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A Cross Sectional Study of Retraction Notices of Scholarly Journals of Science

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ABSTRACT

Retraction is the withdrawal of published article after it is found that the authors did not ensure integrity in conducting and reporting their research activities. The bibliometric information of 4716 document categorised as retractions in Science Citation Index, Web of Science was downloaded and analysed to understand trend, pattern and reasons of retraction. The results showed that retractions had increased during the ten-year period, 2008-2017. The main reasons for retractions were plagiarism, falsified data, manipulation of images and figures. It was also found that just 40 out of 4716 retraction notices had explicitly stated reasons for retracting the published articles. The open access journals had more number of retractions as compared to subscription based journals. The study will guide library professionals and research scholars towards a better comprehension of the reasons behind retractions in science discipline in the ten-year period. They would be better equipped to steer clear of inauthentic publications in their citations and references.

Keywords: Retraction; Misconduct; Scholarly journal

1. INTRODUCTION

The scholarly journals are prime channels of extensive communication of research findings to the world. The credibility of journals is calibrated in terms of the quality of their publications and genuineness of published research. The scholarly journals established as core and coveted in specific areas of research are highly selective in publishing articles to maintain a high standard. The submitted manuscripts undergo rigorous peer review for quality check and to ensure standards, values and ethics of research. This leads to a high rate of rejection of papers submitted for consideration for publication. Still, some flawed research may successfully cross review stage and get published. Even after the release of false articles, whenever publishers and scholars note something amiss with the methodology and findings in published works; or when it is learnt that the authors did not follow the accepted norms and procedures of conducting and reporting research, they decide to withdraw the published articles. This is done to maintain the integrity, credibility and quality of the published literature. The mechanism of withdrawal of a published article is known as the retraction. It is initiated by the journal to widely disseminate and publicise that the published article has been withdrawn and findings of the retracted paper are null and void, no longer valid to be referred and cited. The retractions take place because of a range of reasons including redundant, dual publication, substantial overlap, use of falsified or fabricated data, adoption of unethical norms or procedures during research activities or experiments, partial or complete manipulation of figures and images, or non-replication of reported research. Recently, it has been observed that retractions occur because of compromised peer reviews.

Fanelli[1] and Cokol[2], *et al.* noted a sharp rise in retraction rate in recent years. Therefore, it is the necessity of the time to sensitise researchers, academics and library professional on the issue of retraction. This paper explains trends in retraction in science discipline by using qualitative and quantitative approaches. The study has analysed the retraction notices of 4716 retracted articles published in research journals and indexed under "retracted publications" category in Web of Science (WoS). Retraction in Specific areas of research in Science such as health, medicine, biochemistry, and environmental science are highly crucial for the survival of human and ecology of the globe, as minor lapses or misconduct in research in these areas will have severe implications for humanity. There is persistent need of close monitoring of research lapse and malpractices in science disciplines. This factor encouraged researchers to review retractions in the science discipline. This study analysed retraction details indexed in Web of Science hence this study is unique in its coverage from earlier published work on retraction in science discipline. This study will help researchers in understanding the reasons for retraction. The paper is equally helpful for academics, research scholars and library professionals.

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2. LITERATURE REVIEW

Science and research are not only about seeking and establishing truth and knowledge, but It involves all the traits of human behaviour, from earnest desire to explore new and more to vulnerability to misconduct and envy. This human behavior makes the researchers falter and indulge in misconduct. This misconduct culminates in retractions of published literature.

