

## OPEN ACCESS JOURNALS AND THEIR RESEARCH IMPACT: AN ANALYTICAL STUDY

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The main purpose of this paper is to carry out a comparative analysis of the Open Access (OA) journals published by Elsevier's ScienceDirect from Medical Science domain and indexed in CWTS Journal Indicators database maintained by Leiden University, Netherlands and powered by Scopus for before and after making these journals OA. Around 50 OA journals from the Medical Science domain indexed on or before 2007 and made OA in 2010 were taken into consideration for this research study. Data were retrieved from 2007 to 2011 and from 2012 to 2016 for before and after making these journals OA respectively. The analytical research method was used and found suitable for this research study. The results of this study will help the authors, researchers, scholars, and scientists of the developing nations to follow the footsteps of the scholars of developed nations who are publishing and citing the research published in the OA journals since the journals have higher impact factor after making open access compared to the impact factor before.

**Keywords:** Gold Open Access, Indian OA Journals, Open Access Journals, Open Access Publishing, Research Impact, Scholarly Communication.

### INTRODUCTION

Scholarly communication of research has evolved from the exchange of research findings among the informal group of experts, often termed 'Invisible colleges', to research articles in scientific journals in print format, to online access through the Internet. Change has been witnessed both qualitatively and quantitatively in the ways and means of scholars' communications, the publication of their research works, and its dissemination which is reaching a wider audience electronically. The researchers publish their work to disseminate to the readers, establish their claim, and allow other scholars for further research (Brody, 2004). The Internet has become the main platform for the dissemination of the scholars' research which enables them for sharing at any time, to anyone, and anywhere. The

escalating journal prices had avoided the researcher for accessing the latest research and content necessary for their research study, while only a few wealthier institutions had access to a reasonable proportion of the scholarly journals.

Research output and making it openly accessible has witnessed a worldwide movement during the last two decades which included the research articles, research data, monographs, and software that are facilitated by the internet and digital technologies. Open-access leads to quality, collaborative, and widely accessed, and highly cited research is the argument of the advocates of the OA. The momentum of the OA is significant and there have several high-level victories in policy matters for access to publicly funded research. There have numerous criticisms to open access in its way as well (Gray, 2014). In the recent times the open access phenomena are rapidly changing the long existed predominant subscription model of scientific publishing and during the last 10 years the OA publishing has rapidly grown and its total share of journal articles published has increased dramatically (McVeigh, 2004). Therefore, the open access publishing is contributing to the universe of knowledge heavily, through the content produced by its various publishing models.

Open access (OA) publishing provides a new platform for scholarly communication among researchers in different fields. Apart from researchers, communities of practice – rarely producers but definitely consumers of the research results – benefit immensely from open access publishing (Nashipudi, 2018). For the

researchers and their affiliations that often fund the research, the greatest concern is how to make the research available to the global scientific community and to enhance its impact and visibility; a situation that will, by extension, improve the impact and visibility of both the authors and their affiliate institutions. Consequently, journals that would enable high impact and wider visibility are usually selected as publication outlets by many researchers and this trend has moved scholarly publishing to online platforms (Nashipudi & Ravi, 2019).

In India, there has been a gradual realization of the usefulness of open access among various institutions. Various open access initiatives have been undertaken and are operational. Many are in the developmental stage (Nashipudi & Ravi, 2014). The debate on the research impact of OA over non-OA journals has generated a lot of interest resulting in several studies. This study has focused on OA journals published by Elsevier's ScienceDirect from the Medical Science domain and which are indexed in the CWTS Journal Indicators database maintained by Leiden University, Netherlands, and powered by Scopus for before and after making these journals OA. The journal quality indicators viz Impact per Publication (IPP) and Source Normalized Impact per publication (SNIP) for these journals and its data was collected, analyzed, and interpreted in this research study.

## **OPEN ACCESS**

Though several pioneering open access initiatives took place as early as the mid-1960s, the open access movement gained momentum only in the late 1990s. It developed primarily in

the biomedical sciences as a response to increasing journal costs, which charged many individual and institutional subscribers out of access to the latest research studies. The philosophy of open access is based on the concept that research findings, particularly in health sciences, should be freely and immediately available to the worldwide scientific community, clinicians, and the public. Since the past two decades, scientific journal publishing has undergone an actual rebellion empowered by the emergence of global web publications. The publishers are swiftly shifting from a print publication to Open Access Journals (OAJ). These journals appeared in the early 1990s, and after the year 2000, an increasing number of professional OA publishers have emerged and established as an industry. Free online access to scientific journal articles without charges to the readers or libraries is known as open access. Commitment with open access meant the removal of financial, legal, and technical hindrances that limit access to scientific articles for the readers. Now, the publishers of the open-access have shifted their revenue models to sources from the subscription income.

