Research Publications in the IEEE Transactions on Education: A BibliometricAnalysis

Dr. M. Suresh Babu
Gokaraju Rangaraju Institute of Engineering & Technology
(Autonomous & NAAC A++)
Hyderabad
drsureshsvu@gmail.com

P Gopala Krishna
Department of Information Technology
Gokaraju Rangaraju Institute of Engineering and Technology
Hyderabad
gopalakrishna@griet.ac.in

ABSTRACT: *In the last decade, scientometric studies get momentum due to extensive research activities in the domain. Out of the various kinds of studies, the research on individual journals and their contributions is gaining interest among researchers. We, in this work, have analyzed the 1169 contributions published in the IEEE Transactions on Education for twenty years between 2001 and 2020. An attempt is made to explore and discuss the article, year-wise and volume-wise authorship, the annual growth rate of publications, relative growth rate, doubling time, author's productivity, and the single and multi-authored papers of the journal. The findings of the results revealed that the maximum number of publications ((7.36%) were published in the year 2005, whereas the minimum number (2.91%) were published in the year 2014. The degree of collaboration (DC) ranges, the relative growth rates (RGR), and doubling time (DT) has also been measured. The average number of authors per paper is 2.72, and the average productivity per author is 0.37. The highest number of documents for authors at an average is 3.27, which was published in 2016.*

Keywords: Bibliometrics, Scientometrics, IEEE Transactions on Education, Authorship Pattern; Degree of Collaboration, Relative Growth Rate, Publication Analysis

Received: 5 December 2021, Revised 28 March 2022, Accepted 16 April 2022

DOI: 10.6025/ijis/2022/14/3/79-90

1. Introduction

The proliferation of scientific journals and other scholarly publications has dramatically fostered the evolution of the assessment systems, which translated the practices into well-improved models. The recent advances in altmetrics, peer review metrics, and other article-level metrics have driven the development of the next generation of assessment systems featured with resilient, scalable, reliable, and intelligent services across diverse research institutions.

Quantitative measurement of publications leads to the production of parameters that have been primarily applied and used in evaluating scientific research. However, fully realizing comprehensive and reliable assessment metrics still faces several conceptual and technical challenges:

1. Broadly adopting various metrics models also leads to massive and heterogeneous platforms, bringing enormous values and methodological challenges.

2. The assortment of evaluations poses challenges in reliability and metrics. Specifically, existing information silos across scientific publishing also pose challenges.

3. It is challenging to implement resilient, scalable, and automatic metric models.

Bibliometric or Scientometric analyses of literature in various disciplines have been carried out using either primary journals or secondary sources to examine the quantitative aspects of literature growth in a particular field of knowledge. Scientometric analysis of Scientometric publications is an essential aspect of research endeavors in information science. It could be attributed to the fact that Scientometric studies identify the pattern of publications, authorship, citations, secondary journal coverage, and soon. These factors can give an insight into the dynamics, leading to better information handling and management.

1.1. Source Journal

The scientific assessment systems use a database of a set of journals or a particular journal for taking an extended window to carry out the exercise. The study of individual journals has been carried out extensively in the literature, and we can cite several examples and case studies.

The IEEE Transactions on Education (ToE) started in 1963, and the frequency of the journal is quarterly. For the present research study, the IEEE Transactions on Education was selected as the source journal for four years between 2001 and 2020. The IEEE Transactions on Education publishes significant and original scholarly contributions to education in electrical and electronics engineering, computer engineering, and computer science. Contributions must address the discovery, integration, and application of knowledge in education in these fields.

2. Review Literature

The study of individual journals has been emphasized for more than three decades in scientometric literature. Some of the significant studies are conducted by Arkhipov) (1999)

Rice, Chapin J, Pressman Park and Funkhouser (1996) and by Harper.

The primary purpose of studying individual core journals for assessment is supported by the fact that the distribution of citations over papers is uneven (Seglen 1992). Many scientometiricians accept that scientific progress is made primarily through information in publications acknowledged by a relatively more number of citations (Plomp 1990; Aksnes 2003; Vinkler 2010a, 2017a). As a result, the magazines with strong influence may reveal the relatively highly cited journal papers.

The systematic meta-analysis of Annals of Surgery for ten years concluded that it is more likely to provide conclusive statements than systematic reviews, while LOE and IF failed to do so. The work on systematic reviews and meta-analyses are performed to integrate low-to-moderate levels of evidence (LOE) with the ambition to provide consensus from the included data, and this practice is found to be more meaningful [2,3]

The current study's authors acknowledge the reputation of the Annals of Surgery and recognize the quality and importance of the data published in this top-ranking journal in the respective domains.