The growing number of retractions[3] in recent years indicates that the researchers have become more aware and vigilant in identifying and reporting fraudulent research works. Grieneisen and Zhang[4] have said that the retractions occur across all the disciplines. Their study further noted that authors whose articles are retracted end up attracting less visibility and citation for their prior publications; thus retraction of published works minimises the scholarly damage, but also affects research credibility of authors. Azoulay[5], *et al*. have reported that faculty members experience a drop of 10 per cent in citations to their previous unretracted articles. This study also highlighted that the senior, reputed scientists witnessed more criticism and penalty than junior scientists when they got their articles retracted because of misconduct. However, when retraction occurs due to some honest error both the senior and junior faculty members and scientists face criticism equally. The researchers whose articles are retracted experience 91.8 per cent decrease in publication output; and don't get grants to conduct their research in future[6]. Wang[7] examined the EMBASE, and MEDLINE databases along with independent websites of Neurological journals for understanding phenomena of retraction of articles, published in 1995 to 2016 and noted that common reasons of retraction were duplicate publications, plagiarism, use of fraudulent data, scientific errors, lack of acknowledgement of authors and compromised peer review. Al-Gharreb[8], *et al*. have reported that the retracted articles in Nursing and Midwifery have received 7 to 52 citations, which is unsafe for human in clinical like sensitive discipline; though the rate of retraction is low in this field as compared to other subjects. Cox[9], *et al*. have analysed the frequency and nature of retractions in the peer-reviewed journals of Economics and noted that the journals do not issue clear retraction notices explaining reasons of retraction, hence editors fail to take concrete steps to prevent malpractices in future by not mentioning reasons of retractions in notices. Research has also shown that most of the misconduct cases remain hidden and are not discovered and reported[10].

3. OBJECTIVES OF THE STUDY

The objectives of the study are as follows.

- To highlight the number of retractions in science in 10-year period (2008-17)
- To highlight time gap between publication and their retraction
- To understand pattern of authorship of retracted articles
- To identify reasons of retractions
- To understand difference in trends of retraction in commercial and open access journals.

3.1 Null Hypothesis

H_{01}: There is no association in number of retracted articles in a journal with its Impact Factor

H_{02}: Open access and fee based publications don't differ on volume of retraction.

4. METHOD OF STUDY

The study adopted blend of qualitative and quantitative research methodologies. The analysis is based on secondary data obtained from the Web of Science. Researchers applied following steps for extracting data for the study:

In the Basic Search interface of WoS, '2008-2017' was entered in 'year published' option. In the setting, 'Science Citation Expanded Index' was chosen.

As a result, of the above query, a list of 1,71,53,125 record was obtained. The results mentioned were further filtered by type of documents – "Retraction and Retracted documents" which resulted in 4,716 records. The results were downloaded

Table 1. Trend in retraction of articles in science discipline

Year of publication	Total Papers (in SCI)	Retracted papers		Number of retraction per one lakh* paper	Absolute growth rate	Growth rate in numbers of retractions per lakh papers
		Number	Percent			
2008	14,15,686	280	5.9	19.8		
2009	14,89,724	318	6.7	21.3	13.6	7.6
2010	15,28,677	349	7.4	22.8	9.7	7.0
2011	16,03,653	284	6.0	17.7	-18.6	-22.4
2012	16,84,237	362	7.7	21.5	27.5	21.5
2013	17,81,542	337	7.1	18.9	-6.9	-12.1
2014	18,30,229	413	8.8	22.6	22.6	19.6
2015	18,80,301	436	9.2	23.2	5.6	2.7
2016	19,56,001	958	20.3	49.0	119.7	111.2
2017	19,83,085	979	20.8	49.4	2.2	0.8
Total	1,71,53,125	4,716				

*10 lakh = one million

in a batch of 500 record, as only a maximum of 500 record can be downloaded at a time from Web of Science, and saved as Excel files for further evaluation and analysis. The downloaded data were analysed on following parameters.

- Number of retracted publications
- Number of authors in retracted publications
- Countries of authors of the retracted publications
- Research areas of the retracted publications
- Number of citations of retracted publications
- Publisher of retraced articles.

5. NUMBER OF RETRACTED ARTICLES

Table 1 reflects trends of retraction of articles in science discipline from 2008 to 2017. The volume of research publications has been consistently enhancing due to rapid expansion of knowledge with passage of time so it is obvious that number of retraction will also go up. The impact of increase in volume of publications in each year on volume of retraction has been eliminated by reflecting number of retraction per lakh publications in a year. Similarly, annual growth rate in retraction has been reflected as absolute as well as adjusted by volume of publication, as shown in Table 1.

