-efficient (CC), Collaborative Index (CI)

1. Introduction

Forensic Medicine today is a large medical field that includes many sub areas. However, generally, when one speaks or thinks about it, one associates it immediately with death, autopsies, and related problems. Yet, this is only part of legal medicine, as new approaches and sub specialties are realized because of the advances in medical sciences and socio-political changes around the world. Forensic anthropology and clinical Forensic Medicine are perhaps the best examples of these “New Sciences.”

The origin of Forensic Medicine remains lost in a distant past, whenever the principles of medical sciences met those of law and justice.¹⁻² Perhaps it began with the Code of Hammurabi (1792–1750 BCE), which imposed sanctions for errors in medical and surgical practices. The same type of punishment also existed in Persia.

Forensic dissections of bodies began in the 13th century at the University of Bologna in Italy by a surgeon and teacher of anatomy, Saliceto³. Surprisingly, these forensic dissections appeared before the hospital autopsies that started by the end of the 19th century with Rokitansky, Virchow, and the advent of the pathogenesis of diseases and cellular pathology.

However, some authors⁴ consider the French surgeon AmbrosioParé, who in 1575 began a real scientific period in France, the father of legal medicine. This paternity is divided with

Zacchia, the Pope's physician, who taught in Italy and wrote in 1601 what can be considered the first medicolegal textbook.

Measuring and analysing science, technology and innovation. Major research issues include the measurement of impact, reference sets of articles to investigate the impact of journals and institutes, understanding of scientific citations, mapping scientific fields and the production of indicators for use in policy and management contexts. In practice there is a significant overlap between Scientometrics and other scientific fields such as Bibliometrics, information systems, information science and science of science policy.

2. Review of Literature

Shankar Reddy Kollé and T. H. Shankarappa. (2016),⁵ examined the coverage of Indian medical literature in MEDLINE was not comprehensive and this affects visibility of Indian medical research output. So Indian Council of Medical Research (ICMR) launched IndMed and MedInd. There are no studies investigating the coverage, the services and the gaps in coverage of IndMed. Subramanyam, Krishnamurthy and Asundi. (2016),⁶ discussed the growth of research work in the field of social sciences and humanities in Odisha during the period 1996 to 2015. The analysis has been done taking into account the publication output of Odisha as reflected in Scopus database. Baskaran, C. (2015),⁷ examined the confront the publications output trend among USA scientists, Wang Y has secured top level as measured 0.226%. USA scientists have contributed totally 15832 (30.815%) items and include 87.947% percent are appeared as journal articles. Harvard University scientists are much attention in produced large number of research papers and they hold top level among research collaboration in enzyme research. Sivakami, N and Baskaran, C. (2016),⁸ examined the Swine Flu is that, unlike seasonal flu, which is typically most dangerous to the very young, elderly and those with a weakened immune system. By keeping this in mind the researcher intends to study the research productivity of Swine Flu. This study attempts to analyze the performance of researcher working in the field of swine flu at global level and country wise distribution during the study period of 23 years from 1991 to 2013. Baskaran, C. (2016),⁹ explored the relative growth rate and doubling time of Bioinformatics Publication during 1999-2013. The mean relative growth was measures and doubling time observed from the analysis. Total number 20577 of records on bioinformatics publication during the study. The Maximum of Publications 2234 in 2012 was published compare to rest of the years. Ramesh Babu, P and Baskaran, C. (2017),¹⁰ analyzed the highest out of Forensic Medicine research Forensic Medicine research in 2013 was 447 (11.05 %) of the publications, followed by 420 (10.38%) of the publication brought out in 2015. the doubling time of the publications also a fluctuate trend appears whole study period. It could be found that the highest Dt. is 17.32 in 1993.