## REVIEW OF LITERATURE

Vaughan and Shaw (2003) in their research study choose 46 LIS journals which included, 209 articles and compared both online and offline citations and discovered more online citations. The results reported that most electronic citations (42 percent) came from the paper on the web or class reading lists. Web citations counts for the same articles were higher than bibliographic

citation counts. Shin (2003) in his comparative study conducted for the non-OA journals in psychology in pre- and post-electronic journals periods for the period of 1994-1995 and 2000-2001 on the impact factor revealed that the online availability increased the impact factor. In journals which were both print and online did not show a major statistical difference in the impact factor in the pre- and post-electronic periods. The impact factor was increased to a minimum of 2 % to a maximum of 254% with the changed publishing medium from print to electronic. Harnad and Brody (2004) conducted a study in which they demonstrated that research articles from Physics discipline submitted to arXiv (a preprint server covering mainly physics, hosted by Cornell University), and which later gets published in the peer-reviewed refereed journals, generated a citation impact up to 400% higher than papers in the same journals that had not been posted in arXiv.

Kurtz et al. (2005) argued in their research study that there are several possible explanations for the higher citation rates for open access articles. The major reason for the higher citations of OA articles is its early publication, so it has primacy and longer time in the public eye. This is described as the early access postulate. Malone and Coleman (2005) in their study emphasized the extent to which open access affects the impact of an article. They further state that Open Access is relatively new and related to digital information that is only slowly becoming an integral part of the library world. Maharana (2006) in his study chooses the papers published in the Proceedings of the Society of Information Science which

involved 95 scholarly papers and a total of 837 articles and around 292 (34.88%) web citations were found. The data analysis was structured on the criteria viz, domain, file format, type of source, and components of citations. The results revealed that 86% of the web documents citing were retrieved within 6 months of the submission of the articles. Norris et al. (2008) found that papers freely available over the web did have a greater impact. These advantages are of the order of a 40 to 80 percent increase in citations and found that this impact varied between disciplines. Neither study was able to identify the reasons for these differences, although author self-citation, which was observed to be higher in Open access sources, seems to account for part of this. Davis (2009) in his research selected 11 journals published from 2003 to 2007 which employed author-choice open-access models and analyzed the number of citations. The results showed that 2 out of 11 journals proved the positive and vital effect of open access provided explanatory predictors of citations were controlled. The study reported that there is evidence to suggest that OA citation advantage is decreasing by 7% each year, which earlier was 32% in 2004 to 11% in 2007.

Willinsky (2006) in his study proposes that open access makes the research available to needy users. The author further states that the OA publishing model has demonstrated the author's reach and the reputation among the scholarly community and the impact of the OA journals measured by bibliographic tools and quotes the example of high-profile open access journals of PLoS. Donovan and Watson (2011) focus on the impact of the scholarly research of the law

discipline. The authors of this study choose the 3 OA journals published from the University of Georgia School of Law and concludes that open access improves the research impact of the research articles. Solomon and Bjork (2012) studied the journals listed in the Directory of Open Access Journals (DOAJ) that charged APCs and article volumes of journals and found that the journals published by developing countries charged lower APC, while the journals with high-impact factor charged higher APC, majorly published by international publisher belonging to Biomedicine discipline accounting for the 59% of the sample journals and the 58% of the sample article volume. Wen and Hsieh (2013) studied the publishing behaviors of the highly productive researchers publishing in the biomedical OA journals. For this study, they took 2,927 research papers published by 30 highly productive authors from the Web of Science database. The results of this study revealed that the papers published in the OA journals by the productive authors' amounted to 36% and were increasing year by year.