There were 19.8 retracted research papers per lakh publications in 2008; subsequently the rate of retraction was consistently same with minor variations over a period of eight year, till 2015. There was exceptionally high retraction in the last two year of the research period; 49 research paper per lakh publications were retracted in 2016 and 2017.

The annual growth rate of retraction noted minor drop in 2011 and 2013.The annual growth rate of retraction when adjusted with volume of publication noted no major change from 2008 to 2015; it was followed by a surge of 111 per cent increase in annual retraction rate in 2016. Absolute and adjusted annual growth rates of retraction were same hence there was no impact of volume of publication on retraction.

6. OPEN ACCESS *VS* PAID ACCESS JOURNALS

The largest share of open access articles is under the new category which is known as "Bronze". Such articles are available on the publishers' websites either instantly or after an embargo period, but these articles are not accompanied by a formal legal license, The non-availability of a legal license prevents the free use and distribution by other researchers[11]. The study explains extent of retraction under open access and paid access journals .

The 2357 retracted article were published in paid access journals and almost same numbers of retracted articles were contributed by Open access journals in the ten year period of investigation, thus both types of journals contributed equally in terms of volume of retraction. Although there is remarkable difference in volume of retraction contributed by paid access and open access publications, when volume of retraction is adjusted by volumes of journals being indexed in SCI, WoS in each category. There are 18.7 retracted papers per one lakh publications for commercial publication; at the other end Open access journals contributed almost three times more retracted papers per lakh publications.

The difference in adjusted retraction rates of open access and no open access journals is examined statically. The researchers applied binomial test to examine the null hypothesis i.e. Open access and fee based publications don't differ on volume of retraction.

The significance level of the binomial test rejects the null hypothesis i.e. that paid access and open access based publications do not differ on volume of retraction. Retraction is more frequent in open access journals.

Table 2. Retraction in open access and paid access journals (2008-17)

Publishing model	Total Papers (in SCI)	Retracted articles		Number of retraction per one lakh paper
		Number	Percent	
Paid access	1,26,31,522	2,357	50.0	18.7
Open access	45,21,593	2,359	50.0	52.2
Total articles	1,71,53,115	4,716	100.0	27.5

Table 3. Difference in volume of retraction rates in paid access and open access journals

Parameters	Observed proportional	Test Proposal	Significance (2 tail)
Paid Access Journals	0.261	0.5	.000
Open Access Journals	0.738		

7. ORIGIN OF THE RETRACTED ARTICLES

Origin of the retracted articles in this study indicates citizenship of authors of retracted articles. For example, single authored paper is credited once in country of citizenship of author, when a paper has two or more authors with different nationalities; it is credited once in each country in Table 4. All the countries were given equal weightage irrespective of their location or position in the byline.

The highest number of retractions was from China followed by USA and Iran with 1219, 875 and 299 retracted article respectively in science discipline in the 10-year period (2008-17). India stood at the 4th place with 272 retraced article.

The adjusted retraction per lakh published articles was the highest for Iran; there were over 113 retraction per lakh publications from Iran. China and India contributed over 40 retractions per lakh publications in the same reported period. The top 15 countries with highest retracted articles are listed in the Table 4.

8. JOURNALS REPORTED FREQUENT RETRACTION OF ARTICLES

There were 1627 unique journals in Science discipline, retracted 4716 article in the 10-year period, 2008-17. There were only 4 unique journal which retracted over 50 article; other 1567 unique journal contributed less than 10 retraced paper in the reported period as shown in Table 5.

Table 6 shows top 20 journal with highest retractions contributed 909 retraced articles; thus 1.2 per cent of unique journals contributed 19.3 per cent of retracted articles in the reported period.

