



Research Article

Impact of cytopathology authors work: Comparative analysis based on Open-access cytopathology publications *versus* non-Open-access conventional publications

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ABSTRACT

Objectives: Open access (OA) is based on a set of principles and a range of practices through which fruits of research are distributed online, free of cost, or other access barriers. According to the 2001 definition, OA publications are without barriers to copy or reuse with free access to readers. Some studies have reported higher rates of citation for OA publications. In this study, we analyzed the citation rates of OA and traditional non-OA (with or without free access) publications for authors publishing in the subspecialty of cytopathology during 2010–2015.

Material and Methods: We observed and compared citation patterns for authors who had published in both OA and traditional non-OA, peer-reviewed, scientific, cytopathology journals. Thirty authors were randomly selected with criteria of publishing a total of at least five cytopathology articles over 2010–2015. Number of citations per article (CPA) (during 2010–2015) for OA publications (in CytoJournal and Journal of Cytology) and non-OA publications (in Diagnostic Cytopathology, Cytopathology, Acta Cytologica, Journal of American of Cytopathology, and Indian Journal of Pathology and Microbiology) was collected and compared statistically using two-tailed Student's *t*-est. The data were collected manually through science citation analysis sites, mostly Google Scholar.

Results: Thirty authors published 579 cytopathology articles in OA and non-OA journals. Average CPA for OA publications was 26.64. This was 11.35 higher than the average CPA) of non-OA conventional with subscription cytopathology journals (74% increase) and 11.76 higher than the average CPA of conventional cytopathology non-OA journal articles with free access (79% increase). These differences were statistically significantly with $P < 0.05$.

Conclusion: We observed that the cytopathology publications in the OA journal attained a higher rate of CPA than the publications in the traditional non-OA journals in the field of cytopathology during 2010–2015.

Keywords: Open access, Cytopathology, Journal, CytoJournal

INTRODUCTION

As defined by Peter Suber: “Open-access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions.”^[1,2] Thus, OA platform extends benefits to both readers (in general by removing cost barriers such as pay-per-view fees, subscriptions,

and licensing fees) and authors by softening the permission barriers related to most copyright and licensing restrictions. In nutshell, OA allows free dissemination with barrier-free academic recycling for best productivity.^[3-7]

The conventional model of publishing and disseminating scientific research has served the purpose with public good over a long period, especially in the era before advances in internet. Any model of scientific literature is dependent on the willingness of scholars to publish their work. In the traditional model, the authors could publish without paying, because the copyright to work is taken by the publisher to be sold for revenue generation. However, this restricts the access of their work by public without ability to pay. This is in contrast to the general expectation of authors that their work should be widely disseminated and freely available. In addition, the loss of copyright compromises the long-term interests of authors and public without freedom to use this work for later use.

Barrier-free access to scientific literature would enhance research and enrich scholarly activities by easy sharing for learning irrespective of financial resources. This will ultimately strengthen the scientific foundations and progress in the quest for knowledge.

In a small subspecialty field like cytopathology, the majority of journals are traditional-type publications. The hypothesis of this study entails that the publications in OA Cytopathology Journal under the OA charter would have higher rate of citation per article (CPA)^[8] as compared to the publications in the traditional non-OA cytopathology journals.^[3] This study evaluates the impact of publishing in OA by individual authors in recent times after relatively established role of OA in cytopathology.

MATERIAL AND METHODS

The data about citations for cytopathology articles were collected from the Google Scholar search database with additional help from other databases such as PubMed^[9] over a 5-year time period (2010–2015).

Multiple authors publishing in cytopathology subject area were randomly selected. Only 30 of these, who fulfilled the following criteria were included in this study:

- Those who published at least five total articles (OA and non-OA publications) [Figure 1] during 2010–2015.
- Those who were not editors/coeditors of the journals under the study during 2010–2015.
- OA journal was put in category #1. Non-OA publications (category #2) were split further into category #2A: Available with paid subscription without free access and category #2B: Non-OA publications with free access [Figure 1 and Table 1].