3. Objectives of the Study

- To know the year-wise distribution of Forensic Medicine research output from Web of Science (WOS) PubMed database.
- To examine Relative Growth Rate (RGR) and Doubling time (Dt) of publications on Forensic Medicine from Web of Science (WOS) database.
- To analyze the Degree of Collaboration of authors and Measuring of Collaboration of the authors.
- To analyze the Exponential Growth for authors and Activity Index

4. Methodology

The study analysed the impact of the publications in Forensic Medicine research at the global prospective. The study explores the research contribution of the countries growth and their trends have been investigated during 1989 - 2016. The present study attempts to extract the data of Web of Science (WOS) database. Totally 4152 records were retrieved from Web of Science (WOS) database during the period of study. The publications have been extracted the Web of Science (WOS) data on Forensic Medicine was covered during 1989 - 2016. Data exported in Excel sheets according to various parameters needed for study. Then all the indicators quality, quantity consistency for countries, institution, authors, journal etc. were exported on excel sheets.

5. Data Analysis

5.1 Year –wise distribution of the Publications on Forensic Medicine (WOS)

It is analyzed the research growth of Forensic Medicine records retrieved from Web of Science (WOS) database during 1989 - 2016. The result of the study found that publications growth rate between 11 (0.26%) in 1989 and 447 (10.76%) in 201. Table 1 is observed the largest output in was found 447 publications in 2013. It is followed by 420 (10.38%) of the publication identified in 2015. There were no record published in the year 2003. Further, It could be found that publications growth is appeared a fluctuated trend in 1992, 1997, 2002, 2011 and 2014

Table 1- Year –wise distribution of the Publications on Forensic Medicine (WOS)

Year	No. of output	%	Cumulative %
1989	11	0.26	0.26
1990	17	0.40	0.66
1991	47	1.13	2.82
1992	43	1.02	3.9
1993	45	1.08	4.98
1994	45	1.08	6.23
1995	52	1.25	7.69
1996	61	1.45	8.94
1997	52	1.25	10.61
1998	69	1.66	12.18
1999	66	1.58	13.84
2000	69	1.66	15.98
2001	89	2.14	18
2002	84	2.02	18
2003	0	0	0
2004	82	1.97	19.97
2005	100	2.40	22.37
2006	101	2.42	24.79
2007	143	3.44	28.23
2008	148	3.56	31.79
2009	277	6.67	38.46
2010	308	7.41	45.87
2011	287	6.91	52.78
2012	294	7.08	59.86

2013	447	10.76	70.62
2014	365	8.79	79.41
2015	420	10.11	89.65
2016	430	10.35	100
Total	4152	100	

5.2 - Relative Growth Rate (RGR) and Doubling time (Dt) of the Publications(WOS)

Relative Growth Rate (RGR) and Doubling time (Dt) of the publications in Forensic Medicine have retrieved from Web of Science database during 1989 - 2016. It is analyzed Table 2. RGR shows a fluctuates trend appeared between 0.02 and 1.02 in 2005, 2006 and 1991 respectively. Twenty three years out of the whole study observed that RGR less than 1. Similarly, fig.2 indicates the Doubling Time of the publications also seems that a fluctuated trend throughout the study period and there was observed the highest Dt was 34.65 in 2016. However, it could be analyzed from the discussion; range of RGR was measured between 0.02 and 1.02 in the year 2016 and 1991 respectively, whereas the range of Dt was found between 1.1 and 34.65 in the year 2009 and 2016 respectively during the study period, it is also indicated in Fig.2.

Table 2-Relative Growth Rate (RGR) and Doubling time (Dt) of the Publications(WOS)