Table 4. Countries with high number of retractions

Citizenship of author	Total Papers (in SCI)	Retracted articles		Number of retraction per one lakh paper
		Number	Percent	
China	22,54,168	1219	25.8	54.1
USA	47,80,485	875	18.6	18.3
Iran	2,63,316	299	6.3	113.6
India	5,88,472	272	5.8	46.2
Japan	9,51,505	205	4.3	21.5
South Korea	5,56,314	161	3.4	28.9
Germany	11,84,196	150	3.2	12.7
England	11,10,445	141	3.0	12.7
Italy	7,46,846	136	2.9	18.2
France	8,21,550	98	2.1	11.9
Sweden	2,67,154	89	1.9	33.3
Spain	6,06,090	89	1.9	14.7
Australia	5,72,485	85	1.8	14.8
Taiwan	2,77,383	75	1.6	27.0
Canada	7,17,855	75	1.6	10.4
Rest of the countries	14,54,861	747	15.8	51.3
Total	171,53,125	4716	100.0	27.5

Table 5. Journals in science discipline reported retractions from 2008-17

Numbers of retracted papers during 2008- 2017	Number of unique journals
200-300	01
101-200	Nil
51-100	03
10-50	59
Less than 10	1564
Total	1627

'Tumor Biology' journal retracted 295 article, highest in the ten-year period under investigation, the journal retracted 107 article through a single retraction note. Tumor Biology journal focuses on publishing experimental and clinical cancer research. It is published by Sage on behalf of the international Society for Oncology and Biomarkers. Earlier it was published by Springer. Its website mentions that from July 2017, it has been deselected from being indexed in Web of Science. The main reason of retraction was compromised peer review process; it was not undertaken as per the norms of the scholarly communication[12]. 'Plos One' listed second highest number of retraction. An open access journal and publishes research findings from Science and Medicine fields. It retracted 88 articles during the 10-year period. The journals highlighted that retracted publications failed on benchmarks set on ethics in research. The third place was held by 'Journal of Biological Chemistry' which retracted 86 article.

9. ASSOCIATION IN NUMBERS OF RETRACTIONS AND IMPACT FACTOR OF JOURNALS

The study has examined whether Impact factor (IF) of journal influences its retraction. The association in numbers of retractions and Impact Factor is graphically presented with scatter plot. (Fig. 1)

The scatter plot reflects no major associations in Impact Factor of journals and number of retracted articles. The association is also examined statically with Pearson Correlation test.

Table 7 reflects that there is minor negative association in number of retractions and Impact Factor of journals; it may be observed that the rigorous review methods of high Impact Factor journals result in filtration of substandard papers which involve nonstandard methods and procedures at review stage itself. The association in number of retractions and Impact Factor of journals is not significant hence null hypothesis i.e. there is no association in number of retracted articles in a journal with its Impact Factor cannot be rejected.

10. MAJOR PUBLISHERS

The international publishers like Elsevier, Taylor and Francis, Wiley, Sage Biomed Central, Oxford University Press, ACM (Association for Computing Machinery), ASM(American Society for Microbiology) and so on so forth, are sensitive to seriousness of fraud in research have their robust retraction policies. The common essence of their policies is that the published article is retracted, when it indicates that there is an infraction of professional ethics codes such as redundant, duplicate submission, overlapping of content with already published material, fabrication of data, manipulation of images etc. The publishers, who participate in the Cross mark program, help researchers in learning and identifying when an article has undergone a status update, which may influence the interpretation or use or acknowledgement of the published work. The retraction notices have different DOIs and metadata from the original articles. The original content or material is not modified. Some publishers like ASM follow COPE guidelines as well as recommendations of the International Committees of Medical Journal Editors. The authors or researchers who work on human subjects or animals should obtain approval from their institutional review board or institutional animal care and use committees. In case, the institutional review boards are not present, the authors and researchers must adhere to the International Guiding Principles for Biomedical Research involving animals.

The publishers ask the authors to submit an explanation when any allegation of infringement of ethics is raised before retracing articles. The authors are also expected to preserve underlying data of their articles for a specified period from the date of publication. They have to submit their data on being asked, failing which their articles may be retracted.

