Evaluating Open Access Publication and Research Impact in Gynecologic Oncology

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Abstract

Objective

To evaluate whether a citation advantage exists for open access (OA) publications in gynecologic oncology.

Method

A cross-sectional study of research and review articles published in the *International Journal of Gynecological Cancer* (*IJGC*) and in *Gynecologic Oncology* during 1980-2022. Bibliometric measures were compared between OA publications and non-OA publications. The role of authors in low/middle income countries was assessed. We analyzed article characteristics associated with a high citations per year (CPY) score.

Results

Overall, 18,515 articles were included of which 2,398 (13.0%) articles were published OA. The rate of OA has increased since 2007. During 2018-2022, the average proportion of articles published OA was 34.0% (range; 28.5%-41.4%). OA articles had higher CPY (median [IQR], 3.0 [1.5-5.3] vs. 1.3 [0.6-2.7], p<0.001). There was a strong positive correlation between OA proportion and impact factor; *IJGC* – r(23)=.90, p<0.001, *Gynecologic Oncology* – r(23)=.89, p<0.001. Articles by authors from low/middle income countries were less common among OA articles compared to non-OA articles (5.5% vs. 10.7%, p<0.001). Articles by authors from low/middle income countries were less common in the high CPY group compared to articles without a high CPY score (8.0% vs. 10.2%, p=0.003). The following article characteristics were found to be independently associated with a high CPY: publication after 2007, (adjusted odds ratio [aOR] 4.9, 95% confidence interval [CI] [4.2-5.7]), research funding reported (aOR 1.6, 95% CI 1.4-1.8), and being published OA (aOR 1.4, 95% CI 1.2-1.6). Articles written by authors in Central/South America or Asia had lower odds of having high CPY (Central/South America, aOR 0.4, 95% CI 0.2-0.8; Asia, aOR 0.5, 95% CI 0.4-0.7).

Conclusion

OA articles have higher CPY, with a strong positive correlation between OA proportion and impact factor. OA publishing has increased since 2007 with articles written by authors in low/middle income countries are underrepresented among OA publications.

Key words: bibliometrics, citation, income level, open access, subscription.

What is already known on this topic –

Articles published open access are cited more than comparable articles published under a subscription model.

What this study adds –

Open access publishing in subscription-based gynecologic oncology journals has increased and is independently associated with bibliometric measures of academic impact. Relative to the total number of articles written by authors in low/middle income countries, authors in low/middle income countries publish their articles infrequently under an open access license, however there is an increase in this proportion.

How this study might affect research, practice or policy –

Journals that weigh possibilities to change to open access models should include results of our study in their considerations. It would be important to study the role of open access in other journals and to find means for equality in open access for low/middle income countries' authors.

Introduction

Publishing original medical research has traditionally relied on authors who provide a journal's content and on editors and peer reviewers who perform the review and processing of such work. Historically, publishers relied on paid subscriptions to cover journal production costs. Despite hopes that online electronic publishing would be less expensive to produce[1], increasing journal subscription prices outpaced university libraries budgets, leading them to cancel subscriptions[2, 3]. Open access (OA) publishing emerged as a response to subscription-based publishing's paired problems of rising journal production costs and decreased access to research[4, 5].

OA is a model of publishing in journals in which the full text of articles can be freely accessed, as the publishing is funded through means other than subscriptions, most commonly articles process fees. Proponents of OA believe that it promotes wider distribution of research while also removing barriers to accessing it. Alongside with being an initiative with the intent of decreasing the costs of publication/subscription and improving scientific communication[6-8]. On the other hand, the article processing charges required for OA publishing may be prohibitively expensive, especially for authors from low or middle income countries[9].

In some research fields, articles published in OA seem to have a 'citation advantage' as they can be cited more often than comparable articles published under a subscription model. No investigation has evaluated if a citation advantage exists for OA publication in gynecologic oncology research. Our goal was to assess for an association between OA publication and citation impact, hypothesizing that articles published OA would have higher bibliometric measures of citation impact.