Year	No. of output	%	W1	W2	$R(A) = \frac{W2-W1}{T2-T1}$	$Dt. = \frac{0.693}{R(A)}$
1989	11	0.26	0	2.39	0	0
1990	17	0.40	2.39	2.83	0.44	1.57
1991	47	1.13	2.83	3.85	1.02	0.69
1992	43	1.02	3.85	3.76	0.09	7.7
1993	45	1.08	3.76	3.80	0.04	17.32
1994	45	1.08	3.80	3.80	0	0
1995	52	1.25	3.80	3.95	0.15	4.62
1996	61	1.45	3.95	4.11	0.16	4.33
1997	52	1.25	4.11	3.95	0.16	4.33
1998	69	1.66	3.95	4.23	0.28	2.47
1999	66	1.58	4.23	4.18	0.05	13.86
2000	69	1.66	4.18	4.23	0.05	13.86
2001	89	2.14	4.23	4.48	0.25	2.77
2002	84	2.02	4.48	4.43	0.05	13.86
2003	0	0	0	0	0	0
2004	82	1.97	4.43	4.40	0.03	2.31
2005	100	2.40	4.40	4.60	0.2	3.46
2006	101	2.42	4.60	4.61	0.2	3.46
2007	143	3.44	4.61	4.96	0.35	1.38
2008	148	3.56	4.96	4.99	0.03	23.1
2009	277	6.67	4.99	5.62	0.63	1.1
2010	308	7.41	5.62	5.73	0.31	2.23
2011	287	6.91	5.73	5.65	0.08	8.66
2012	294	7.08	5.65	5.68	0.03	23.1
2013	447	10.76	5.68	6.10	0.42	1.65
2014	365	8.79	6.10	5.89	0.21	3.3
2015	420	10.11	5.89	6.04	0.15	4.63
2016	430	10.35	6.04	6.06	0.02	34.65
Total	4152	100	118.24	124.32	5.4	200.41

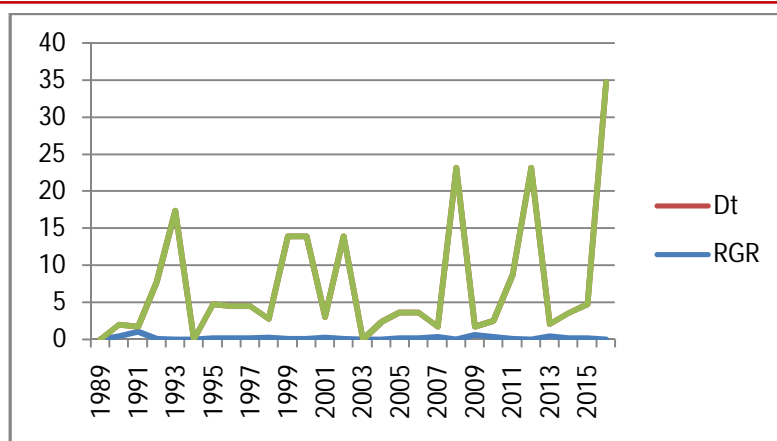


Fig 2- Relative Growth Rate (RGR) and Doubling time (Dt) of the Publications (WOS)

5.3 Degree of Collaboration of authors

Table 3 is observed the degree of collaboration in different years calculated as per the Subramanian formulae and it reflects that degree of collaboration of the authors for twenty eight years between 1989 and 2016. Normally where we can find the more quantum of papers appeared on Multi authors than single authors. It found the DC between 0.64 and 0.94 and overall DC measured to be 23.08 throughout study period. The study could be found DC was an increased and a decreased trend appeared in the whole study period.

Table 3- Degree of Collaboration of authors

Year	Single Authored (NS)	Multi Authored (Nm)	Total No. of authored (NS+ Nm)	Degree of Collaboration
1989	1	10	11	0.90
1990	2	15	17	0.88
1991	6	41	47	0.87
1992	5	38	43	0.88
1993	6	39	45	0.86
1994	11	34	45	0.75
1995	12	40	62	0.64
1996	9	52	61	0.85
1997	10	42	52	0.80
1998	9	60	69	0.86
1999	6	60	66	0.90
2000	20	49	69	0.71
2001	16	73	89	0.82
2002	20	64	84	0.76
2003	0	0	0	0
2004	19	63	82	0.76
2005	18	82	100	0.82
2006	23	78	101	0.77
2007	18	125	143	0.87
2008	11	137	148	0.92
2009	18	259	277	0.93
2010	15	283	298	0.94
2011	16	271	287	0.94
2012	20	274	294	0.93
2013	35	412	447	0.92

2014	21	344	365	0.94
2015	26	394	420	0.93
2016	29	401	430	0.93
Total	402	3750	4152	23.08

5.4 Collaborative Index (CI)

Table 4 shows total number of single and multiple authored publications were contributed the research output of 373 and 3349 respectively. It is noted from Table 10, the values of CI was measured between 0.04 and 5.56 in the year 2014 and 2009 respectively. It is analyzed range of collaborative Index between 0.01 and 5.56 appeared in 1998 and 2009 respectively. It is witnessed that whole growth of CI was a fluctuated trend during the study period.

