


Article

# Hybrid Gold Open Access Citation Advantage in Clinical Medicine: Analysis of Hybrid Journals in the Web of Science

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**Abstract:** Biomedical fields have seen a remarkable increase in hybrid Gold open access articles. However, it is uncertain whether the hybrid Gold open access option contributes to a citation advantage, an increase in the citations of articles made immediately available as open access regardless of the article's quality or whether it involves a trending topic of discussion. This study aimed to compare the citation counts of hybrid Gold open access articles to subscription articles published in hybrid journals. The study aimed to ascertain if hybrid Gold open access publications yield an advantage in terms of citations. This cross-sectional study included the list of hybrid journals under 59 categories in the 'Clinical Medicine' group from Clarivate's Journal Citation Reports (JCR) during 2018–2021. The number of citable items with 'Gold Open Access' and 'Subscription and Free to Read' in each journal, as well as the number of citations of those citable items, were extracted from JCR. A hybrid Gold open access citation advantage was computed by dividing the number of citations per citable item with hybrid Gold open access by the number of citations per citable item with a subscription. A total of 498, 636, 1009, and 1328 hybrid journals in the 2018 JCR, 2019 JCR, 2020 JCR, and 2021 JCR, respectively, were included in this study. The citation advantage of hybrid Gold open access articles over subscription articles in 2018 was 1.45 (95% confidence interval (CI), 1.24–1.65); in 2019, it was 1.31 (95% CI, 1.20–1.41); in 2020, it was 1.30 (95% CI, 1.20–1.39); and in 2021, it was 1.31 (95% CI, 1.20–1.42). In the 'Clinical Medicine' discipline, the articles published in the hybrid journal as hybrid Gold open access had a greater number of citations when compared to those published as a subscription, self-archived, or otherwise openly accessible option.

**Keywords:** open access; gold open access; citations; clinical medicine



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## 1. Introduction

Since the Budapest Open Access Initiative statement was released in 2002, open access articles in biomedical fields have grown remarkably [1,2]. Gold open access articles refer to those published under Creative Commons (CC) licenses and are freely accessible without the need to subscribe to journals or make a purchase to have access to those articles [3]. Quite a few fully open access publishers (e.g., Frontiers, Hindawi, MDPI, and PLoS) have been founded since then [4], and several traditional publishers have also made their journals either fully open access (Gold) journals or hybrid journals offering the option for authors to choose immediate hybrid Gold open access [5,6]. It is well accepted that Gold open access articles have numerous benefits, such as the retention of copyright by authors, a greater public engagement, more social media attention, and an increased article usage [7–10]. However, the main drawback of making articles immediately freely available through hybrid Gold open access is the article processing charge which the authors are required to pay and which many cannot afford [11–13].

It is still up for debate whether Gold open access would accelerate scientific advancement and the translation of research knowledge into practice [14,15]. While the Gold open access approach has the potential to hasten the dissemination of research findings, its advantage for article citations, a proxy for the scientific impact of an article, remains controversial [16,17]. Several studies support the existence of an open access citation advantage—increased citations of articles made available as open access irrespective of the article’s quality or whether it is part of a trending topic of attention [18–20]; however, this claim has been refuted by many other studies [21–24]. It is undeniable that hybrid Gold open access articles can reach more readers than subscription ones [25], but it is uncertain if this translates to greater recognition and, in turn, more article citations [26–28]. Hitherto, an immediate hybrid Gold open access citation advantage has been the topic of much discussion [29–31].

Assuming that there is some level of citation advantage, this would mean that the articles published as hybrid Gold open access would receive an additional citation advantage beyond their intrinsic quality from their availability. Hence, the present study was designed to compare the citation counts of hybrid Gold open access articles to subscription articles from hybrid journals with the aim of determining whether hybrid Gold open access publications result in an advantage in terms of citations.

## 2. Materials and Methods

### 2.1. Study Design and Selection Criteria

In this cross-sectional study, the selected journals were drawn from Clarivate’s Journal Citation Reports (JCR) which used data sources from the Web of Science database. The list of journals was limited to 59 categories in the ‘Clinical Medicine’ group which included: (1) Allergy, (2) Andrology, (3) Anesthesiology, (4) Audiology & Speech-language Pathology, (5) Behavioral Sciences, (6) Cardiac & Cardiovascular Systems, (7) Clinical Neurology, (8) Critical Care Medicine, (9) Dentistry, Oral Surgery & Medicine, (10) Dermatology, (11) Emergency Medicine, (12) Endocrinology & Metabolism, (13) Engineering, Biomedical, (14) Gastroenterology & Hepatology, (15) Genetics & Heredity, (16) Geriatrics & Gerontology, (17) Health Care Sciences & Services, (18) Health Policy & Services, (19) Hematology, (20) Immunology, (21) Infectious Diseases, (22) Integrative & Complementary Medicine, (23) Materials Science, Biomaterials, (24) Medical Ethics, (25) Medical Informatics, (26) Medical Laboratory Technology, (27) Medicine, General & Internal, (28) Medicine, Legal, (29) Medicine, Research & Experimental, (30) Neuroimaging, (31) Neurosciences, (32) Nursing, (33) Nutrition & Dietetics, (34) Obstetrics & Gynecology, (35) Oncology, (36) Ophthalmology, (37) Orthopedics, (38) Otorhinolaryngology, (39) Pathology, (40) Pediatrics, (41) Peripheral Vascular Disease, (42) Pharmacology & Pharmacy, (43) Primary Health Care, (44) Psychiatry, (45) Psychology, Clinical, (46) Public, Environmental & Occupational Health, (47) Radiology, Nuclear Medicine & Medical Imaging, (48) Rehabilitation, (49) Reproductive Biology, (50) Respiratory System, (51) Rheumatology, (52) Sport Sciences, (53) Substance Abuse, (54) Surgery, (55) Toxicology, (56) Transplantation, (57) Tropical Medicine, (58) Urology & Nephrology, and (59) Virology.