Abadal et al. (2015) assess open access journals and its impact, published from Spain and indexed in WoS and Scopus. The study used 7 indicators viz. age, subject, language, publisher, portals, access type, and copyright for analysis of 406 journals. Data analysis showed that 63% of the total journals were published after 1980, 42% of publishers were universities and 31% were commercial publishers, social science and health science were the major subjects accounting for 33% and 60% of the journals were published with immediate open access and 76% of the

journals granted permission for self-archiving manuscript and it was estimated that about 48% of the journals were open access. Singh and Kumar (2016) in their research study aimed to examine the research impact of the OA journals of Animal Sciences discipline. They selected the OA journals listed in DOAJ under the heading Animal Culture and Veterinary Medicine and opted Impact Factor (IF), National Academy of Agricultural Sciences (NAAS) rating of journals, SCImago Journal Rank (SJR) and h-index parameters to assess the research impact. The results revealed that out of 126 journals 1/3<sup>rd</sup> journals received IF and NAAS rating. Zhang and Watson (2017) in their research investigate and compare the citation counts of articles published through gold and green models. It was found that, for articles published between 2008 and 2015, 9% were available through gold open access routes and 13% were available through green routes; most were not openly accessible.

### **OBJECTIVES OF THE STUDY**

The present research study has set the following objectives to ascertain the research impact of open access journals of Medical Science from Science Direct database indexed in the CWTS Journal Indicators database. The specific objectives of the study are to:

1. identify open access journals that are published by Elsevier's Science Direct Database from the Medical Science domain and to collect the data on the journal quality indicators from the CWTS Journal Indicators database;
2. evaluate and compare the data of the journal quality indicators such as Impact per

Publication (IPP), Source Normalized Impact per publication (SNIP); and

3. evaluate the research impact of the OA journals published in the Science Direct database and to compare the research impact before and after making these journals open access using statistical tools.

### **HYPOTHESES OF THE STUDY**

1. H0- The impact per publication of the subscribed and open access journals is the same.

H1- Journals have a higher impact per publication after making open access compared to the impact per publication before.

2. H0- The impact factor of the subscribed and open access journals is the same.

H1- Journals have a higher impact factor after making open access compared to the impact factor before.

### **METHODOLOGY**

As this study has been designed to assess the research impact of the open access journals from Elsevier's Science Direct database, the use of the Analytical Research Method was applied to evaluate and compare the research impact of the open access journals. In the analytical research method, the researcher has to make the critical evaluation of the hypothesis, making use of the data and information already available, and analysis of it for the critical evaluation and hence suitable for the present research study. It involves the deep study and examination of the information for gaining an explanation of the particular phenomena. The Analytical Research is connected

with the hypothesis and its testing, specification, and interpretation of relationships and comparing, by analyzing the facts or information already available. Statistical tools have been used for testing the hypothesis.

### DATA ANALYSIS AND INTERPRETATION

Open Access journals are not necessarily new publications. Many established journals make only a few recent years of content available online, while majority of content is accessible only through traditional access paths. Other established journals, having moved to Open Access distribution, offer access to much older content as well. The important factor for all authors is the impact of their work. If authors can see an improvement in the impact of their work due to Open Access, they will be willing to use Open Access routes. Access to the content of journals via the web provides a new metric for measuring the impact of articles – electronic citations which can be considered to be comparable to bibliographic citations in assessing the impact of published works. The correlation between citation

counts provides a measure of the usefulness of selected articles called the “citation impact.” Citation impact can be used as a measure of the impact of an article within its particular field. An article being widely read and cited is an indication that it has influenced other researchers within the field.

Around 50 OA journals from the Medical Science domain indexed on or before 2007 and made OA in 2010 were taken into consideration for this research study. Data were retrieved from 2007 -2011 and from 2012-2016 for before and after making these journals OA respectively with a time interval of 5 years each.

### Language wise Analysis of Open Access journals of Science Direct

The table 1 demonstrates the language-wise distribution of the Medical Science OA journals of Science Direct database with English language leading the table with 35 (70%) journals followed by Portuguese, Spanish; Castilian, English with 8 (16%) journals and Spanish; Castilian, English & English, Portuguese with 3 (6%) journals respectively.

**Table 1: Language wise Analysis of Open Access journals of Science Direct**

Sl. No.	Journal Language	No. of Journals	Percentage (%)
1	English	35	70
2	Spanish; Castilian, English	3	6
3	Spanish; Castilian	1	2
4	Portuguese, Spanish; Castilian, English	8	16
5	English, Portuguese	3	6
	Total	50	100

### Language-wise distribution of OA journals

The table 2 depicts the number of publishing language-wise distribution of OA journals with single language leading the table with 35 (70%) journals, followed by More than 3 Languages with 8 (16%) journals and Two Languages & Three Languages with 4 (8%) & 3 (6%) journals respectively.