Table 4- Collaborative Index (CI)

Year	Single Authored	Multi Authored	Total No. of authored	CI
1989	1	10	11	0.08
1990	2	15	17	1.06
1991	6	41	47	0.01
1992	5	38	43	1.05
1993	6	39	45	1.05
1994	11	34	45	0.02
1995	12	40	62	0.02
1996	9	52	61	1.38
1997	10	42	52	1.90
1998	9	60	69	0.01
1999	6	60	66	0.08
2000	20	49	69	0.03
2001	16	73	89	1.75
2002	20	64	84	2.50
2003	0	0	0	0
2004	19	63	82	2.41
2005	18	82	100	1.15
2006	23	78	101	2.36
2007	18	125	143	1.15
2008	11	137	148	0.06
2009	18	259	277	5.56
2010	15	283	298	4.24
2011	16	271	287	0.04
2012	20	274	294	0.05
2013	35	412	447	0.06
2014	21	344	365	0.04
2015	26	394	420	0.05
2016	29	401	430	1.09
Total	402	3750	4152	29.2

5.5 Collaborative Co-efficient (CC)

It is analyzed that the Collaborative Co-efficient of the authors for publications sharing in Forensic Medicine. Table 5 examines that CI growth trend was witnessed an increased and a decreased trend during the period of study. The CC values measured between 9.87 in 2016 and 6.15 in 1995 and 1995, the whole CC is observed as 230.26 during the period of study

Table 5- Collaborative Co-efficient (CC)

Year	Single Authored	Multi Authored	Total No. of authored	CC
1989	1	10	11	9.09
1990	2	15	17	8.82
1991	6	41	47	8.72
1992	5	38	43	8.83
1993	6	39	45	8.61
1994	11	34	45	7.52
1995	12	40	62	6.45
1996	9	52	61	6.45
1997	10	42	52	8.02
1998	9	60	69	8.61
1999	6	60	66	9.01
2000	20	49	69	7.12
2001	16	73	89	8.26
2002	20	64	84	7.60
2003	0	0	0	0
2004	19	63	82	7.65
2005	18	82	100	8.29
2006	23	78	101	7.78
2007	18	125	143	8.72
2008	11	137	148	9.21
2009	18	259	277	9.33
2010	15	283	298	9.42
2011	16	271	287	9.47
2012	20	274	294	9.33
2013	35	412	447	9.26
2014	21	344	365	9.45
2015	26	394	420	9.37
2016	29	401	430	9.87
Total	402	3750	4152	230.26

5.6 Modified Collaborative Co-efficient (MCC)

The equation is not defined for the trivial case when A = 1, which is not a problem since collaboration is meaningless unless at least two authors are available. CC approaches MCC only when A but is otherwise strictly less than MCC by the factor 1/A.

$$MCC = \frac{A \{1 - \sum_{j=1}^A (1/j) f_j\}}{A-1} \quad N$$

It is analysed that Modified Collaborative Co-efficient of authors have contributed publications in Forensic Medicine. Table 6 examined the MCC was witnessed that an increased and suddenly appeared a decreased trend during the period of study. The values of MCC were noticed that 0.02 in 1989 and 1.94 in 2016. It also happened to be the whole MCC measured as 11.16 during period of study.