Statistical Analyses are significant for organizing metric-based studies when we analyze journal literature. Descriptive statistics were used to determine the association between the study details and the conclusiveness of many studies. The statistical tests are used as appropriate indicators to derive meaningful results [Kim 2017].

The study of individual journals often provides a more precise estimate of the treatment effect when compared to simple pooled analyses used to report results in conventional systematic reviews [Haidich 2010].

The task of evaluating the quantity and quality of the scientific research of an individual specific scientist and scientific publications collectively dates back to the early days. These activities pose challenges, and it is the most significant and, at the same time, the most challenging exercise in science assessment systems with many issues and problems. For many years in many domains, only a qualitative component was used to evaluate scientific activity and achievements. The samples may be from any scientist or researcher in the scientific world, and the mechanism of which was not documented perfectly. The practice of the qualitative assessment of scientific research and scientific achievements has existed for centuries and continues to grow.

By providing a brief and comprehensive review, we begin our research by drawing a single journal for study.

2.1. Purpose of the Research

The specific objectives of the present study are to determine the,

- **Specific analysis** of the individual journal, namely the IEEE Transactions on Education, for a certain period. This practice includes the systematic study of a particular journal using standardized as well as refined indicators.

- **Author Analysis:** The study of the contributions of individuals will enable us to understand and acknowledge the research produced—we, in this work-study, the authors to reward them. The authors' analysis is a regular exercise in scientometric studies.

- **Growth Pattern:** The growth in terms of literature usually is skewed, which we understand from the early studies. However, the rate of change varies from one field to another. The growth is measured using many indicators which provide significance to many variables. Thus, we primarily intend to measure the Annual Growth Rate (AGR), Relative Growth Rate (RGR), and Doubling

Time (DT). Each growth rate measures the volume in different ways.

- **Collaboration:** In scientometric studies, collaboration plays a significant role as cooperation increases productivity and impact. Thus, to document the influence of collaboration, we in this work produce collaboration data not in numbers only but provide different angles.

- **Productivity analysis:** Productivity is a general term that denotes the growth in varying parameters and variables.

3. Methodology

The scientometric data is sourced either from the primary one, which is the direct access from the source, or with the help of the database. For this work we do not rely on any specific database, rather used the source itself.

One thousand one hundred sixty-nine articles were found for the twenty years between 2001 and 2020 for this present study. The required data were collected from the official website of "The IEEE Transactions on Education" at https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=13. The details regarding each published article such as year, volume, issues number, the title of the article, number of authors, page number, etc., were recorded and analyzed for making observations. The retrieved data were analytically added using the Microsoft-Excel package, following the study's objectives, and the data has been presented.

4. Data Analysis and Results

The table-1shows the overall distribution pattern of contributions during the period of 2 011-2020 published in The IEEE Transactions on Education (ToE)

$$AGR = \frac{\textit{End Value-First Value}}{\textit{First Value}} \times 100$$

The growth rate is a measurement that is necessary for any field, meaning the growth of the number of publications in a specific discipline; this is frequently a measure of the annual increase or decrease. Table 2 illustrates the growth rate of publications from

Year	Vol.No.	Issue1	Issue2	Issue3	Issue4	No. of Articles	Percentage	Cumulative Percentage
2001	44	12	25	12	18	67	5.73	5.73
2002	45	18	16	13	13	60	5.13	10.86
2003	46	25	15	16	15	71	6.07	16.94
2004	47	21	20	17	14	72	6.16	23.10
2005	48	23	17	23	23	86	7.36	30.45
2006	49	23	18	11	8	60	5.13	35.58
2007	50	14	9	16	14	53	4.53	40.12
2008	51	19	21	17	10	67	5.73	45.85
2009	52	23	10	17	14	64	5.47	51.32
2010	53	22	20	20	20	82	7.01	58.34
2011	54	21	23	19	21	84	7.19	65.52
2012	55	18	19	17	20	74	6.33	71.85
2013	56	21	11	15	15	62	5.30	77.16
2014	57	10	7	10	7	34	2.91	80.07
2015	58	8	8	10	13	39	3.34	83.40
2016	59	8	9	10	10	37	3.17	86.57
2017	60	11	10	9	8	38	3.25	89.82
2018	61	10	7	12	10	39	3.34	93.16
2019	62	10	9	9	11	39	3.34	96.49
2020	63	10	7	12	12	41	3.51	100
Total		327	281	285	276	1169	100	

It is evident from the above table-1 that the maximum number of publications ((7.36%) were published in the year 2005, whereas the minimum number (2.91%) were published in the year 2014.