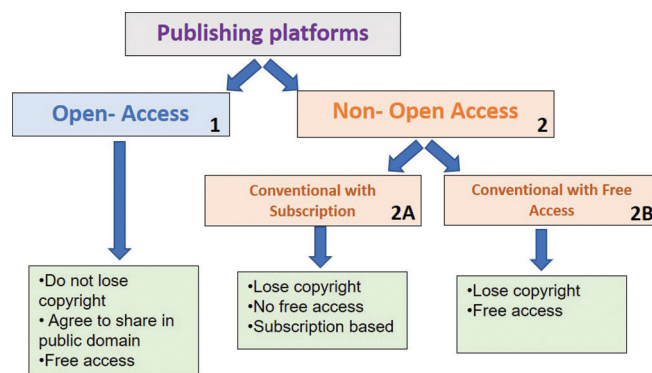


Figure 1: Different types of publications based on open-access (OA) and non-OA platforms.

We observed and compared citation patterns during 2010–2015 for authors who had published in both OA and traditional non-OA peer-reviewed, scientific cytopathology journals.^[3] Citation data for OA publications (CytoJournal and Journal of Cytology) and traditional non-OA cytopathology journals (Diagnostic Cytopathology, Cytopathology, Acta Cytologica, Journal of American of Cytopathology, and Indian Journal of Pathology and Microbiology) were mined from science citation analysis sites, mostly Google Scholar with a few more sites such as PubMed. Google Scholar is a very large database with over 389 million records, and it includes all of the relevant and credible journals in the field of cytopathology. The database is also “publisher neutral” as it does not favor one commercial, OA, or societal and university publication over the other.

The data as of July 2021 were recorded in Excel spreadsheet with formulated calculations for citation per article averages. Citations for each cytopathology publication for each author were noted and categorized by the publication year. The accumulated data during 2010–2015 for all 30 authors are shown in Table 1. Averages of CPA for the three publication types were statistically compared with two-tailed Student’s *t*-test [Table 2].^[10] The significance level (alpha value) was set at 0.05 with 5% acceptance as probability of not having the statistically significant difference.^[11]

RESULTS

Thirty authors published 579 publications during 2010–2015. The average CPA for OA publications (category #1) was 11.35 higher than the average CPA of non-OA conventional publications with subscription (category #2A) (74% increase over 15.29) and 11.76 higher than the average CPA for non-OA conventional publications with free access (category #2B) (79% increase over 14.88) [Table 2 and Figure 2]. The citations for articles in OA (category #1) were statistically significantly higher