Methods

This was a cross-sectional study. We performed a search using Web of Science, a collection of large, online databases of bibliographic information of scientific publications. We initially included all articles that were published in the *International Journal of Gynecological Cancer* (*IJGC*) or *Gynecologic Oncology* from the year each journal adopted an Open Access policy

(*IJGC*, 1992; *Gynecologic Oncology*, 1980) until the present. We excluded all publications that were not either original research or review articles as categorized by Web of Science. The primary outcome measure was citations per year (CPY) in OA compared with non-OA articles.

For each journal, Web of Science was queried to generate a list of all publications. From Web of Science, we collected: article title, author list, corresponding author, OA license, funding support for the research described, and the usage count (the number of times an article's full text of a record has been accessed or saved) since 2013. We collected historical impact factors of both journals from the Journal Citation Reports web platform.

We categorized the articles identified as OA or non-OA. The OA status of each article was ascertained from the Web of Science database. This database classifies OA articles into different OA license types. For the purpose of this analysis, we defined articles in our sample as OA if they were published under any OA license (including those that were free of charge by the journals).

Bibliometric variables were abstracted from the National Institutes of Health (NIH) iCite database, a database maintained by the NIH Office of Portfolio Analysis used to evaluate the impact over time of the scientific research it has supported. From iCite, we collected: citations per year (CPY) (the average number of annual citations); relative citation ratio (the number of citations an article receives relative to a comparison group within the same field); field citation ratio (the number of citations an article has received divided by the average number received by other publications in the same year and same research field).

We defined the country of origin based on the country in the address of the corresponding author. When such was not available (n=6), we used the location of the first author's institution as listed in the publication. Country of origin was classified by geographic region (Africa, Asia, Central/South America, Europe, North America, and Oceania) and by income status (high vs. low/middle income country) as defined by the World Bank[11].

Statistical analysis

All data were gathered and analyzed in October 2022. We used descriptive statistics to summarize the proportion of OA articles. We performed Chi-square test to compare the OA group vs. non-OA group in different categories of each characteristic. We used Mann–Whitney U test to compare continuous variables. We performed univariable and multivariable logistic regression analyses to identify article characteristics associated with high CPY (defined as articles with CPY ≥90th percentile of the entire cohort). The multivariable analysis included the variables that were statistically significant during univariable analysis. We performed a ROC analysis to identify a cutoff value for publication year to differentiate between high CPY and normal CPY groups. That cutoff point (2007) was entered into the regression analysis. For all statistical analyses, a two-sided P< 0.05 was used as the criterion for statistical significance. We performed Spearman's rank correlation test to analyze the correlation between OA percentage of publications in each year and the impact factor of the journal in the same year. All analyses were conducted using SPSS 28 (SPSS Inc., Chicago, IL). Institutional review board approval was not required as the study used publicly available datasets and does not involve individual patient data.

Results

A total of 18,515 articles were included in the analysis (*IJGC*, 29.2% [5,408/18,515]; *Gynecologic Oncology*, 70.8% [13,107/18,515]). Figure 1 presents the rate of OA publications by year during the study period for each journal separately, which has increased constantly since 2007. Since the first OA article was published in either journal, 13% (2,398/18,515) of articles were published OA (*IJGC*, 12.1% [655/5,408]; *Gynecologic Oncology*, 13.3% [1,743/13,107]. During the most recent five years, the average proportion of articles published OA was 34.0% (percent range per year, 28.5%-41.4%). The proportion of publications supported by funding was higher in OA group vs, non-OA group. (77.9% [1,868/2,398] vs. 20.1% [3,243/16,117], p<0.001) (Table 1). There was higher proportion of articles by authors from North America in the OA group than non-OA articles (Table 1).

Compared to non-OA articles, OA articles had higher median CPY (median [IQR], 3.0 [1.5-5.3] vs. 1.3 [0.6-2.7], p<0.001).