**Table 2: Language-wise distribution of OA journals**

Sl. No.	No. of Languages	No. of Journals	Percentage (%)
1	Single Language	35	70
2	Two Languages	4	8
3	Three Languages	3	6
4	More than 3 Languages	8	16
	Total	50	100

### Country-wise distribution of OA journals

The table 3 represents the country-wise distribution of the OA medical sciences journals with Brazil leading the table with 9 (18%) journals, followed by Taiwan with 8 (16%) journals whereas Argentina, Belgium, Greece, India, Japan, Mexico, Portugal, Saudi Arabia & United Kingdom have only 1 (2%) journal each.

### Article Processing Charges (APC) wise distribution of OA journals

The table 4 reveals the APC information of OA medical sciences journals with about 22 (44%) journals do not charge APC while 19 (38%) journals do charge APC.

**Table 3: Country-wise distribution of OA journals**

Sl. No.	Publishing Country	No. of Journals	Percentage (%)
1	Argentina	1	2
2	Australia	2	4
3	Belgium	1	2
4	Brazil	9	18
5	Chile	2	4
6	China	2	4
7	Egypt	2	4
8	Greece	1	2
9	Hong Kong	2	4
10	India	1	2
11	Japan	1	2
12	Mexico	1	2
13	Netherlands	7	14
14	Portugal	1	2
15	Saudi Arabia	1	2
16	Spain	4	8
17	Taiwan	8	16
18	United Kingdom	1	2
19	United States of America	3	6
	Total	50	100

**Table 4: Article Processing Charges (APC) wise distribution of OA journals**

Sl. No.	Article Processing Charges	No. of Journals	Percentage (%)
1	Yes	19	38
2	No	22	44
3	Information not available	9	18
	Total	50	100

## IMPACT PER PUBLICATION (IPP) ANALYSIS

### Journals Indexed from 2007 to 2016 and their Sum of Impact per Publications (IPP)

The figure 1 demonstrates sum of IPP for the OA medical sciences journals with 26 (52%) journals in the lower range of 0-2 before OA while it is 15(30%) journals in the same range after OA. Meanwhile, in the higher range of 8.1-10 & 10.1-12, it is 2 (4%) journals before OA, whereas, it is 4 (8%) journals in the same range after OA. This shows that the IPP has increased after the OA.

### Annual percentage growth rate of Sum of Impact per publication after making Open Access

The table 5 depicts the Annual percent growth rate of IPP of the medical sciences journals after making OA with about 34 (68%) journals having the growth rate in the range of 0-25 followed by 6 (12%) journals in the

range of 26-50 and 4 (8%) journals in the range of 51-75; while 4 (8%) journals saw the negative growth.

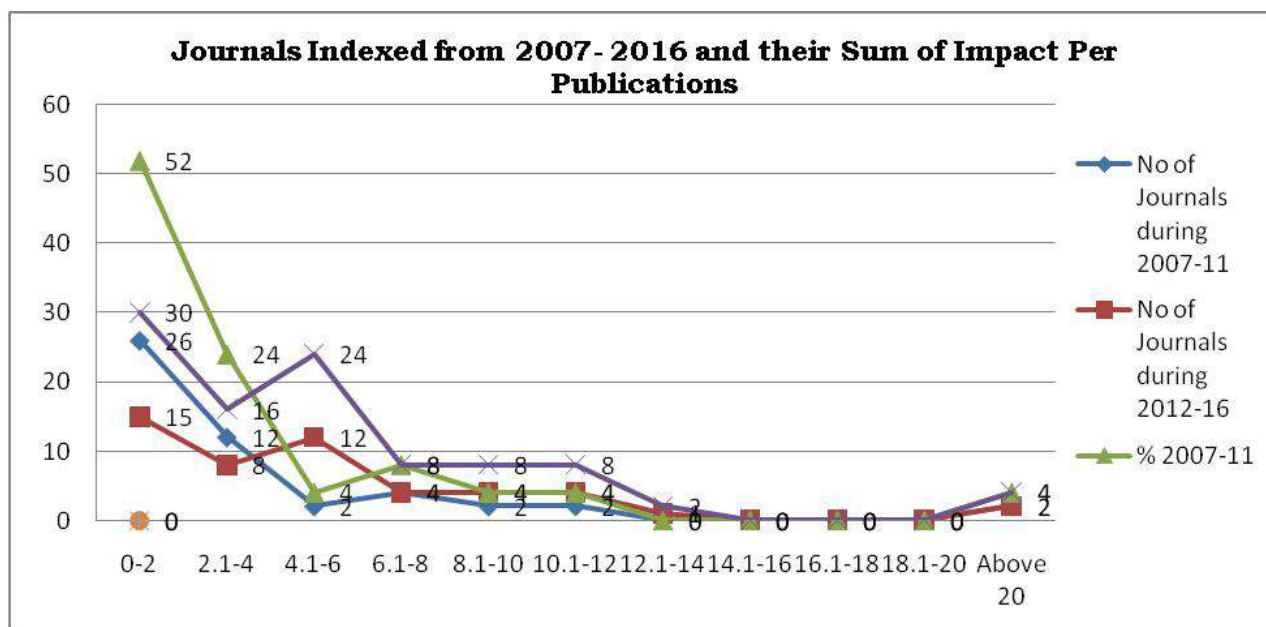
**Table 5: Annual percentage growth rate of Sum of Impact per publication after making Open Access**