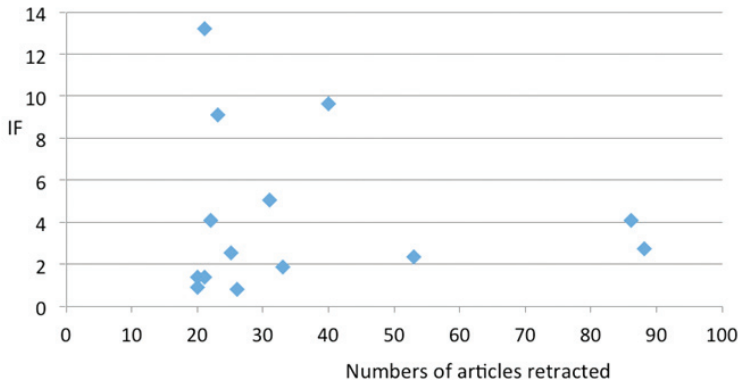

Figure 1. Association in numbers of retractions and impact factor of journals.

The Table 8 shows the top ten publishers who reported frequent retraction. These publisher accounted over 58 per cent of total retracted papers from 2007 to 2018.

Elsevier contributed over 14 per cent of retraced articles, followed by Springer which had 11 per cent of retraced articles, contributions of other publishers individually was less than 10 per cent.

Table 6. Impact factor of journals which reported frequent retractions

Title of Journal	Number of retracted articles (2008-17)	Impact Factor (JCR 2018)
Tumor Biology	295	3.650
Plos One	88	2.766
Journal of Biological Chemistry	86	4.125
Diagnostic Pathology	53	2.396
Proceedings of the National Academy of Sciences of the United States of America	40	9.661
Molecular Biology Reports	33	1.889
Molecular Neurobiology	31	5.076
International Journal of Clinical and Experimental Medicine	26	0.833
Biomed Research International	25	2.583
Renewable & Sustainable Energy Reviews	24	9.184
Cancer Research	23	9.130
Nature	22	40.137
Scientific Reports	22	4.122
Cell	21	31.398
European Journal of Medical Research	21	1.414
Journal of Clinical Investigation	21	13.251
Human Factors and Ergonomics in Manufacturing & Service Industries	20	0.917
International Journal of Clinical and Experimental Pathology	20	1.396
Medicine	20	
RSC Advances	18	2.936
Others	3807	
Total	4716	

Table 7. Association in numbers of retractions and impact factor of journals

Parameters	Pearson Correlation value	Significant level
Impact factor of journal and number of retracted articles	-0.158	0.519

10.1 Rate of Retraction in Various Researches Areas of Science Disciplines

Table 9 has listed top 10 research areas of science discipline, with frequent retractions from 2007-18.

Oncology subject reported maximum number of retractions; 608 article were retracted in this research area. It was followed by 'Biochemistry & Molecular Biology', 'Chemistry' and 'Science & Technology 'with 441, 320 and 307 retraced article. Retraction rate adjusted by volume of publication also retains 'Oncology' and 'Biochemistry& Molecular Biology' on the top of the list, however at third place the adjusted retraction rate has 'Research & Experimental Medicine' with 40.9 retraced paper per lakh publication.

10.2 Authorship Pattern of Retraced Articles

Out of the 4716 retraced paper from 2007-18, 432 paper were authored by single authors while 607, 723 paper were written by two and three authors respectively. There were 2940 retraced paper authored by more than three, while 14 paper were contributed by corporate authors. (Fig. 2)

The retraction policies of scholarly journals specify that they retract articles only when there is some serious or crucial scientific error which disproves or negates the findings or conclusions of the articles. It may also be due to some misconduct like fabrication or falsification of data. There may be some error in the calculation or methodology adopted. The articles are withdrawn because of redundant publication which implies findings were published earlier too and again in the retracted article which has not properly acknowledged other sources; inappropriate authorship like guest or ghost authorship. The journals usually follow the COPE guidelines for retraction. According to COPE guidelines[13], the retraction notices should mention the reasons and the ground for which the article is being retracted. The notices should clearly mention that the articles have been withdrawn due to misconduct or honest errors like experimental or calculation errors. They should also clearly state whether the articles have been withdrawn by authors or editors. The article which is retracted is known as Version of