The characteristics of journals used in the analysis were as follows: (1) they were indexed in the Science Citation Index Expanded (SCIE), Social Science Citation Index (SSCI), or Arts & Humanities Citation Index (AHCI); (2) they were hybrid journals with a percentage of hybrid Gold open access articles between 10 and 90; and (3) they had at least 20 hybrid Gold open access articles. Fully Gold open access journals or those indexed in the Emerging Sources Citation Index (ESCI) were excluded.

The Research Ethics Committee of the Faculty of Medicine, Chiang Mai University, granted an exempt research determination for this study (No. EXEMPTION 9047/2022).

### 2.2. Data Extraction

This study extracted data from the 2018–2021 JCRs. Data to be extracted included the bibliometrics of the journal (i.e., journal impact factor, journal impact factor percentile, journal impact factor without self-citation, 5-year journal impact factor, normalized Eigenfactor, article influence score, immediacy index, cited half-life, and citing half-life), the publisher,

the number of citable items with ‘Gold Open Access’ and ‘Subscription and Free to Read’ in each journal, and the number of citations of citable items with ‘Gold Open Access’ and ‘Subscription and Free to Read’ in each journal.

In this study, the model of open access was based on JCR classifications: (1) ‘Gold Open Access’ and (2) ‘Subscription and Free to Read’. Citable items were defined as any materials indexed as articles, reviews, or proceedings papers. Citation counts were derived from citations of citable items published in the two preceding years.

### 2.3. Data Analysis

As appropriate, descriptive analyses were presented as the frequency with percentage or mean with standard deviation. The number of citations per citable item with hybrid Gold open access divided by the number of citations per citable item with a subscription was regarded as a measure to indicate a hybrid Gold open access citation advantage. This value of 1.0 indicated that hybrid Gold open access articles were cited equally when compared to subscription articles in a journal, while those above or below 1.0 indicated that the citation impact was above or below, respectively. Statistical analyses were performed using RStudio (R version 4.2.2) [31]. A *p*-value of less than 0.05 was regarded as indicating statistical significance.

## 3. Results

From the 2018 JCR, 2019 JCR, 2020 JCR, and 2021 JCR, a total of 498, 636, 1009, and 1328 journals were included in this study. The characteristics of the journals included in this study are shown in Table 1. The percentage of hybrid Gold open access items in a journal was found to be around one-fifth to one-fourth during the four-year period. The publisher with the largest number of journals included in this study was Springer Nature (23.95–29.52%), followed by Elsevier (16.25–19.65%), Wiley (12.65–19.23%), and several other publishers. The average journal impact factor of the included journals was  $4.57 \pm 4.69$  in the 2018 JCR and gradually increased year after year to  $6.01 \pm 9.35$  in the 2021 JCR. Other journal metrics of the journals in each JCR year are displayed in Table 1.

**Table 1.** Characteristics of the included journals.

Variables	2018 ( <i>n</i> = 498)	2019 ( <i>n</i> = 636)	2020 ( <i>n</i> = 1009)	2021 ( <i>n</i> = 1328)
Number of articles in the included journals				
Hybrid Gold open access items in a journal	107.06 ± 211.70	107.85 ± 227.00	118.08 ± 181.16	118.75 ± 157.36
Subscription items in a journal	386.62 ± 356.43	376.15 ± 345.96	371.44 ± 319.59	380.34 ± 326.04
Percentage of hybrid Gold open access items in a journal	22.23 ± 16.35	21.61 ± 14.67	24.90 ± 18.28	24.73 ± 17.22
Publisher				
Elsevier	91 (18.27)	108 (16.98)	164 (16.25)	261 (19.65)
Wiley	63 (12.65)	98 (15.41)	194 (19.23)	245 (18.45)
Springer Nature	147 (29.52)	184 (28.93)	273 (27.06)	318 (23.95)
Taylor & Francis	22 (4.42)	25 (3.93)	38 (3.77)	78 (5.87)
Oxford University Press	34 (6.83)	42 (6.60)	66 (6.54)	78 (5.87)
SAGE	22 (4.42)	27 (4.25)	38 (3.77)	49 (3.69)
Miscellaneous	119 (23.90)	152 (23.90)	236 (23.39)	299 (22.52)

Table 1. Cont.