Table 6- Modified Collaborative Co-efficient (MCC)

Year	Single Authored	Multi Authored	Total No. of authored	MCC
1989	1	10	11	0.02
1990	2	15	17	0.04
1991	6	41	47	0.12
1992	5	38	43	0.11
1993	6	39	45	0.12
1994	11	34	45	0.12
1995	12	40	62	0.16
1996	9	52	61	0.16
1997	10	42	52	0.13
1998	9	60	69	0.13
1999	6	60	66	0.17
2000	20	49	69	0.18
2001	16	73	89	0.23
2002	20	64	84	0.22
2003	0	0	0	0
2004	19	63	82	0.22
2005	18	82	100	0.26
2006	23	78	101	0.27
2007	18	125	143	0.38
2008	11	137	148	0.39
2009	18	259	277	0.74
2010	15	283	298	0.80
2011	16	271	287	0.77
2012	20	274	294	0.78
2013	35	412	447	1.20
2014	21	344	365	0.98
2015	26	394	420	1.12
2016	29	401	430	1.94
Total	402	3750	4152	11.16

5.7 Exponential Growth for authors in Forensic Medicine research

Value n in the field of Forensic Medicine is being analysed, it has calculated the exponential growth is $n = 4.4320914$ for author data is presented in Table 7. It shows the calculation for exponent of the author productivity as given below the formulas.

$$\begin{aligned}
 N &= \frac{N \sum xy - \sum x \sum y}{N \sum x^2 - (\sum x)^2} \\
 &= \frac{22 \times 278.83 - 64.81 \times 131.89}{22 \times 129.62 - 64.81 \times 64.81} \\
 &= \frac{800499.76}{180614.45} \\
 &= 4.4320914
 \end{aligned}$$

Table 7- Exponential Growth for authors in Forensic Medicine research

No.of articles (X)	Observed (Y)	X=log (X)	Y=log (Y)	XY	X ²
1	1345	0	7.20	0	0
2	1142	0.69	7.04	4.85	1.38
3	984	1.09	6.89	7.51	2.18
4	902	1.38	6.80	9.38	2.76
5	887	1.60	6.78	10.84	3.20
6	834	1.79	6.72	12.04	3.58
7	764	1.94	6.63	12.86	3.88
8	712	2.07	6.56	13.57	4.14
9	684	2.19	6.52	14.27	4.38
10	602	2.30	6.40	14.72	4.60
11	542	2.39	6.29	15.03	4.78
12	424	2.48	6.04	14.97	4.96
13	312	2.56	5.74	14.69	5.12
14	204	2.63	5.31	13.96	5.26
15	197	2.70	5.28	14.25	5.40
16	168	2.77	5.12	14.18	5.54
17	112	2.83	4.71	13.32	5.66
18	97	2.89	4.57	13.20	5.78
19	86	2.94	4.54	13.34	5.88
20	52	2.99	3.95	11.81	5.98
21	32	3.04	3.46	10.51	6.08
22	18	3.09	2.89	8.93	6.18
23	12	3.13	2.48	7.76	6.26
24	9	3.17	2.19	6.94	6.34
25	3	3.21	1.09	3.49	6.42
31	2	3.48	0.693	2.41	6.96
32	1	3.46	0	0	6.92
Total		64.81	131.89	278.83	129.62

5.8 Year- wise activity Index of Forensic Medicine research output

It is analysed that growth of B was found to be an increasing and a decreasing trend perform in the whole study period. Table 8 shows the whole Activity Index (A) was measured from Indian Output 0.84 in throughout study period. It is found that activity index of world output in Forensic Medicine (B) was an increasing and a decreasing trend in whole study period. It is indicated the year-wise analysis of Activity Index AI was higher than an average (AI>1on the over period over 28years (1989 – 2016).

It could be discussed that Activity Index noted in the year-wise analysis of Indian output and World output on Forensic Medicine. It is witnessed that whole Activity Index could be found between 1 and 11, also activity trend is appear a fluctuated trend during 1989-2016.

Table 8- Year- wise Activity Index of Forensic Medicine research output

YEAR	INDIAN OUTPUT	(A)	WORLD OUTPUT	(B)	A/B	AI
1989	4	0.01	11	0.29	0.03	11
1990	5	0.01	17	0.45	0.02	7.
1991	8	0.02	47	1.25	0.01	4