Table 1. Overall distribution pattern of contributions

2001 to 2020. Growth of engineering education 2338 records the maximum number of publications in the year 2020 with (96.49%) publications followed by the year 2019 with (93.16%) publications and the least number (5.73%) of

Year	No. of Articles	Percentage	Cumulative growth	Cumulative Percentage	Annual Growth Rate (AGR)
2001	67	5.73	67	5.73	
2002	60	5.13	127	10.86	-0.10
2003	71	6.07	198	16.94	0.18
2004	72	6.16	270	23.1	0.01
2005	86	7.36	356	30.45	0.19
2006	60	5.13	416	35.58	-0.30
2007	53	4.53	469	40.12	-0.12
2008	67	5.73	536	45.85	0.26
2009	64	5.47	600	51.32	-0.04
2010	82	7.01	682	58.34	0.28
2011	84	7.19	766	65.52	0.02
2012	74	6.33	840	71.85	-0.12
2013	62	5.3	902	77.16	-0.16
2014	34	2.91	936	80.07	-0.45
2015	39	3.34	975	83.4	0.15
2016	37	3.17	1012	86.57	-0.05
2017	38	3.25	1050	89.82	0.03
2018	39	3.34	1089	93.16	0.03
2019	39	3.34	1128	96.49	0.00
2020	41	3.51	1169	100	0.05
Total	1169	100	2338		

Table 2. Growth rate of publications

publicationsintheyear2001publications respectively. The maximum annual growth rate is (0.28%).

Relative Growth Rate (RGR)
The Relative Growth Rate (RGR) is the number of articles/ pages per unit of time. This definition is derived from the definition of

relative growth rates in the study of growth analysis of individual plants and effectively applied in the field of Botany Hunt (1919), Blackman (1919) defined, which in turn had its origin from the study of the rate of interest in the financial investment. The mean Relative Growth rate (R) over the specific period of the interval can be calculated from the following equation.

$$W1RGR = \frac{W2}{T2\text{-}T1}$$

W1is log of initial number of articles;

W2 is log of final number of articles after a specific period of interval

T2-T1 is unit difference between the initial time and the final time.

Row Labels	**No. of Articles**	**Cumulative growth**	**W1**	**W2**	**R(p) W2-W1**	**MeanR (p)W2-W1**	**Doubling Time Dt (p)**	**Mean Dt (p)(1-2)**
2001	67	67		4.21	0		0	
2002	60	127	4.21	4.84	0.64		1.08	
2003	71	198	4.84	5.29	0.44		1.56	
2004	72	270	5.29	3.82	-1.47		-0.47	
2005	86	356	3.82	5.60	1.78		0.39	
2006	60	416	5.60	6.03	0.43		1.60	
2007	53	469	6.03	6.15	0.12		5.77	
2008	67	536	6.15	6.28	0.13		5.21	
2009	64	600	6.28	6.40	0.11		6.13	
2010	82	682	6.40	6.53	0.13	0.26	5.41	2.97
2011	84	766	6.53	6.64	0.12		5.97	
2012	74	840	6.64	6.73	0.09		7.53	
2013	62	902	6.73	6.81	0.07		9.62	
2014	34	936	6.81	6.84	0.04		18.73	
2015	39	975	6.84	6.88	0.04		17.33	
2016	37	1012	6.88	6.92	0.04		18.24	
2017	38	1050	6.92	6.96	0.04		18.73	
2018	39	1089	6.96	6.99	0.04		19.25	
2019	39	1128	6.99	7.03	0.03		19.80	
2020	41	1169	7.03	7.06	0.04	0.11	19.25	15.45
Total	1169	2338				**0.37**		**18.41**

Table 3. Relative growth rate and doubling time for contributions

Table- 3 denoted the Relative Growth Rate (RGR) of engineering education for the study period. The maximum RGR value was (1.78%) in the year 2005 and followed by the year1993 with a discount of (0.64%), and the mean average of RGR was (0.26%) in the year 2010. Similarly, the lowest value showed in the years 2019 with (0.03%),2013, 2014, 2015, 2016,2017, 2018, and 2020 with the same value of (0.04%), and the mean average of RGR is (0.11%) in the year 2020). For the study doubling time of publications was calculated by the formula given. The Doubling time is the time required for publications to double size. As observed by Bradford, “Between Relative growth rate and doubling time, there is a direct equivalence.”.