Variables	2018 (n = 498)	2019 (n = 636)	2020 (n = 1009)	2021 (n = 1328)
Journal metrics				
Journal impact factor	4.57 ± 4.69	4.59 ± 4.72	5.18 ± 5.38	6.01 ± 9.35
Journal impact factor percentile	64.96 ± 26.45	63.64 ± 26.22	60.95 ± 26.63	58.64 ± 26.91
Journal impact factor without self cites	4.27 ± 4.52	4.30 ± 4.57	4.84 ± 5.26	5.70 ± 9.23
Journal citation indicator	1.32 ± 1.21	1.30 ± 1.21	1.21 ± 1.08	1.18 ± 1.18
5-year journal impact factor	4.65 ± 4.52	4.74 ± 4.74	5.33 ± 5.27	5.75 ± 6.94
Normalized Eigenfactor score	2.22 ± 3.88	2.01 ± 3.64	2.78 ± 5.25	2.59 ± 5.40
Article influence score	1.54 ± 1.85	1.52 ± 1.85	1.59 ± 1.97	1.56 ± 2.37
Immediacy index	1.31 ± 1.44	1.32 ± 1.48	2.71 ± 10.33	1.55 ± 2.77
Citing half-life	7.62 ± 1.86	7.55 ± 1.68	7.43 ± 1.73	7.35 ± 1.70
Cited half-life	7.21 ± 2.85	7.38 ± 1.68	7.41 ± 3.05	7.47 ± 3.01

Values indicate mean ± standard deviation or frequency (percentage).

The citation advantages of hybrid Gold open access articles versus subscription articles were 1.45 (95% confidence interval (CI), 1.24–1.65) in 2018, 1.31 (95% CI, 1.20–1.41) in 2019, 1.30 (95% CI, 1.20–1.39) in 2020, and 1.31 (95% CI, 1.20–1.42) in 2021 (Figure 1). The hybrid Gold open access citation advantage was also observed in several subgroups of the journals based on the publishers (Table 2). The journals published by Springer Nature, Elsevier, and Oxford University Press were significantly associated with a hybrid Gold open access citation advantage across the study period (from 2018 JCR to 2021 JCR).

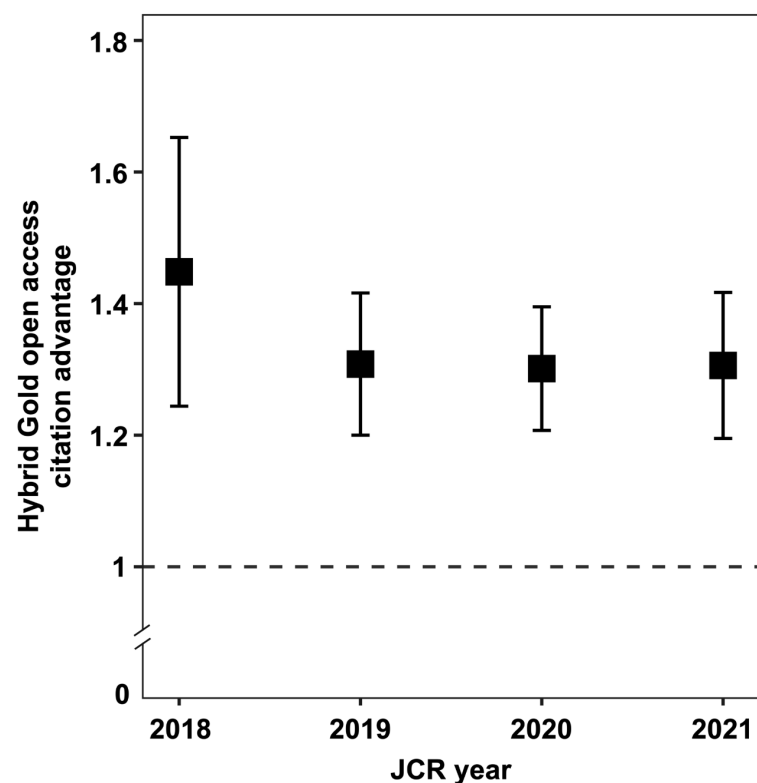


Figure 1. Hybrid Gold open access citation advantages in 2018–2021 JCR years. Error bars indicate 95% confidence intervals.