Table 1: Citation pattern for 30 authors for 5 years (2010–2015).						
I	II	III	IV	V	VI	VII
S. No.	Author	Category	Articles	Total citations	Average citation per article	Remark (Year-citations)
1.	Shipra Agrawal	1 2A 2B	4 2 1	22 8 2	5.50 4 2	2011–5, 2011–6, 2014–8, 2015–3 2012–6, 2014–2 2012–2
2.	Manon Auger	1 2A 2B	17 7 7	356 140 52	20.94 20 7.43	2010–8, 2010–6, 2012–23, 2012–0, 2012–4, 2012–65, 2013–21, 2013–12, 2013–29, 2013–87, 2014–11, 2014–0, 2014–8, 2014–28, 2015–19, 2015–12, 2015–23 2010–10, 2010–17, 2013–14, 2014–84, 2014–12, 2015–0, 2015–3 2010–21, 2011–9, 2014–0, 2015–7, 2015–11, 2015–3, 2015–1
3.	R.M. Austin	1 2A 2B	17 6 10	291 51 170	17.11 8.50 17	2010–10, 2011–30, 2011–16, 2011–10, 2012 2012–21, 2012–0, 2014–6, 2015–13, 2015–10, 2015–1 2011–7, 2011–70, 2012–27, 2013–16, 2013–13, 2013–1, 2014–17, 2015–13, 2015–5, 2015–1
4.	Zubair W. Baloch	1 2A 2B	13 6 11	1653 52 912	127.15 8.67 82.91	2011–4, 2011–65, 2011–32, 2012–116, 2012–33, 2012–1058, 2013– 6, 2014–101, 2014–35, 2015–40, 2015–42, 2015–11, 2015–110 2012–3, 2013–13, 2014–4, 2015–0, 2015–23, 2015–9 2010–23, 2010–10, 2010–0, 2010–1, 2012–780, 2012–9, 2014–30, 2014–14, 2015–6, 2015–15, 2015–24
5.	Joel S. Bentz	1 2A 2B	9 1 2	214 14 14	23.78 14 7	2010–42, 2010–9, 2010–10, 2010–20, 2011–26, 2011–5, 2013–44, 2015–35, 2015–23 2015–14 2011–8, 2015–6
6.	Fadi Brimo	1 2A 2B	5 5 2	314 114 2	62.8 22.8 1	2010–16, 2010–14, 2014–23 2010–2, 2014–84, 2014–19, 2015–9, 2015–0 2014–0, 2014–2
7.	Robert A Goulart	1 2A 2B	3 4 2	53 30 6	17.67 7.50 3	2010–16, 2010–14, 2014–23 2010–5, 2011–11, 2011–0, 2014–14 2014–0, 2014–6
8.	Prabodh K Gupta	1 2A 2B	3 1 1	59 7 12	19.67 7 12	2015–13, 2015–34, 2015–12 2015–7 2014–12
9.	Rana S. Hoda	1 2A 2B	7 12 1	235 182 6	33.57 15.17 6	2012–28, 2012–7, 2013–46, 2013–84, 2014–59, 2015–4, 2015–7 2010–16, 2010–9, 2011–70, 2011–0, 2012–7, 2013–12, 2014–17, 2014–0, 2014–23, 2015–0, 2015–9, 2015–19 2015–6
10.	Venkateswaran K Iyer	1 2A 2B	12 9 1	270 76 3	22.50 8.44 3	2010–12, 2011–5, 2012–90, 2012–3, 2012–0, 2013–3, 2013–27, 2014–24, 2014–15, 2015–34, 2015–18, 2015–39 2010–23, 2012–6, 2013–13, 2013–3, 2013–0, 2014–14, 2015–8, 2015–9, 2015–0 2010–3,
11.	Darshana N. Jhala	1 2A 2B	5 6 5	166 66 42	33.20 11 8.4	2011–85, 2011–63, 2014–13, 2014–5, 2015–0 2010–15, 2011–4, 2011–8, 2011–10, 2013–27, 2015–2 2010–2, 2011–0, 2012–0, 2015–21, 2015–19
12.	Walid Khalbuss	1 2A 2B	21 16 8	518 299 134	24.67 18.69 16.75	2010–52, 2010–34, 2010–20, 2010–9, 2010–13, 2011–21, 2011–22, 2011–13, 2011–11, 2011–12, 2011–14, 2011–11, 2012–52, 2012–18, 2012–9, 2013–34, 2013–95, 2013–18, 2013–9, 2014–38, 2015–13 2010–11, 2010–19, 2010–2, 2011–15, 2011–8, 2011–7, 2012– 126, 2012–3, 2013–3, 2013–14, 2013–6, 2014–15, 2014–12, 2015–23, 2015–21, 2015–14 2010–17, 2011–63, 2011–2, 2012–0, 2012–6, 2012–12, 2014–15, 2015–19

(Contd...)