Sl. No.	Annual percentage growth rate of Impact per publication	No. of Journals	Percentage (%)
1	0-25	34	68
2	26-50	6	12
3	51-75	4	8
4	76-100	1	2
5	Above 100	2	4
6	-ve GROWTH	4	8
	Total	50	100

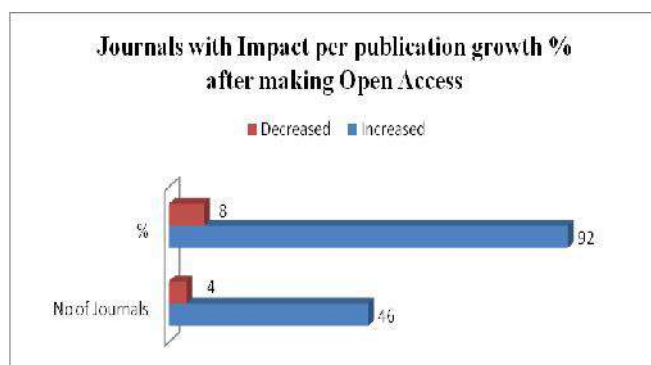
### Journals with Impact per publication growth percentage after making Open Access

The figure 2 represents the growth percentage of the journals after making OA with 46 (92%) journals having increased their growth percent of IPP, while only 4 (8%) journals have decreased their IPP growth.

**Fig. 1: Journals Indexed from 2007 to 2016 and their Sum of Impact per Publications (IPP)**





**Fig. 2: Journals with Impact per publication growth percentage after making Open Access**

### Statistical Analysis of IPP using Paired t-Test

The Paired t-Test tool performs a paired two-sample Student's t-Test to ascertain if the hypothesis can be accepted or rejected. Paired t-tests are typically used to test the means of a population before and after some treatment.

The result of this tool is calculated t-value. This value can be negative or positive, depending on the data. The test statistic is calculated as: Here  $\bar{d}$  bar is the mean difference,  $s^2$  is the sample variance,  $n$  is the sample size and  $t$  is a Student  $t$  quantile with  $n-1$  Degree of Freedom (df).

### Sum of Impact per Publication (IPP) before and after OA

The table 6 reveals the results of the paired t-Test conducted for the sum of IPP before and after OA. The result shows that there is extremely statistically significant variation after making the journals openly accessible in comparison with before OA and has improved the IPP of the journals. Therefore, the Hypothesis 1 H1 "Journals have higher impact per publication after making open access compared to the impact per publication before" is also statistically tested and accepted and the null hypothesis is rejected.