$$Doubling\ Time\ (DT) = \frac{0.693}{RGR}$$

Table 3 is disturbed with the Doubling Time (DT). It was recognized that the maximum DT in the first decade between 2001 to 2010 of 2009 with the value of (6.13%) and a mean value is (2.97%). In the second decade between 2011 to 2020 DT of 2018 and 2020 with a matter of (19.25%) and the mean value was (15.45%). Similarly, the lowest DT was reported in the year2005 with a value of (0.39%). On the whole, it was known that there was also variation in both Relative Growth Rate and Doubling Time during the study period.

Year	Single authored	Percentage	Multi authored	Percentage
2001	19	6.55	48	5.46
2002	23	7.93	37	4.21
2003	27	9.31	44	5.01
2004	24	8.28	48	5.46
2005	26	8.97	60	6.83
2006	16	5.52	44	5.01
2007	13	4.48	40	4.55
2008	18	6.21	49	5.57
2009	9	3.10	55	6.26
2010	21	7.24	61	6.94
2011	16	5.52	68	7.74
2012	14	4.83	60	6.83
2013	11	3.79	51	5.80
2014	7	2.41	27	3.07
2015	6	2.07	33	3.75
2016	7	2.41	30	3.41
2017	9	3.10	29	3.30
2018	7	2.41	32	3.64
2019	9	3.10	30	3.41
2020	8	2.76	33	3.75
	290	100	879	100

No. of Authors	Number of Contributions	% of Records
Single Author	290	24.81
Multiple Authors	879	75.19
Total	1169	100

Table 4. Single Vs. multiple authorship in engineering education research

Table 4 highlights the analysis of a single Vs. the multiple-authored pattern of engineering research productivity observed in this study. Out of a total of 1169 contributions, the maximum number of contributions, i.e. (75.194%), have been contributed by multiple authored and followed by (24.81%) contributions contributed by a single author. The analysis reveals the maximum number of contributions (7.74%) by multiple-authored papers in the year 2011 and the lowest contributions (3.07%) in 2014. It can be shown that there is a decreasing trend towards multiple-authored. Similarly, the maximum number of contributions (9.31%) by a single author in 2002, and the lowest number of contributions (2.07%) in 2015, there is an increasing trend for more than a decade toward single-authored publications.

Year	Single authored	Multi authored	Total	Percentage
2001	19	48	67	0.72
2002	23	37	60	0.62
2003	27	44	71	0.62
2004	24	48	72	0.67
2005	26	60	86	0.70
2006	16	44	60	0.73
2007	13	40	53	0.75
2008	18	49	67	0.73
2009	9	55	64	0.86
2010	21	61	82	0.74
2011	16	68	84	0.81
2012	14	60	74	0.81
2013	11	51	62	0.82
2014	7	27	34	0.79
2015	6	33	39	0.85
2016	7	30	37	0.81
2017	9	29	38	0.76
2018	7	32	39	0.82
2019	9	30	39	0.77
2020	8	33	41	0.80
	290	879	1169	0.75

Table 5. Degree of collaboration of research papers

Table-5 shows the degree of collaboration is defined as the ratio of the number of collaborative research papers to the total number of research papers in the discipline during a certain period of time.

The formula suggested by Subramanyam (1983) is used in this study.

It is expressed as

The formula is Where

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

C = Degree of Collaboration
Nm = Number of multiple authors
Ns= Number of single authors

$$C = \frac{879}{\text{----------------------------}}$$

C = 0.75879+ 290=1169

Year	No. of publications	No. of authors	AAPP*	Productivity Per Year
2001	67	153	2.28	0.44
2002	60	131	2.18	0.46
2003	71	160	2.25	0.44
2004	72	163	2.26	0.44
2005	86	225	2.62	0.38
2006	60	145	2.42	0.41
2007	53	138	2.60	0.38
2008	67	170	2.54	0.39
2009	64	189	2.95	0.34
2010	82	235	2.87	0.35
2011	84	267	3.18	0.31
2012	74	212	2.86	0.35
2013	62	190	3.06	0.33
2014	34	93	2.74	0.37
2015	39	126	3.23	0.31
2016	37	121	3.27	0.31
2017	38	115	3.03	0.33
2018	39	109	2.79	0.36
2019	39	110	2.82	0.35
2020	41	127	3.10	0.32
	1169	3179	2.72	0.37

**Average Authors per Paper(AAPP) = Number of authors/Number of papers.*

Productivity per author = Number of papers/Number of authors.