Table 1: (Continued)						
I	II	III	IV	V	VI	VII
S. No.	Author	Category	Articles	Total citations	Average citation per article	Remark (Year-citations)
13.	Sandeep Mathur	1 2A 2B	6 6 6	135 70 26	22.50 11.67 4.33	2011-28, 2012-8, 2012-3, 2013-49, 2013-34, 2013-13 2010-10, 2011-14, 2012-12, 2013-12, 2013-10, 2015-12 2010-6, 2012-7, 2012-7, 2013-3, 2013-0, 2015-3
14.	Pam Michelow	1 2A 2B	6 5 3	98 52 21	16.33 10.40 7	2010-42, 2010-9, 2011-15, 2011-1, 2012-18, 2015-13 2010-20, 2011-5, 2011-4, 2011-15, 2013-8, 2014-0, 2014-9, 2015-12
15.	Sara Monoca	1 2A 2B	16 10 3	457 280 83	28.56 28 27.67	2010-63, 2010-21, 2010-9, 2010-52, 2011-11, 2011-22, 2011-43, 2011-12, 2011-14, 2012-48, 2012-18, 2013-18, 2013-19, 2014-83, 2014-21, 2014-3 2011-13, 2011-15, 2011-8, 2012-126, 2012-10, 2013-43, 2014-14, 2014-38, 2015-7, 2015-6 2013-47, 2014-15, 2015-21
16.	Liron Pantanowitz	1 2A 2B	15 10 4	432 219 78	28.80 21.90 19.50	2011-85, 2011-11, 2011-22, 2011-12, 2011-14, 2011-13, 2012-18, 2012-21, 2013-29, 2013-18, 2014-18-2014-8, 2014-15, 2014-79, 2015-69 2010-15, 2010-14, 2011-63, 2011-15, 2012-48, 2013-13, 2014-19, 2014-4, 2015-7, 2015-21 2011-0, 2012-39, 2014-38, 2015-1
17.	Bharat Rekhi	1 2A 2B	20 6 6	313 66 91	15.65 11 15.12	2010-13, 2010-11, 2010-2, 2010-17, 2010-0, 2011-28, 2011-22, 2012-2, 2012-41, 2013-8, 2013-6, 2013-39, 2014-32, 2014-12, 2014-1, 2014-2, 2014-29, 2015-0, 2015-23, 2015-25 2010-4, 2012-0, 2013-54, 2014-4, 2015-3, 2015-1 2010-57, 2013-0, 2014-0, 2014-15, 2015-16, 2015-3
18.	Torill Sauer	1 2A 2B	8 5 2	156 95 29	19.5 19 14.5	2010-15, 2010-18, 2012-18, 2012-9, 2014-6, 2015-34, 2015-44, 2015-12 2011-41, 2014-12, 2014-10, 2014-9, 2015-23 2011-22, 2015-7
19.	Michael J. Thrall	1 2A 2B	8 4 1	148 48 5	18.5 12 5	2010-12, 2010-32, 2012-37, 2013-2, 2013-0, 2015-22, 2015-1, 2015-42 2010-27, 2014-13-2014-4, 2014-4 2014-5
20.	Neda A. Moatamed	1 2A 2B	7 4 1	112 29 9	16 7.25 9	2012-5, 2012-24, 2013-5, 2013-14, 2014-12, 2015-7, 2015-45 2011-8, 2013-12, 2013-0, 2015-9 2011-9,
21.	Radhika Srinivasan	1 2A 2B	15 6 5	352 132 109	23.47 22 21.8	2010-10, 2010-7, 2011-8, 2012-24, 2012-30, 2012-18, 2012-25, 2012-33, 2013-49, 2013-14, 2014-17, 2015-62, 2015-20, 2015-7, 2015-28 2010-24, 2010-36, 2012-16, 2013-15, 2015-35, 2015-6 2010-42, 2011-22, 2012-6, 2012-20, 2013-19
22.	Fernando Schmitt	1 2A 2B	12 6 4	307 105 57	25.58 17.5 14.25	2010-19, 2012-19, 2012-59, 2013-13, 2013-19, 2013-8, 2014-49, 2014-27, 2014-14, 2014-20, 2015-27, 2015-23 2013-5, 2013-21, 2014-11, 2014-41, 2015-8, 2015-19 2011-16, 2013-25, 2014-7, 2014-9
23.	Esther Diana Rossi	1 2A 2B	11 6 2	500 247 55	45.45 41.17 27.5	2011-117, 2013-60, 2013-29, 2013-19, 2014-27, 2014-46, 2014-14, 2015-77, 2015-65, 2015-18, 2015-28 2011-103, 2013-86, 2013-6, 2013-2, 2015-37, 2015-13 2010-36, 2015-19
24.	Manju Kaushal	1 2A 2B	5 2 2	55 12 13	11 6 6.5	2010-4, 2012-25, 2015-16, 2015-5, 2015-5 2015-5, 2015-7 2015-11, 2015-2