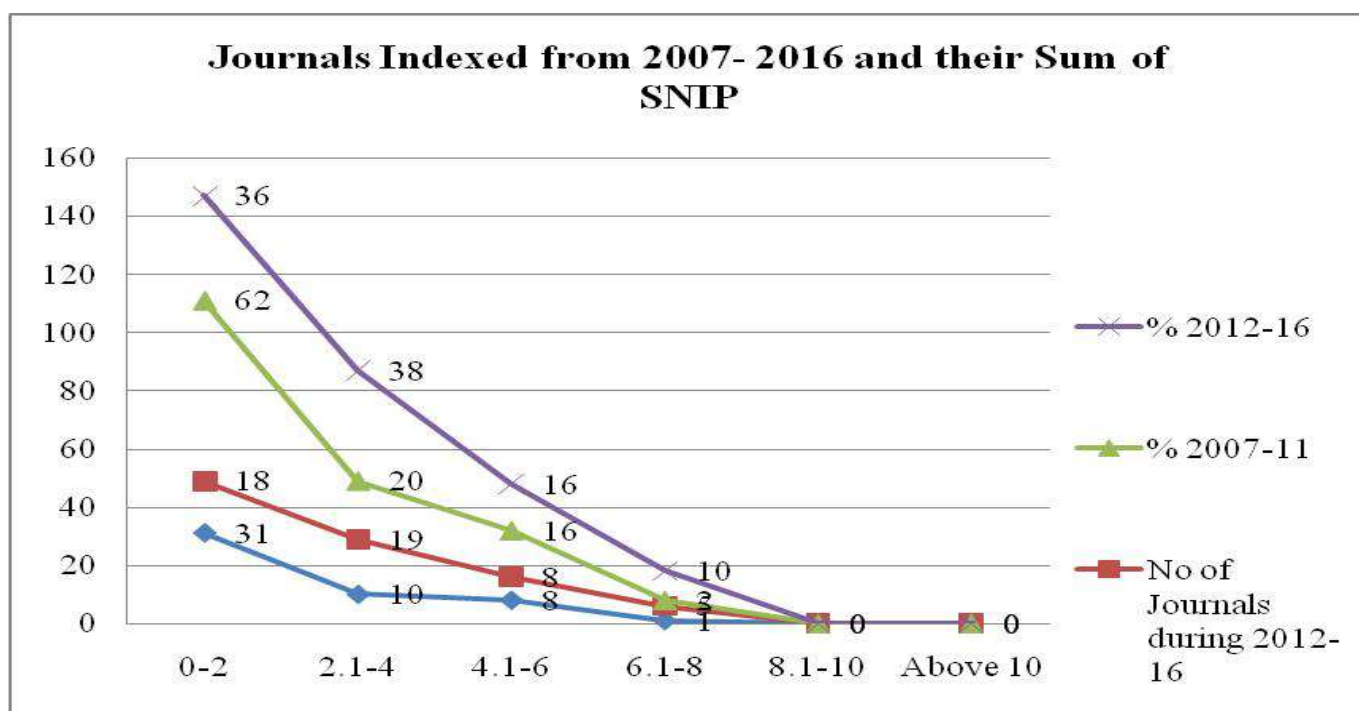
### SOURCE NORMALIZED IMPACT PER PUBLICATION ANALYSIS (SNIP)

#### Journals Indexed from 2007 to 2016 and their Sum of SNIP

The figure 3 represents the sum of SNIP of the journals indexed from 2007-16 with 31 (62%) journals in the lower range of 0-2 before OA, while it is 18 (36%) journals in the same range after OA, meanwhile, in the range of 2.1-4 it is 10 (20%) journals before OA whereas, it is 19 (38%) journals in the same range after OA and in the higher range of 6.1-8, it is only 1 (2%) journal before OA and 2 (4%) journals after OA. This shows that the SNIP has increased after the OA.