Table 6. Author productivity

Where, *C* is the degree of collaboration in a discipline. *Nm* is the number of multi-authored research papers in the discipline published during a year. Ns is the number of single authored research papers in the discipline published during a year. Above table reveals that the value of the Degree of Collaboration was 0.72 in the year 2001, and 0.75 in the year 2020. In the present study the value of *C* is *C* =0.75 As a result, it was found that the degree of collaboration in the IEEE Transactions on Education is 0.75, which openly indicates its dominance upon multiple contributions.

In the light of the above discussion, it is appropriate to examine and analyze the implications of Lotka's Law regarding author productivity in publishing articles. Lotka's Law describes the frequency of publication by authors in a given field. It states, " the number of authors making n contribution is about 1/n2 of those making one; and the proportion of all contributors, that make a single contribution, is about 60 percent" (Lotka 1926, cited in potter1988). This means that out of all the authors in a given field, 60 percent will have just one publication, and 15 percent will have two publications (1/22 times.60). Seven percent of authors will have three publications (1/32 times.60), and so on. According to Lotka's Law of scientific productivity, only six percent of the authors in a field willproducemorethan10 articles.

Table -6: shows the data related to author productivity, which leads that the total average number of authors per paper is 2.72 and the average productivity per author is 0.37. The highest number of author productivity, i.e.,(3.27), was published in 2016.

Author	**No.of articles**	**Percentage**
M.Castro	6	0.51
M.Reisslein	6	0.51
D.A.Conner	5	0.43
A.Abramovitz	4	0.34
C.D.Kloos	4	0.34
E. M.Kim	4	0.34
J.E.Froyd	4	0.34
J. J.Sluss	3	0.26
M. Borrego	3	0.26
T. J.Cavicchi	3	0.26
SingleArticle@Author1013 x1	1013	86.66
Two Articles@ Author57x2	114	9.75
Total	**1169**	**100**

Table 7. Ranked list of most prolific contributor

Table 7 reveals the most prolific authors. 1169 authors contributed the total output, M. Castro and M. Reisslein have published (0.51%%) publications, followed by D.A. Conner (0.43%),A. Abramovitz, C. D. Kloos, E. M. Kim and J. E. Froyd (0.34%) publications, M. Borrego and T. J. Cavicchi (0.26%) publications. The other ranks have been detailed in table-7.

Among the contributions, there were (86.66%) of articles by single article contribution and114(9.75%) authors are contributed two articles.

Row Labels	No. of Publications	No. of Pages	Percentage	Average No. of pages Per publication
2001	67	406	4.67	6.06
2002	60	381	4.38	5.69
2003	71	491	5.64	7.33
2004	72	506	5.82	7.55
2005	86	684	7.86	10.21
2006	60	464	5.33	6.93
2007	53	354	4.07	5.28
2008	67	463	5.32	6.91
2009	64	538	6.19	8.03
2010	82	667	7.67	9.96
2011	84	637	7.32	9.51
2012	74	571	6.56	8.52
2013	62	459	5.28	6.85
2014	34	236	2.71	3.52
2015	39	275	3.16	4.10
2016	37	296	3.40	4.42
2017	38	299	3.44	4.46
2018	39	318	3.66	4.75
2019	39	327	3.76	4.88
2020	41	326	3.75	4.87
Total	1169	8698	100	12.98

Tale 8. Year-wise Distribution of pages output

Table 8 represents the number of pages in engineering education during the period 2001-2020 of the study. It was found that 8698 pages are found to contain 1169 publications during the period. The highest number of pages (7.86%) was 684 publications in 2005, followed by (7.67%) of the pages found to be in 667 publications in 2010. It concludes that the overall pages of the publications (3.16%) appeared in 275 publications in 2015. It is found that, in general, when there is an increase in the publication, the growth is also increased. It is noted that the same did not appear in the fluctuating trend during the study and the highest average number of pages per publication (10.21%) in 2005.

References

[1] Blackman, V.H. (2005) Thecompoundinterestlawandplantgrowth. AnnalsofBotany, 33, 353–360.

[2] Ezhilrani, R., Surianarayanan, S. & Kanthimathi, S. (2006) Authorship patterna Collaborative researchinaquaculture *Journals.SRELS JournalofInformationManagement*, 43, 4, 391–398.