**Table 2.** Hybrid Gold open access citation advantages by subgroup analysis.

	Hybrid Gold Open Access Citation Advantage			
	2018	2019	2020	2021
Overall	1.45 [1.24–1.65]	1.31 [1.20–1.41]	1.30 [1.20–1.39]	1.31 [1.20–1.42]
Publisher				
Elsevier	1.31 [1.22–1.40]	1.60 [1.04–2.17]	1.26 [1.17–1.35]	1.11 [1.05–1.16]
Wiley	1.26 [1.08–1.44]	1.17 [1.08–1.27]	1.22 [0.93–1.52]	1.32 [0.80–1.84]
Springer Nature	1.89 [1.22–2.57]	1.46 [1.35–1.56]	1.33 [1.22–2.55]	1.25 [1.18–1.31]
Taylor & Francis	1.31 [1.04–1.59]	1.01 [0.80–1.22]	1.02 [0.87–1.90]	1.08 [0.99–1.17]
Oxford University Press	1.17 [1.06–1.27]	1.20 [1.09–1.31]	1.25 [1.14–1.35]	1.27 [1.17–1.37]
SAGE	0.86 [0.43–1.29]	0.87 [0.56–1.19]	1.03 [0.87–1.20]	1.18 [0.98–1.38]
Miscellaneous	1.31 [1.20–1.43]	1.16 [1.02–1.29]	1.47 [1.18–1.75]	1.62 [1.39–1.85]

Values indicate mean [95% confidence interval].

#### 4. Discussion

The present study observed an association between being hybrid Gold open access and receiving more citations. In the ‘Clinical Medicine’ discipline, hybrid Gold open access articles received, on average, 30% more citations than subscription articles. Our observation is consistent with several previous studies indicating the advantage of open access in terms of article citations [32]. However, most studies supporting the open access citation advantage are observational and based on historical data [33–38], but there are far fewer with randomized controls [39,40]. Further investigations are required to explore reasonable explanations for the observation of open access citation advantage in some studies but not in others [41]. An increase in citations may be attributable to several factors, including but not limited to immediate access to the article [42,43].

This study was designed to determine a hybrid Gold open access citation advantage based on the hypothesis that articles published as hybrid Gold open access in hybrid journals would have had more citations on average than subscription articles in the same journals. This study design minimizes the bias arising from the journal’s reputation (e.g., journal prestige and journal impact factor) and editorial policies (e.g., research fields, acceptance rates, publication lag, and early view effects), all of which are considered confounders that may affect citation rates [44,45]. However, this design has a selection bias (i.e., the authors may have only selected their high-quality work to share openly) since the authors are required to pay the article processing charge to make their articles open from the outset [32,46]. Furthermore, the article processing charge may restrict the hybrid Gold open access option to those who have a grant or other financial means [47–49]. However, it is to be noted that some funders may adopt the Plan S principles and do not financially support ‘hybrid’ open access publication fees in subscription venues unless the publisher has signed a Transitional Agreement with the institution or consortium thereof [50].

With this study design, we cannot claim causation; rather, we aimed to provide insight into the association between hybrid Gold open access and citation counts. In our analysis, there were quite a few confounding factors we could not control that may affect citation counts independently from any hybrid Gold open access effect. For example, articles with more authors are more likely to be self-archived (as it takes only one author to self-archive) and are also cited more often through increased self-citations [51,52]. Another example is that articles tend to have more citations when they are linked with online platforms for cross-publisher distribution or social media platforms [53–56]. To assess the hybrid Gold open access citation advantage, confounding factors are not always easy to address since every article is (or at least should be) unique. Finding an appropriate control is rather challenging and does not offer a straightforward means for comparison [57]. Additionally, a randomized-controlled study on this subject is much more challenging to conduct, which is another well-known fact. That is why there have been few randomized-controlled studies on this subject.

The results of the present study should be evaluated in light of its limitations. First, the citation counts in this study were limited to the journals indexed by the Web of Science, where the citation coverage is much lower than some other sources of citation data, such as Scopus or Google Scholar citation databases [58,59]. Second, the citation counts were extracted from the JCR, which refers to citations in the JCR data year to items published in the previous two years. This timeframe is considered sufficient to detect a citation advantage, if one exists, since citing authors typically need time to prepare and publish their articles [60]. However, citation advantages across extended time horizons are beyond the purview of this study. Third, this study collected data since the 2018 JCR which is the first JCR year to include 'Gold Open Access' and 'Subscription and Free to Read' items, as well as their citations, in the JCR database. Therefore, the findings of this study should be interpreted on the basis of this time frame. Since the Transformative Agreement is now more widely adopted, it is uncertain if the citation advantage will continue to hold true in the near future when the number of hybrid Gold open access articles dramatically increases [61]. Fourth, subscription articles might have been openly available through other modes [46], none of which were taken into account in our analysis. For example, Bronze articles, which are available to readers for free on the publisher site without an explicit open access license, or Green articles, which are subject to an embargo period (typically one year or six months) prior to their self-archiving in a public repository (e.g., PubMed Central®), were categorized as 'Subscription and Free to Read' in the JCR [62,63]. Furthermore, there are many other modes of making articles open to access regardless of the journal's policy, such as academic social networks (e.g., ResearchGate or Academia.edu) [64] and websites offering pirate access to full-text articles (e.g., SciHub) [65]. As a result, our analysis might over- or underestimate the impact of open access with the hybrid Gold open access option on citations.