A total of 1,858 (10.0%) publications were by authors in low/middle income countries (*IJGC*, 20.6% [1,112/5,408]; *Gynecologic Oncology*, 5.7% [746/13,107]). Overall, the proportion of all publications by authors in low/middle income countries during the last decade has declined from a peak of 14.5% [96/661] in 2012 to 9.3% [31/333] in 2022 (p<0.001). During the last decade, the proportion of publications by authors in low/middle income countries in OA publications has increased from 0.8% in 2012 to 8.5% in 2022 while their proportion in non-OA group has declined from 17.8% to 9.7%, p<0.001 (Figure 2).

Table 2 presents comparison of articles with a CPY above the 90th percentile (n=1,801; median CPY, 7.7 [IQR 6.4-10.7]) vs. less than the 90th percentile (n=16,146; median CPY, 1.3 [IQR 0.6-2.4]). Total number of citations, publication year, and OA status were positively associated with high CPY. Among high CPY articles compared to all other articles, North American authorship was more common (55.9% [1,007/1,801] vs. 47.8% [7,724/16,146]). Using multivariable regression (Table 3), the variables found to be independently associated with high CPY were: publication after 2007 (adjusted odds ratio [aOR] 4.9 [95% CI 4.2-5.7]), research funding reported (aOR 1.6 [95% CI 1.4-1.8]), and OA status (aOR 1.4, [95% CI 1.2-1.6)]. Articles written by authors in Central America, South America, and Asia had lower odds of being in the high CPY group.

The correlation between OA-publication proportion in each year and journal impact factor are presented in Figure S1. There was a strong positive correlation between OA proportion and IF; *IJGC* – r(23)=.90, p<.001, *Gynecologic Oncology* – r(23)=.89, p<.001.

Sensitivity analysis for original research articles [n=17,234 (93.1%)] and review articles [(n=1,281) 6.9%) is presented in Tables S1-S4. Among original research articles, the results of the regression analysis remained mostly unchanged. Articles written by authors in Africa, Central/South America, and Asia had lower odds of being in the high CPY group. Among review articles, the variables found to be independently associated with high CPY were: publication after 2007 (adjusted odds ratio [aOR] 4.7 [95% CI 2.1-10.5]) and research

funding reported (aOR 1.53 [95% CI 1.001-2.35]). Geographic region and OA status were not associated with different odds for being in the high CPY group.

Discussion

Summary of main results

In gynecologic oncology research, we found that OA publication has become gradually more common since its adoption. Over the last 5 years, 34.0% of articles published in two major gynecologic oncology journals were published OA. Articles published OA tended to have higher measures of scientific impact. We also found that articles by low/middle income countries authors were underrepresented among OA publications.

Results in the Context of Published Literature

OA refers to unrestricted and free online access to full-text published articles[12]. Some subscription-based journals provide OA publishing options to authors at the cost of article processing charges. Both *IJGC* and *Gynecologic Oncology* are among most often cited gynecologic oncology journals and each offers OA publishing at a cost to the authors. There is a great debate in recent years regarding publishing and knowledge distribution in academics [12-14]. Furthermore, the movement of endorsing OA publishing is increasing with some evidence that in 2015 nearly half the published literature was OA [5].

Open access publishing has a variety of advantages including social, economic, and academic benefits[15]. However, OA relies on financial support, either by the authors, institutions, or research funders. Article processing charges may be unaffordable for authors or institutions, particularly those in low/middle income countries. [16, 17].

Most literature regarding OA publishing examines articles in journals that exclusively publish OA rather than in hybrid subscription journals, such as *IJGC* or *Gynecologic Oncology*. Therefore, the impact of OA publishing is difficult to estimate as there is limited comparison between OA and non-OA articles published within the same journal.[18, 19]. It is important to highlight that there is a marked distinction between OA journals, such as the International

Journal of Gynecological Cancer and Gynecologic Oncology, that provide a strict and rigorous process for manuscript review and 'predator journals' where articles are open access but rather because these undergo little or no review and authors pay a fee for a guaranteed publication. [20-22] Readers need to be aware and should interpret the available literature cautiously about OA publications due to this bias.