(Contd...)

Table 1: (Continued)

I	II	III	IV	V	VI	VII
S. No.	Author	Category	Articles	Total citations	Average citation per article	Remark (Year-citations)
25.	Vijay Kumar	1	4	103	25.75	2011–39, 2014–27, 2015–2, 2015–35 2015–6 2015–11
		2A	1	6	6	
		2B	1	11	11	
26.	Hussain A. Saleh	1	9	177	19.67	2010–7, 2010–22, 2013–29, 2013–12, 2013–5, 2014–13, 2014–39, 2014–23, 2015–27 2010–124, 2011–0, 2014–23, 2014–14, 2014–2, 2015–29 2015–5
		2A	6	192	32	
		2B	1	5	5	
27.	Savitri Krishnamurthy	1	7	85	12.14	2010–16, 2013–41, 2013–3, 2014–3, 2014–2, 2015–19, 2015–1 2011–26, 2014–19, 2014–11, 2014–13, 2015–5, 2015–2, 2015–0, 2015–1
		2A	4	69	17.25	
		2B	4	8	2	
28.	Nalini Gupta	1	9	180	20	2010–16, 2010–7, 2011–18, 2012–24, 2012–16, 2012–9, 2012–8, 2015–62, 2015–29 2011–22, 2012–30, 2012–10, 2012–25, 2014–11, 2015–17, 2015–3 2010–42, 2012–70, 2015–14
		2A	7	118	16.85	
		2B	3	126	42	
29.	Raje Nijhawan	1	14	316	22.57	2010–5, 2011–40, 2012–9, 2012–30, 2012–19, 2012–13, 2012–16, 2013–14, 2014–50, 2014–28, 2015–62, 2015–20, 2015–13, 2015–7 2010–16, 2010–7, 2011–22, 2011–25, 2012–24, 2012–18, 2012–16, 2013–15, 2015–17 2010–19, 2010–4, 2011–53, 2012–25,
		2A	9	160	17.78	
		2B	4	101	25.25	
30.	Pranab Dey	1	7	134	19.14	2011–14, 2012–24, 2013–14, 2014–20, 2014–13, 2015–26, 2015–23 2011–23, 2011–16, 2012–30, 2015–20, 2015–13, 2015–4, 2015–0 2012–43, 2015–2
		2A	7	106	15.14	
		2B	2	45	22.5	

Category # 1: OA journal, Category # 2A: Non-OA publications without free access, Category # 2B: Non-OA publications with free access. The highest **Average citation per article** as compared to other categories (#1, #2A, #2B) for the same author are **bolded** in column #VI

($P < 0.05$) than the articles published in conventional, non-OA, and journals with (category #2B) or without (category #2A) free access [Table 2 and Figure 2]. P value for comparison between category #1 and #2A was 0.010329766 and for comparison between category #1 and #2B was 0.020726153 [Table 2].