It should be noted that the present study merely focused on the impact of hybrid Gold open access on citations. Whether citation metrics are representative of article quality, knowledge utilization, or any other scientific impact is beyond the scope of our discussion. Scientific impact and exposure go beyond simple citation counts and several articles have already discussed those aspects in detail [66–68]. Furthermore, whether the hybrid model for the open access publication of articles is appropriate or not is also beyond the scope of the present study and it is extensively discussed elsewhere [69–71].

## 5. Conclusions

In conclusion, our empirical study suggests that articles published as hybrid Gold open access on the journal site are associated with higher citation rates than subscription, self-archived, or otherwise openly accessible articles. Hybrid Gold open access articles are more likely to be cited by peers than subscription articles published in the same journal in the 'Clinical Medicine' discipline. Further studies are required to examine any hybrid Gold open access citation advantage trends across other areas and disciplines, as well as other data sources.

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## References

1. Kurata, K.; Morioka, T.; Yokoi, K.; Matsubayashi, M. Remarkable growth of open access in the biomedical field: Analysis of PubMed articles from 2006 to 2010. *PLoS ONE* **2013**, *8*, e60925. [[CrossRef](#)] [[PubMed](#)]
2. Severin, A.; Egger, M.; Eve, M.P.; Hürlimann, D. Discipline-specific open access publishing practices and barriers to change: An evidence-based review. *F1000Research* **2018**, *7*, 1925. [[CrossRef](#)] [[PubMed](#)]
3. van der Heyden, M.A.G.; van Veen, T.A.B. Gold open access: The best of both worlds. *Neth. Heart J.* **2018**, *26*, 3–4. [[CrossRef](#)] [[PubMed](#)]
4. Brower, V. Public library of science shifts gears. As scientific publishing boycott deadline approached, advocates of free scientific publishing announce that they will create their own online, free-access archive. *EMBO Rep.* **2001**, *2*, 972–973. [[CrossRef](#)]
5. Laakso, M.; Björk, B.C. Anatomy of open access publishing: A study of longitudinal development and internal structure. *BMC Med.* **2012**, *10*, 124. [[CrossRef](#)]
6. Solomon, D.J.; Laakso, M.; Björk, B.-C. A longitudinal comparison of citation rates and growth among open access journals. *J. Informetr.* **2013**, *7*, 642–650. [[CrossRef](#)]
7. McKiernan, E.C.; Bourne, P.E.; Brown, C.T.; Buck, S.; Kenall, A.; Lin, J.; McDougall, D.; Nosek, B.A.; Ram, K.; Soderberg, C.K.; et al. How open science helps researchers succeed. *Elife* **2016**, *5*, e16800. [[CrossRef](#)]
8. Tennant, J.P.; Waldner, F.; Jacques, D.C.; Masuzzo, P.; Collister, L.B.; Hartgerink, C.H. The academic, economic and societal impacts of Open Access: An evidence-based review. *F1000Research* **2016**, *5*, 632. [[CrossRef](#)]
9. Wang, X.; Liu, C.; Mao, W.; Fang, Z. The open access advantage considering citation, article usage and social media attention. *Scientometrics* **2015**, *103*, 555–564. [[CrossRef](#)]
10. Zhang, G.; Wang, Y.; Xie, W.; Du, H.; Jiang, C.; Wang, X. The open access usage advantage: A temporal and spatial analysis. *Scientometrics* **2021**, *126*, 6187–6199. [[CrossRef](#)]
11. Hunter, P. The deal with DEAL for open access: The recent publish-and-read deals have increased momentum for open-access publishing but may not solve the challenge of open science. *EMBO Rep.* **2020**, *21*, e49794. [[CrossRef](#)] [[PubMed](#)]
12. Ross-Hellauer, T.; Reichmann, S.; Cole, N.L.; Fessl, A.; Klebel, T.; Pontika, N. Dynamics of cumulative advantage and threats to equity in open science: A scoping review. *R. Soc. Open Sci.* **2022**, *9*, 211032. [[CrossRef](#)]