Our finding that one in three recent articles in *IJGC* or *Gynecologic Oncology* were published under an OA license is in line with the literature in other specialties where an estimated 28% of articles are OA[5]. Outside gynecologic cancer research, the existence of an OA citation advantage (OA articles are more likely to be cited than non-OA articles) has been debated. Whether or not an OA citation advantage is identified in a given analysis seems to depend on the field of research in question, the methodology of the investigators, and the journal's impact factor. Our findings that CPY, relative citation ratio, and field citation ratio were higher in OA articles suggest that an OA citation advantage is present in gynecologic cancer research. This hypothesis is further supported by the finding that OA status was independently associated with being among the most frequently cited articles in the two journals studied.

We found that 10% of all articles were written by authors in low/middle income countries. Among OA articles, an even smaller percentage were from low/middle income countries authors. Although an intuitive explanation would be that low/middle income countries authors find OA article processing charges to be prohibitive, the publishers for both journals in our study waive or reduce these fees for authors from low/middle income countries. For example, *IJGC*'s publisher, BMJ Publishing Group, completely waives the full article processing charge for authors from low income countries[23]. Nevertheless, it is possible that some authors are unaware of these waivers.

Although we have found higher number of total citations in the non-OA group, we believe that this is a result of the 'seniority effect' (older studies accrue more citations over time). Indeed, the adjusted measure – the number of citations per year is not higher in the non-OA group.

We demonstrate a strong correlation between OA proportion and journal impact factor. There is scarce literature on this correlation, as most literature compares fully-OA journals to subscription based journals and some studies analyzed the conversion of journals from subscription based to fully-OA model, also known as 'flipping'[24]. Generally, it is understandable that OA articles are easier to access and therefore to cite, this would increase the journal's impact factor. On the other hand, OA publications are more likely to have research funding support and this could be a confounder for representing high quality manuscripts funded by industry and randomized trials that would be published in higher impact factor journals.

Strengths and Weaknesses

Among the strengths of the study is that it included all original research and review articles published in two major gynecological cancer journals subsequent to when each journal began offering OA publication. To our knowledge, this study is the first to evaluate whether OA citation advantage exists in gynecologic oncology research. Our study has a number of limitations. Unmeasured confounding could influence the relationship between OA status and high CPY. Although we present a sensitivity analysis evaluating differences between review articles and original research articles, we did not analyze differences among different types of original research articles. We defined the country of origin based on the geography of a single author. It is uncertain if more comprehensive definition of article provenance would have resulted in different findings. Additionally, research relevant to our field can also often be found in other publications that have broader focus (*Obstetrics & Gynecology, Journal of Clinical Oncology*). It is also possible that OA policy has changed during the study period and that OA fees has changed, thereby we cannot exclude biases introduced by OA policy change during the study period. The World Bank's income classification is not static, but in this study, we used the categorization from July 2022. Some countries may have changed income category during the study period, meaning the classification of a country's income in this study may be different than the year when an author submitted their article for

publication. Finally, we did not analyze the different source of funding (industry vs. government) which may be a confounder.

Implications for Practice and Future Research

While some publishers and journals might consider the OA model for various reasons, we hereby provide data regarding the role of OA in two subscription model journals in gynecologic oncology. The findings of our study should be further validated by future research of the impact of OA in other journals as well. This might aid in underlining inequalities between high and low/middle income countries in accessibility to the advantages of OA identified in our study.

Conclusion

In *the International Journal of Gynecological Cancer* and *Gynecologic Oncology*, a third of recent articles are published OA. These OA-published articles have a higher number of citations per year and other citation metrics score compared to articles published without OA. Articles written by authors in low/middle income countries are underrepresented overall, but even more so among OA publications, raising a concern that authors from these regions face obstacles to using OA to publish and distribute their research work.