[3] Gupta, D.K. (1989) Lotka'sLawandItsapplicationtoAuthorProductivityDistribution of psychological LiteratureofAfrica,1966-1975. HeraldofLibraryScience, 28, 11–21.

[4] Gupta, R., Ahmed, K.K.M., Gupta, B.M., Bansal, M. & Gupta, B.M. (2016) Lungcancer in India: A scientometric study of publications during 2005–14. International Journal of Medicine and Public Health, 6, 200–208 [DOI: 10.5530/ijmedph.2016.4.11].

[5] Plant, H.R. (1978). Growth Analysis. Edward Arnold: London.

[6] Kumar, R.S. & Kaliyaperumal, K.A. (2015) Scientometricanalysisofmobiletechnology publications. *Scientometrics Int. J. Quant. Aspects Sci. Sci., Commun. Sci.Sci.Policy*, 105, 921–939.

[7] Lotka, A.J. (1926) Statistics:Thefrequencydistributionofscientificproductivity. *Journal of theWashington Academy of Sciences*, 16, 317–325.

[8] Singh, K.P. & Bebi (2014) Libraryherald:Abibliometricstudy (2003–12). *Library Herald*, 52, 19–27.

[9] Subramanyan, K. (1983) Bibliometricstudiesofresearchcollaboration:areview. *Information Sciences*, 6, 33–38.

[10] Thavamani, K. (2014). Authorship Patterns and Collaborative Research in Malaysian *Journal of Library and Information Science*, 1996-2012. *Library Philosophy and Practice (E-journal)*, Vol. 117.

[11] Arkhipov, D.B. (1999) Scientometric analysis of Nature, the journal. *Scientometrics*, 46, 51–72 [DOI: 10.1007/BF02766295].

[12] Rice, R.E., Chapin, J., Pressman, R., Park, S. & Funkhouser, E. (1996) What's in a name? Bibliometric analysis of 40 years of the journal of broadcasting (& electronic media). *Journal of Broadcasting and Electronic Media*, 40, 511–539 [DOI: 10.1080/08838159609364373].

[13] Harper, J.A. (1991) A bibliometric profile of the Canadian Journal of Agricultural Economics. Canadian Journal of Agricultural Economics/Revue Canadienne d'Agroeconomie, 39, 503–513 [DOI: 10.1111/j.1744-7976.1991.tb03590.x].

[14] Seglen, P.O. (1992) The skewness of science. Journal of the American Society for Information Science, 43, 628–638 [DOI: 10.1002/(SICI)1097-4571(199210)43:9<628::AID-ASI5>3.0.CO;2-0].

[15] Plomp, R. (1990) The signifcance of the number of highly cited papers as an indicator of scientific prolifcacy. *Scientometrics*, 19, 185–197 [DOI: 10.1007/BF02095346].

[16] Aksnes, D.W. (2003) Characteristics of highly cited papers. *Research Evaluation*, 12, 159–170 [DOI: 10.3152/147154403781776645].

[17] Vinkler, P. (2007) Eminence of scientists in the light of the h-index and other scientometric indicators. *Journal of Information Science*, 33, 481–491 [DOI: 10.1177/0165551506072165].

[18] Vinkler, P. (2013) Quantity and impact through a single indicator. *Journal of the American Society for Information Science and Technology*, 64, 1084–1085 [DOI: 10.1002/asi.22833].

[19] Davey, M.G., Davey, M.S., Lowery, A.J. & Kerin, M.J. (2019) What proportion of systematic reviews and meta-analyses published in the annals of surgery provide definitive conclusions—*A systematic review and bibliometric analysis. Publications*, 10, 2022 [DOI: 10.3390/publications10020019].

[20] Juhl, C.B. & Lund, H. (2018) Do we really need another systematic review? British Journal of Sports Medicine, 52, 1408–1409 [DOI: 10.1136/bjsports-2018-099832] [PubMed: 30154206].

[21] Lund, H., Juhl, C. & Christensen, R. (2016) Systematic reviews and research waste. Lancet, 387, 123–124 [DOI: 10.1016/S0140-6736(15)01354-9] [PubMed: 26841992].

[22] Kim, H.Y. (2017) Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test. Restorative Dentistry and Endodontics, 42, 152–155 [DOI: 10.5395/rde.2017.42.2.152] [PubMed: 28503482].

[23] Haidich, A.B. (2010) Meta-analysis in medical research. Hippokratia, 14 (Supplement 1), 29–37 [PubMed: 21487488].