13. Zhu, Y. Who support open access publishing? Gender, discipline, seniority and other factors associated with academics' OA practice. *Scientometrics* **2017**, *111*, 557–579. [[CrossRef](#)] [[PubMed](#)]
14. Dorta-González, P.; González-Betancor, S.M.; Dorta-González, M.I. Reconsidering the gold open access citation advantage postulate in a multidisciplinary context: An analysis of the subject categories in the Web of Science database 2009–2014. *Scientometrics* **2017**, *112*, 877–901. [[CrossRef](#)]
15. Spedding, S. Open Access Publishing of Health Research: Does Open Access Publishing Facilitate the Translation of Research into Health Policy and Practice? *Publications* **2016**, *4*, 2. [[CrossRef](#)]
16. Snijder, R. Revisiting an open access monograph experiment: Measuring citations and tweets 5 years later. *Scientometrics* **2016**, *109*, 1855–1875. [[CrossRef](#)] [[PubMed](#)]
17. Piwowar, H.; Priem, J.; Larivière, V.; Alperin, J.P.; Matthias, L.; Norlander, B.; Farley, A.; West, J.; Haustein, S. The state of OA: A large-scale analysis of the prevalence and impact of Open Access articles. *PeerJ* **2018**, *6*, e4375. [[CrossRef](#)]
18. Bautista-Puig, N.; Lopez-Illescas, C.; de Moya-Anegón, F.; Guerrero-Bote, V.; Moed, H.F. Do journals flipping to gold open access show an OA citation or publication advantage? *Scientometrics* **2020**, *124*, 2551–2575. [[CrossRef](#)]
19. Cooke, R.; Jain, N. Open access journals are as likely to be referenced by the Orthopaedic literature, despite having a lower impact factor than subscription-based journals. *SICOT-J* **2021**, *7*, 64. [[CrossRef](#)]
20. Gargouri, Y.; Hajjem, C.; Larivière, V.; Gingras, Y.; Carr, L.; Brody, T.; Harnad, S. Self-selected or mandated, open access increases citation impact for higher quality research. *PLoS ONE* **2010**, *5*, e13636. [[CrossRef](#)]
21. Björk, B.C.; Solomon, D. Open access versus subscription journals: A comparison of scientific impact. *BMC Med.* **2012**, *10*, 73. [[CrossRef](#)]
22. Calver, M.C.; Bradley, J.S. Patterns of citations of open access and non-open access conservation biology journal papers and book chapters. *Conserv. Biol.* **2010**, *24*, 872–880. [[CrossRef](#)] [[PubMed](#)]
23. Chen, X.; Bharti, N.; Marsteller, M.R. Use of Bibliometrics Data to Understand the Citation Advantages of Different Open Access Categories in COVID-19 Related Studies. *Proc. Assoc. Inf. Sci. Technol.* **2021**, *58*, 410–414. [[CrossRef](#)] [[PubMed](#)]
24. Mitra, A.N.; Aurora, N.; Grover, S.; Ananth, C.V.; Brandt, J.S. A bibliometric analysis of obstetrics and gynecology articles with highest relative citation ratios, 1980 to 2019. *Am. J. Obstet. Gynecol. MFM* **2021**, *3*, 100293. [[CrossRef](#)]
25. Holmberg, K.; Hedman, J.; Bowman, T.D.; Didegah, F.; Laakso, M. Do articles in open access journals have more frequent altmetric activity than articles in subscription-based journals? An investigation of the research output of Finnish universities. *Scientometrics* **2020**, *122*, 645–659. [[CrossRef](#)]
26. Baek, S.; Yoon, D.Y.; Lim, K.J.; Cho, Y.K.; Seo, Y.L.; Yun, E.J. The most downloaded and most cited articles in radiology journals: A comparative bibliometric analysis. *Eur. Radiol.* **2018**, *28*, 4832–4838. [[CrossRef](#)] [[PubMed](#)]
27. Hong, J.H.; Yoon, D.Y.; Lim, K.J.; Moon, J.Y.; Baek, S.; Seo, Y.L.; Yun, E.J. Characteristics of the Most Cited, Most Downloaded, and Most Mentioned Articles in General Medical Journals: A Comparative Bibliometric Analysis. *Healthcare* **2020**, *8*, 492. [[CrossRef](#)]
28. Nieder, C.; Dalhaug, A.; Aandahl, G. Correlation between article download and citation figures for highly accessed articles from five open access oncology journals. *Springerplus* **2013**, *2*, 261. [[CrossRef](#)]