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389 **Table 1.** Open Access publications compared to non-Open Access publications (n=18,515)

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Characteristics	Open Access (n=2,398)	Non-Open Access (n=16,117)	P value
Citations per year	3 (1.5-5.3)	1.3 (0.6-2.7)	<0.001
Field citation ratio	6.1 (4.8-7.4)	4.4 (3.2-5.8)	<0.001
Relative citation ratio	0.9 (0.5-1.8)	0.7 (0.3-1.3)	<0.001
Total citations	14 (6-31)	18 (8-35)	<0.001
Usage count since 2013	4 (2-8)	2 (0-4)	<0.001
Year of publication	2015 (2012-2018)	2006 (1998-2012)	<0.001
Number of pages	7 (6-8)	6 (5-7)	<0.001
Research funding reported , n (%)	1,868 (77.9%)	3,243 (20.1%)	<0.001
Geographic region, n (%)			
Africa	9 (0.4%)	101 (0.6%)	
Central/South America	31 (1.3%)	265 (1.6%)	
Asia	163 (6.8%)	3,572 (22.2%)	<0.001
Europe	489 (20.4%)	4,430 (27.5%)	
North America	1,654 (69.0%)	7,338 (45.5%)	
Oceania	52 (2.2%)	411 (2.6%)	
Low/medium income country authorship, n (%)	132 (5.5%)	1,726 (10.7%)	<0.001

Figures are median (IQR) unless indicated otherwise.

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395 **Table 2.** Publications with high CPY (≥90th percentile) compared to publications with CPY

396 <90th percentile (n=17,947)

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Characteristics	CPY ≥90th percentile n=1,801	CPY <90th percentile n=16,146	P value
Citations per year, median (IQR)	7.7 (6.4-10.7)	1.3 (0.6-2.4)	<0.001
Total citations, median (IQR)	61 (30-106)	16 (8-31)	<0.001
Usage count since 2013, median (IQR)	7 (3-13)	2 (0-4)	<0.001
Year of Publication			
1997-2007	313 (17.4%)	8.938 (55.4%)	
2007-2014	585 (32.5%)	3.904 (24.2%)	<0.001
2015-2022	903 (50.1%)	3,304 (20.4%)	
Research funding reported	947 (52.6%)	4,005 (24.8%)	<0.001
Geographic Region			
Africa	3 (0.2%)	98 (0.6%)	<0.001
Central/South America	18 (1.0%)	256 (1.6%)	
Asia	243 (13.5%)	3,402 (21.1%)	
Europe	492 (27.3%)	4,263 (26.4%)	
North America	1,007 (55.9%)	7,724 (47.8%)	
Oceania	38 (2.1%)	403 (2.5%)	
Open access	541 (30.0%)	1,712 (10.6%)	<0.001
Low/medium income country authorship	144 (8.0%)	1,643 (10.2%)	0.003

Figures are n (%) unless indicated otherwise. 17,947 (96.9%) of the articles had a citations per year score.

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400 **Table 3.** Multivariable analysis of characteristics associated with high CPY (≥90th percentile)

401 (n=17,947)

Variable	Adjusted Odds Ratio	95% Confidence Interval
Published after 2007	4.93	4.26-5.71
Open Access	1.47	1.29-1.68
Research Funding Reported	1.61	1.43-1.82
Geographic Region		
Ref. (other[1])	-	-
Africa	0.33	0.10-1.12
Central/South America	0.48	0.27-0.84
Asia	0.57	0.46-0.70
North America	1.06	0.94-1.19
Low/medium income country authorship	1.12	0.86-1.46

[1] Europe and Oceania. 17,947 (96.9%) of the cohort had a citations per year score. A total of 1,801 articles had CPY ≥90th percentile.

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405 Legend for figures:

406 **Fig. 1 –** Proportion of Open Access publications in *IJGC* and *Gynecologic Oncology*

407 **Fig. 2** Proportion of Open Access and non-Open Access publications per year by authors

408 from low/middle income countries since 2012

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