After a careful analysis of cytopathology articles published by 30 authors, 25 authors (author #1–25) revealed a higher citation per article average in the OA platform [Table 1]. Five authors (author #26–30), however, had lower CPA for OA articles (Chi-square $P = 0.00001$). Based on further scrutiny, most of the OA articles published by these five authors (author #26–30) (Table 1, remarks column #VII) were closer to 2015 with comparatively less time for accumulating citations. Slightly lower CPA for OA cytopathology articles by these authors appears to be due to this aberration. The publication pattern related to authors number 1–25 [Table 1] was relatively random with these authors showing tendency to prefer publishing in OA early in the career with accumulation of more citations.

Table 2: Average CPA based on raw data for 30 authors in Table 1.

Type of publication	Total of CPA*	Mean CPA (Total CPA/30)	SD	Variance
1	799.17	26.64	21.73	472.36
2A	458.68	15.29	8.38	70.27
2B	445.61	14.88	16.05	257.65

*From column VI in Table 1. CPA: Citation per article, SD: Standard deviation, OA: Open access. P value calculated with two-tailed Student's t -test, P value (comparison between #1 and #2A) with 74% higher CPA with #1= 0.010329766, P value (comparison between #1 and #2B) with 79% higher CPA with #1= 0.020726153. Category # 1: OA journal, Category #2A: Non-OA publications without free access, Category # 2B: Non-OA publications with free access

DISCUSSION

The Budapest Declaration triggered by the meeting of the key players in favor of the OA movement stated that “new technology (has) converged to make possible an unprecedented public good.”^[3] Utilizing the internet and OA principles allows access to more research than ever before

Table 3: Views and downloads of OA articles during 2020 (as recorded on July 24, 2021).

Year	Views		Dwlds	
	CytoJournal Views/#Articles	J of Cytology Views/#Articles	CytoJournal Dwlds/#Articles	J of Cytology Dwlds/#Articles
2020	104706/28	82807/48	35222/28	7842/48
Average per article	3739	1725	1258	163

Comparable data could not be evaluated from public data for non-OA articles (with or without free access). Dwlds: Downloads, J of cytology: Journal of cytology, OA: Open access

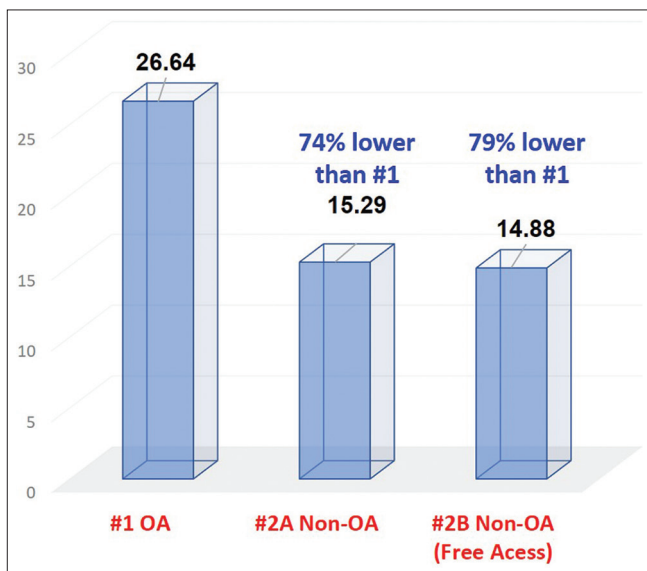


Figure 2: Comparison of average citation per article (CPA) for open-access (OA) and non-OA publications ($P < 0.05$) [Table 2]. The average CPA for OA publications was 26.64. This was 11.35 higher than the average CPA of non-OA conventional publications with subscription (category #2A) (74% increase over 15.29). It was 11.76 higher than the average CPA for non-OA conventional publications with free access (category #2B) (79% increase over 14.88).

with increase in OA publications and overall impact of OA in scientific literature.^[12,13] Top publishers, governing agencies, as well as major scientific communities continue to advocate OA platform.^[14]

In this study, analysis of 579 cytopathology-related articles showed that the average CPA for OA publications was 26.64. This average CPA for OA publications (category #1) showed higher than the average CPA with 74% increase as compared to non-OA conventional publications without free access. This increase was 79% as compared to the average CPA for non-OA conventional publications with free access [Table 2 and Figure 2].