29. Dorta-González, P.; Santana-Jiménez, Y. Prevalence and citation advantage of gold open access in the subject areas of the Scopus database. *Res. Eval.* **2018**, *27*, 1–15. [[CrossRef](#)]
30. Eysenbach, G. Citation advantage of open access articles. *PLoS Biol.* **2006**, *4*, e157. [[CrossRef](#)]
31. RStudio Team. *RStudio: Integrated Development for R*; RStudio, PBC: Boston, MA, USA, 2020. Available online: <http://www.rstudio.com/> (accessed on 24 January 2022).
32. Langham-Putrow, A.; Bakker, C.; Riegelman, A. Is the open access citation advantage real? A systematic review of the citation of open access and subscription-based articles. *PLoS ONE* **2021**, *16*, e0253129. [[CrossRef](#)] [[PubMed](#)]
33. Alkhawtani, R.H.M.; Kwee, T.C.; Kwee, R.M. Citation advantage for open access articles in European Radiology. *Eur. Radiol.* **2020**, *30*, 482–486. [[CrossRef](#)] [[PubMed](#)]
34. Breugelmans, J.G.; Roberge, G.; Tippett, C.; Durning, M.; Struck, D.B.; Makanga, M.M. Scientific impact increases when researchers publish in open access and international collaboration: A bibliometric analysis on poverty-related disease papers. *PLoS ONE* **2018**, *13*, e0203156. [[CrossRef](#)] [[PubMed](#)]
35. Clayson, P.E.; Baldwin, S.A.; Larson, M.J. The open access advantage for studies of human electrophysiology: Impact on citations and Altmetrics. *Int. J. Psychophysiol.* **2021**, *164*, 103–111. [[CrossRef](#)]
36. Hua, F.; Sun, H.; Walsh, T.; Glenn, A.M.; Worthington, H. Open access to journal articles in oncology: Current situation and citation impact. *Ann. Oncol.* **2017**, *28*, 2612–2617. [[CrossRef](#)]
37. Patel, R.B.; Vaduganathan, M.; Mosarla, R.C.; Venkateswaran, R.V.; Bhatt, D.L.; Bonow, R.O. Open Access Publishing and Subsequent Citations Among Articles in Major Cardiovascular Journals. *Am. J. Med.* **2019**, *132*, 1103–1105. [[CrossRef](#)]
38. Wassef, D.W.; Barinsky, G.L.; Behbahani, S.; Peddireddy, S.; Grube, J.G.; Fang, C.H.; Baredes, S.; Eloy, J.A. The Relationship Between Open Access Article Publishing and Short-Term Citations in Otolaryngology. *Ann. Otol. Rhinol. Laryngol.* **2022**, *131*, 704–708. [[CrossRef](#)]
39. Davis, P.M.; Lewenstein, B.V.; Simon, D.H.; Booth, J.G.; Connolly, M.J. Open access publishing, article downloads, and citations: Randomised controlled trial. *BMJ* **2008**, *337*, a568. [[CrossRef](#)]
40. Davis, P.M. Open access, readership, citations: A randomized controlled trial of scientific journal publishing. *FASEB J.* **2011**, *25*, 2129–2134. [[CrossRef](#)]
41. Basson, I.; Blanckenberg, J.P.; Prozesky, H. Do open access journal articles experience a citation advantage? Results and methodological reflections of an application of multiple measures to an analysis by WoS subject areas. *Scientometrics* **2021**, *126*, 459–484. [[CrossRef](#)]
42. Mullins, C.H.; Boyd, C.J.; Lindeman, B. Factors Associated with the Highest and Lowest Cited Research Articles in General Surgery Journals. *J. Surg. Res.* **2020**, *250*, 39–44. [[CrossRef](#)]
43. Yaminfirooz, M.; Ardali, F.R. Identifying the Factors Affecting Papers' Citability in the Field of Medicine: An Evidence-based Approach Using 200 Highly and Lowly-cited Papers. *Acta Inform. Med.* **2018**, *26*, 10–14. [[CrossRef](#)]
44. AlRyalat, S.A.; Saleh, M.; Alaqrana, M.; Alfukaha, A.; Alkayed, Y.; Abaza, M.; Abu Saa, H.; Alshamiry, M. The impact of the open-access status on journal indices: A review of medical journals. *F1000Research* **2019**, *8*, 266. [[CrossRef](#)]
45. Craig, I.D.; Plume, A.M.; McVeigh, M.E.; Pringle, J.; Amin, M. Do open access articles have greater citation impact?: A critical review of the literature. *J. Informetr.* **2007**, *1*, 239–248. [[CrossRef](#)]
46. Lewis, C.L. The Open Access Citation Advantage: Does It Exist and What Does It Mean for Libraries? *Inf. Technol. Libr.* **2018**, *37*, 50–65. [[CrossRef](#)]
47. Ellingson, M.K.; Shi, X.; Skydel, J.J.; Nyhan, K.; Lehman, R.; Ross, J.S.; Wallach, J.D. Publishing at any cost: A cross-sectional study of the amount that medical researchers spend on open access publishing each year. *BMJ Open* **2021**, *11*, e047107. [[CrossRef](#)] [[PubMed](#)]
48. O'Hanlon, R.; McSweeney, J.; Stabler, S. Publishing habits and perceptions of open access publishing and public access amongst clinical and research fellows. *J. Med. Libr. Assoc.* **2020**, *108*, 47–58. [[CrossRef](#)]
49. Singh, H.P. Knowledge and attitude of health researchers from India towards paying to publish and open access journals. *Indian Pediatr.* **2015**, *52*, 252–253. [[PubMed](#)]
50. cOAlition S. Principles and Implementations. Available online: <https://www.coalition-s.org/addendum-to-the-coalition-s-guidance-on-the-implementation-of-plan-s/principles-and-implementation/> (accessed on 14 February 2023).
51. Hsu, Y.H.; Ho, Y.S. Highly cited articles in health care sciences and services field in Science Citation Index Expanded. A bibliometric analysis for 1958–2012. *Methods Inf. Med.* **2014**, *53*, 446–458. [[CrossRef](#)]
52. Smith, E.; Hausteine, S.; Mongeon, P.; Shu, F.; Ridde, V.; Larivière, V. Knowledge sharing in global health research—The impact, uptake and cost of open access to scholarly literature. *Health Res. Policy. Syst.* **2017**, *15*, 73. [[CrossRef](#)]
53. Eysenbach, G. Can tweets predict citations? Metrics of social impact based on Twitter and correlation with traditional metrics of scientific impact. *J. Med. Internet Res.* **2011**, *13*, e123. [[CrossRef](#)] [[PubMed](#)]
54. Dehdarirad, T. Could early tweet counts predict later citation counts? A gender study in Life Sciences and Biomedicine (2014–2016). *PLoS ONE* **2020**, *15*, e0241723. [[CrossRef](#)]
55. Kudlow, P.; Brown, T.; Eysenbach, G. Citation Advantage of Promoted Articles in a Cross-Publisher Distribution Platform: 36-Month Follow-up to a Randomized Controlled Trial. *J. Med. Internet Res.* **2021**, *23*, e34051. [[CrossRef](#)] [[PubMed](#)]