Table 8. Major publishers who published retracted papers

Name of publisher	Number of retracted articles (2007-18)	
	Number	Percent
Elsevier Science Bv.	679	14.4
Springer	519	11.0
Wiley	390	8.3
Sage Publications Ltd.	329	7.0
Biomed Central Ltd.	184	3.9
Taylor & Francis Ltd.	159	3.4
Lippincott Williams & Wilkins	141	3.0
Amer. Chemical Soc.	112	2.4
Public Library Science	93	2.0
Amer. Soc. Biochemistry Molecular Biology Inc.	86	1.8
Others contributed rest of retracted articles	2024	42.9
Total	4716	

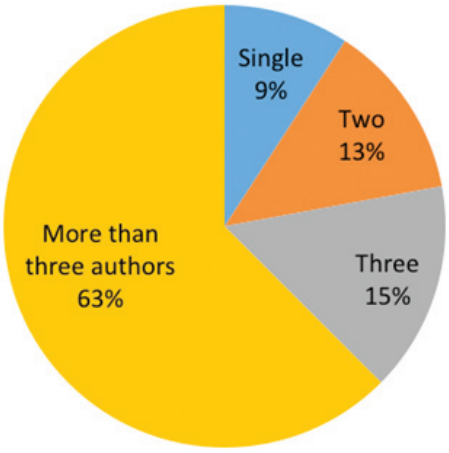

Figure 2. Authorship of retracted articles reasons of retraction of articles.

Table 9. Major research Areas in science discipline which reported frequent retractions

Research areas	Total Papers (in SCI)	Retracted articles		Number of retraction per one lakh paper
		Number	Percent	
OncologY	7,28,709	608	17.6	83.4
Biochemistry & Molecular Biology	7,11,016	441	12.8	62.0
Chemistry	1,875,879	320	9.3	17.1
Science & Technology - Other Topics	8,35,090	307	8.9	36.8
Engineering	1,558,964	252	7.3	16.2
Neurosciences & Neurology	5,59,425	201	5.8	35.9
Materials Science	1,072,754	141	4.1	13.1
Cell Biology	4,37,792	129	3.7	29.5
Pharmacology & Pharmacy	5,99,989	129	3.7	21.5
Research & Experimental Medicine	2,98,329	122	3.5	40.9

Record. Some journals watermark the articles with "retracted" rather than removing it from publication, the retraced article as first published is retained to keep the scientific record of the literature as per the guidelines of International Association of Scientific, Technical and Medical Publishers on retractions and preservation of the record of science. Some journals like, Science, BMJ have issued correction erratum, expression of concern before issuing retraction notice (https://www.ncbi.nlm.nih.gov/pubmed/15905366; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1836914/;https://www.ncbi.nlm.nih.gov/pubmed/7969447). Some articles did not have raw data files; no hospital records were available. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4803183/

The authors visited the links of 4716 article and observed that only 40 article had explicit reasons for their withdrawal or retraction. Some of the reasons which were stated in the retraction notices are as follows :

- Redundant or duplicate publication
- Co-authors' unawareness about the published article
- Authors did not have ownership of the published work or the co- authors were not at all related to the published work
- Figures were used without permission
- Honest errors
- Substantial overlap with other published resources
- Manipulation of figures and images
- Discrepancies in the type and number of animals used in experiments performed and reported. There was falsification of data. The integrity or credibility of the data was not ensured
- Data used was related to organs from executed prisoners- breaching of International organ donation ethical standards
- Results of the published study could not be replicated
- Original data underlying the figures was not available. The authors did not respond regarding the availability of raw data.

Research misconduct is the culmination of individual temperament, character, and extreme desire for success, professional recognition, promotion, grants and fame with less inclination to work hard[10].