As observed in Table 2 and Figure 2, CPAs for both categories #2A and #2B were lower than category #1. This highlights the recent trend that the scholars and authors are more interested in and prefer OA articles, irrespective of their free availability

(category #2B). Other reason may be that many non-OA journals make the articles free after some time period, which discourages the preference to such articles by scholars and authors. Many experienced scholars appear to have understood the significance and benefits of not losing the copyright to their work generated as a result of hard work and efforts.

The slightly higher difference with category #2B and slight difference between category #2A and #2B was marginal, but it was not the topic of the study. This observation, however, highlights that OA publications attract higher CPA irrespective of free availability of non-OA publications (category #2B). One of the possible explanations for this observation is that many OA publications would allow barrier-free incorporation of diagrams, photographs, sketches, tables, etc., from OA articles in their manuscripts.

As confirmed by this study, OA publications translate in to increased citations. It has higher potential for wider collaboration, enabling researchers to carry out collaborative projects on global scale in public domain. With global access, the OA platform allows medical experts, authors, and readers to the enhanced discovery and treatment.

Table 3 shows number of views and downloads for 2020 articles in OA cytopathology journals (CytoJournal and Journal of Cytology) as recorded on July 24, 2021. The numbers for these articles in <1 year were significantly high for a small subspecialty like cytopathology. However, these data were not available for non-OA publications in the public domain and so could not be compared [Table 3]. In contrast to the non-OA publications, these and other parameters related to all OA publications can be retrieved easily in real time on web in public domain. This has many benefits, including auditing and confirmation of impact parameters at author or journal level. Publications cited in curriculum vitae under evaluation for scholarly progress can be easily scrutinized transparently (by allowing access to various statistical data in real time) if they are in OA. This may not be possible with non-OA category, even for those with free access.

One primary advantage of OA to the scientific medical community includes availability of reasonably equitable platform for authors and readers. A study highlights more

cited articles under OA^[13] with a substantial percentage of literature available through search engines such as Google Scholar^[15] and other specialized services such as PubMed^[9] and Research Index^[16] extending powerful search methods available recently to general public at global level in public domain. A general understanding suggests that the peer-reviewed OA publications lead to higher rates of citation which has been reported by several publications.^[12,13] A citation is defined as “a reference to the source of information used in one’s research.”^[8] The majority of authors strive to be seen as an “authoritative source” and their work as “substantial.” The citations are crucial metric in determining the success of both authors and journals.

CONCLUSION

This study demonstrates that, in the field of cytopathology, the authors who published in OA journals during 5-year period from 2010 to 2015 accrued a higher citation rate as compared to the conventional non-OA cytopathology journals even if they were free access articles [Table 2].

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COMPETING INTEREST STATEMENT BY ALL AUTHORS

JK does not have conflicts of interest to declare. VS is Coeditor -in-chief of CytoJournal (so the manuscript review process was conducted by Academic Editor designated for this manuscript).

AUTHORSHIP STATEMENT BY ALL AUTHORS

Each author has participated sufficiently in the work and takes responsibility for appropriate portions of the content of this article. All authors read and approved the final manuscript.

ETHICS STATEMENT BY ALL AUTHORS

The study does not need IRB approval as it is based on public domain data.

LIST OF ABBREVIATIONS (In alphabetic order)

APC: Article publication cost
CCCL: Creative commons copyright license

CF: Cytopathology foundation
CPA: Citations per article
Dwlds: Downloads
IP: Intellectual property
JASC: Journal of American Cytopathology
J of Cytology: Journal of Cytology
non-OA: Non-open access
OA: Open access

EDITORIAL/PEER-REVIEW STATEMENT

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