56. Luc, J.G.Y.; Archer, M.A.; Arora, R.C.; Bender, E.M.; Blitz, A.; Cooke, D.T.; Hlci, T.N.; Kidane, B.; Ouzounian, M.; Varghese, T.K., Jr.; et al. Does Tweeting Improve Citations? One-Year Results from the TSSMN Prospective Randomized Trial. *Ann. Thorac. Surg.* **2021**, *111*, 296–300. [[CrossRef](#)] [[PubMed](#)]
57. Tahamtan, I.; Afshar, A.S.; Ahamdzadeh, K. Factors affecting number of citations: A comprehensive review of the literature. *Scientometrics* **2016**, *107*, 1195–1225. [[CrossRef](#)]
58. Kulkarni, A.V.; Aziz, B.; Shams, I.; Busse, J.W. Comparisons of citations in Web of Science, Scopus, and Google Scholar for articles published in general medical journals. *JAMA* **2009**, *302*, 1092–1096. [[CrossRef](#)]
59. Martín-Martín, A.; Thelwall, M.; Orduna-Malea, E.; Delgado López-Cózar, E. Google Scholar, Microsoft Academic, Scopus, Dimensions, Web of Science, and OpenCitations' COCI: A multidisciplinary comparison of coverage via citations. *Scientomet-rics* **2021**, *126*, 871–906. [[CrossRef](#)]
60. Bai, X.; Zhang, F.; Lee, I. Predicting the citations of scholarly paper. *J. Informetr.* **2019**, *13*, 407–418. [[CrossRef](#)]
61. Björk, B.C. Growth of hybrid open access, 2009-2016. *PeerJ* **2017**, *5*, e3878. [[CrossRef](#)]
62. De Groote, S.L.; Shultz, M.; Smalheiser, N.R. Examining the Impact of the National Institutes of Health Public Access Policy on the Citation Rates of Journal Articles. *PLoS ONE* **2015**, *10*, e0139951. [[CrossRef](#)]
63. Ottaviani, J. The Post-Embargo Open Access Citation Advantage: It Exists (Probably), Its Modest (Usually), and the Rich Get Richer (of Course). *PLoS ONE* **2016**, *11*, e0159614. [[CrossRef](#)] [[PubMed](#)]
64. Niyazov, Y.; Vogel, C.; Price, R.; Lund, B.; Judd, D.; Akil, A.; Mortenson, M.; Schwartzman, J.; Shron, M. Open Access Meets Discoverability: Citations to Articles Posted to Academia.edu. *PLoS ONE* **2016**, *11*, e0148257. [[CrossRef](#)]
65. Björk, B.C. Gold, green, and black open access. *Learn. Publ.* **2017**, *30*, 173–175. [[CrossRef](#)]
66. Ari, M.D.; Iskander, J.; Araujo, J.; Casey, C.; Kools, J.; Chen, B.; Swain, R.; Kelly, M.; Popovic, T. A science impact framework to measure impact beyond journal metrics. *PLoS ONE* **2020**, *15*, e0244407. [[CrossRef](#)] [[PubMed](#)]
67. Maggio, L.A.; Meyer, H.S.; Artino, A.R., Jr. Beyond Citation Rates: A Real-Time Impact Analysis of Health Professions Edu-cation Research Using Altmetrics. *Acad. Med.* **2017**, *92*, 1449–1455. [[CrossRef](#)]
68. Ravenscroft, J.; Liakata, M.; Clare, A.; Duma, D. Measuring scientific impact beyond academia: An assessment of existing impact metrics and proposed improvements. *PLoS ONE* **2017**, *12*, e0173152. [[CrossRef](#)]
69. Björk, B.C. The hybrid model for open access publication of scholarly articles: A failed experiment? *J. Am. Soc. Inform. Sci. Technol.* **2012**, *63*, 1496–1504. [[CrossRef](#)]
70. Ohno-Machado, L. A hybrid open-access model to bridge the publishing divide and reach out to a broader community. *J. Am. Med. Inform. Assoc.* **2011**, *18*, 210–211. [[CrossRef](#)]
71. Fuchs, P.X.; Shiang, T.Y.; Herzog, W. Observations regarding open access publishing in hybrid journals in sport sciences. *J. Sport Health Sci.* **2023**, *12*, 1–2. [[CrossRef](#)]

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