10.3 Gap between Publication and Retraction of Articles

The frequency of citations to retraction articles reflects

Table 10. Gap between publication and retraction

Title of the Article	Number of citations	Retracted year	Published year	Gap in publication and retraction years
Primary Prevention of Cardiovascular Disease with a Mediterranean Diet	1974	2018	2013	5
A Pleiotropically Acting MicroRNA, miR-31, Inhibits Breast Cancer Metastasis	629	2015	2009	6
Selective killing of cancer cells by a small molecule targeting the stress response to ROS	622	2018	2011	7
Non-blinking semiconductor nanocrystals	493	2015	2009	6
Increased muscle PGC-1 alpha expression protects from sarcopenia and metabolic disease during aging	408	2016	2009	7
Detection of an Infectious Retrovirus, XMRV, in Blood Cells of Patients with Chronic Fatigue Syndrome	379	2011	2009	2
Design of curcumin-loaded PLGA nanoparticles formulation with enhanced cellular uptake, and increased bioactivity in vitro and superior bioavailability in vivo	349	2016	2010	6
Generation of pluripotent stem cells from adult human testis	340	2014	2008	6
In utero supplementation with methyl donors enhances allergic airway disease in mice	321	2016	2008	8
SIRT1 Suppresses beta-Amyloid Production by Activating the alpha-Secretase Gene ADAM10	314	2014	2010	4

Average gap (years) in publication and retraction in top 10 most citied retraced articles 5.3
Average numbers of citations per research paper in top 10 most citied retraced articles 613.3

extent of damage to scholarly world as faulty findings become base for future research. Numbers of citations obviously goes high with increase of gap in publishing and retracing of article. It has been observed that the researchers cite retracted articles which are based on flawed research. Wray and Andersen[14] reported that between 1983 and 2017, every year 2.6 paper were retracted per Science journal; and 305 of these retracted papers were retracted within 1 year of publication; while some papers were retracted after 12 year of publication. Out of 4716 retraced publications, 3319 received 136537 citation while 1397 did not receive any citation. Table 10 reflects gap in publishing and retraction of articles of top 10 retraced article which received the highest citations.

The top ten most frequently citied retraced articles have been cumulatively cited 6133 time so each paper on an average cited 613 time hence retraced articles made serious damage to scholarly world before retrieval. Table is also confirms that numbers of retractions goes up with increase in gaps of publishing and retracing of articles.

11. CONCLUSIONS

Researchers and public are sensitive and concerned with retraction in science disciplines as life of individual may be adversely affected by faulty research in science. The trends in retractions in science discipline from 2008-17 reflects no major change in volume of retractions in first eight years followed by significant surge in retraction of research publications in the last two year.

Only 40 article out of 4716 retraced articles in science discipline from 2008-17 explicitly stated reasons for retraction, thus almost all The retraction notices failed to specify reasons. The retraction notices which specify and highlight the reasons for retraction serve as a caution or deterrent for the researchers in the field. Researchers in absence of proper retraction notice may indulge in misconduct and may not fear any kind of retraction against them. The study has stated frequent reasons of retractions which include misconduct, especially due to substantial overlap with already published literature, manipulations of data , use of data without permission, co-authors' unawareness about published articles etc. The journals indexed in SCI have not adhered to COPE guidelines in clearly expressing retraction notices. The journals and publishers should follow COPE guidelines and express loud and clear reasons for retracting the articles. This would ensure the reliability and authenticity of the published literature in science. Further, it would motivate the authors and researchers to practice honesty and prevent misconduct. There are few journals in science disciplines which reported frequent retraction. 1.2 per cent of journals in science disciplines contributed 19.2 per cent of retraction reported in ten-year period.

The study recommends that the libraries be at the forefront to guide researchers about the proper conduct to follow and adhere to ethics and integrity. Libraries should also make concerted efforts to educate researchers about the retraction and its adverse impact on research communication and knowledge generation. The library should periodically comprehend nature and reasons of retractions in different disciplines over a period of time. Retraction notices usually do not reflect whether the notice is initiated and signed by authors or it is initiated by publisher, further researches need be done to find out if the

retraction is initiated by the author(s) or the editors of the journals.

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