1992	7	0.02	43	1.15	0.01	4
1993	9	0.03	45	1.2	0.02	7
1994	6	0.02	45	1.2	0.01	4
1995	9	0.03	52	1.39	0.02	7
1996	8	0.02	61	1.69	0.01	4
1997	9	0.03	52	1.2	0.02	7
1998	8	0.02	69	1.85	0.01	4
1999	9	0.03	66	1.77	0.01	4
2000	9	0.03	69	1.85	0.01	4
2001	7	0.02	89	2.39	0.008	3
2002	7	0.02	84	2.35	0.008	3
2003	0	0	0	0	0	0
2004	9	0.03	82	2.2	0.01	4
2005	8	0.02	100	2.68	0.007	3
2006	10	0.03	101	2.71	0.01	4
2007	13	0.04	143	3.84	0.01	4
2008	11	0.04	148	3.95	0.01	4
2009	13	0.04	277	7.44	0.005	2
2010	12	0.04	308	8.27	0.004	1
2011	17	0.06	287	7.71	0.007	3
2012	11	0.04	294	8.89	0.004	1
2013	13	0.04	447	12	0.003	1
2014	15	0.05	365	9.8	0.005	2
2015	16	0.05	420	11.28	0.004	1
2016	15	0.05	430	12.16	0.004	1
Total	268	0.84	4152	12.96	0.279	103

6. Findings & Conclusion

The study analysed the publication pattern of Forensic Medicine and there applied scientometric tools during 1989-2016. The highest Dt was observed at 13.86 in 2002. It also seems the lowest Dt found to be 0.32 in the year of 2015. It is also could find overall RGR was 9.12 and Dt was 172.42 in the whole study period. The values of CI were measured between 0.04 and 5.56 in the year 2014 and 2009 respectively. It is witnessed that whole growth of CI was a fluctuated trend during the study period. CI growth trend was witnessed an increased and a decreased trend during the period of study. The CC values measured between 9.87 in 2016 and 6.15 in 1995 and 1995, the whole CC is observed as 230.26 during the period of study. *The study discussed on the publications trend in terms of author Collaborations and productivity, Source-wise publications, Institutions-wise productivity, citations counting and h-index etc. measured in the field of Forensic Medicine during 1989-2016. The aim of the study deals the medico legal autopsy brings still more medical advantages and benefits. MCC were noticed that 0.02 in 1989 and 1.94 in 2016. It also happened to be the whole MCC measured as 11.16 during the period of study. The study finds that there was witnessed that whole Activity Index could be found between 1 and 11, also activity trend is appear a fluctuated trend during 1989-2016.*

References

1. Kovacevic, S. (1989). Forensic Medicine in Yugoslavia, *J. Forensic Med. Pathol.*
2. Kaye, S. (1992). The rebirth and blooming of Forensic Medicine. *J. Forensic Med. Pathol.*
3. Saukko, P and Knight, B. (2004). Knight's Forensic Pathology, 3rd Ed. *Arnold, London.*
4. Favero, F. (1991). Medicina Legal [in Portuguese], 12th Ed. *Belo Horizonte, Villa Rica.*
5. Shankar Reddy Kalle and Shankarappa, TH. (2016). Scientometric Analysis of Scientific Papers from India (1989-2015) based on WoS Data, *SRELS Journal of Information Management*, 53(6), 2016, DOI:10.17821/srels/2016/v53i6/90091.
6. Subramanyam, N and Krishnamurthy, M. (2017). IndMed : An Evaluative Study on the Coverage of Indian Medical Literature, *SRELS Journal of Information Management*, 54(1), DOI:10.17821/srels/2017/v54i1/101184.
7. Baskaran, C. (2015). Research productivity of enzymes literature: A Scientometric study, *International Journal of Library Science and Information Management*, 1 (2), 17-25.
8. Sivakami, N and Baskaran, C. (2016). Time series analysis of swine flu literature during 1991-2013, *International Journal of Library Science and Information Management*, 2 (1), 38-46.
9. Baskaran, C. (2016). A Scientometric study on Bioinformatics literature during 1999 - 2013, *International Journal of Library Science and Information Management*, 2 (4), 62-71.
10. Ramesh Babu, P and Baskaran, C. (2017). Research Pattern on Forensic Medicine in Global Output: A Scientometric Analysis, *International Journal of Library Science and Information Management*, 2017, 3(1), 53-64.