**Table 6: Sum of Impact per Publication (IPP) before and after OA**

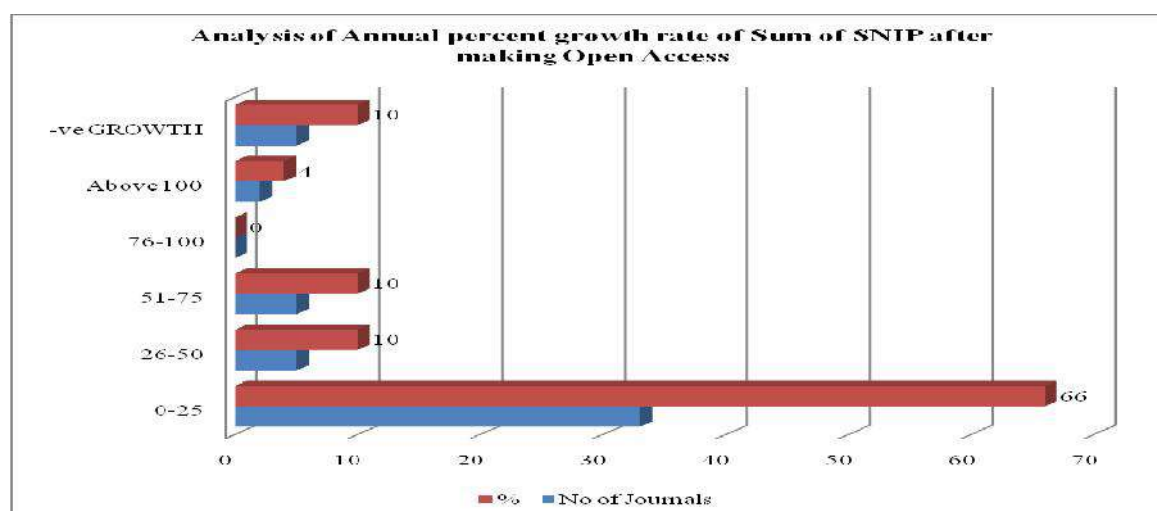
No of Journals	Average IPP		df (Degree of Freedom)	Level of Significance	t-statistic value	P-Value	Remarks	Inference
	Before OA (2007-11)	After OA (2012-16)						
50	3.4788	5.0888	49	0.05	7.4767	0.0001	P-Value < =0.05	Extremely Statistically Significant

**Fig. 3: Journals Indexed from 2007 to 2016 and their Sum of SNIP**

#### Analysis of Annual growth rate of Sum of SNIP after making Open Access

The figure 4 demonstrates the Annual percentage growth rate of SNIP of the medical sciences journals after making OA with 33 (66%)

journals having the growth rate in the range of 0-25 followed by 5 (10%) journals in the range of 26-50, whereas, 5 (10%) journals in the range of 51-75 and the higher range of above 100 there are 2 (4%) journals; while 5 (10%) journals saw the negative growth.

**Fig. 4: Analysis of Annual Growth Rate of Sum of SNIP after making Open Access**

### Journals with Source Normalized Impact per publication growth % after making Open Access

The table 7 represents the growth percentage of the journals after making OA with 45 (90%) journals having increased their growth percentage of SNIP while only 5 (10%) journals have decreased their SNIP growth

**Table 7: Journals with Source Normalized Impact per publication growth % after making Open Access**

Sl. No.	Impact per publication	No. of Journals	Percentage (%)
1	Increased	45	90
2	Decreased	5	10
		50	100

### Statistical Analysis of SNIP using Paired t-Test

The table 8 reveals the results of the paired t-Test conducted for the sum of SNIP before and after OA.

The result shows there is extremely statistically significant variation after making the journals openly accessible in comparison with before OA and has improved the SNIP of the journals. Therefore, the Hypothesis 2 H1

“Journals have higher impact per publication after making open access compared to the impact per publication before.” is also statistically tested and accepted and the null hypothesis is rejected.

### CONCLUSION

Open access publishing in general and OA journals in particular resolves the problem of ‘Serial Crisis’ as called by Librarians. Besides, it also removes the ‘Permission Barriers’ and the scholarly content can be used for further research without any permission. The robust growth of the open access has been demonstrated worldwide, by the content that has been made openly accessible and the continuing infrastructural growth i.e. new publishers, journals and repositories, and the innovations in the open access initiatives. Authors, researchers, scholars and scientists in the developed and developing nations are publishing and citing the research published in the OA journals since the journals have a higher impact factor after making open access compared to the impact factor before. So, it is suggested for the authors to publish and cite the research of the OA journals. The numbers of journals with IPP & SNIP growth percentage increased drastically in comparison with those

**Table 8: Statistical Analysis of SNIP using Paired t-Test**

No of Journals	Average SNIP		df (Degree of Freedom)	Level of Significance	t-statistic value	P-Value	Remarks	Inference
	Before OA (2007-11)	After OA (2012-16)						
50	2.0132	2.9454	49	0.05	5.0134	0.0001	P-Value < =0.05	Extremely Statistically Significant

that have IPP & SNIP growth percentage decreased. Therefore, it is strongly suggested that OA journals indexed by the reputed journals are qualitative and strictly follow the peer-review process for publishing only the qualitative research.

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