Comparative bibliometric analysis of leading Open Access journals: a focus on Chinese and non-Chinese journals in science, technology, and medicine

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ABSTRACT

The objective of this study was to examine the scientific performance and internationalization of leading Chinese Open Access (OA) journals in the fields of science, technology, and medicine, specifically those published in English (referred to Chinese journals hereafter). Based on data taken from the Clarivate Analytics and Directory of Open Access Journals (DOAJ), a comparative bibliometric analysis was carried out. Fourteen Chinese journals were sampled, and a total of 22 non-Chinese OA journals were chosen for comparison. The analysis revealed that the majority of the journals were collaboratively published with large international publishers. While Chinese journals demonstrated a steady increase in publication productivity from 2018 to 2020, it remained noticeably lower than that of international journals.Additionally, Chinese journals received fewer citations from highly ranked journals, as evidenced by the three-fold higher Eigenfactor score observed in international journals compared to Chinese journals. Chinese journals exhibited a higher percentage of domestic manuscripts than international journals, as reflected in their elevated Index of National Orientation (INO) values. This study contributes to a better understanding of the scientific performance and internationalization of Chinese journals in the global publishing landscape, while also identifying potential areas for improvement.

Keywords: Open Access; Chinese journals; Bibliometric analysis; Scientific performance; International journals.

INTRODUCTION

Open science and the equitable sharing of academic accomplishments are viewed as global public goods. In the realm of open science, Open Access (OA) entails providing unrestricted access for anyone to read, share, and utilize a document, contingent on the license model (Logullo et al. 2023). The authors and/or copyright holders of scholarly works explicitly grant all users with a free, irrevocable, worldwide right of access and a license to copy, use, distribute, transmit, and publicly display the work. This extends to creating and distributing derivative works in any digital medium for responsible purposes, with the condition of proper attribution of authorship. Additionally, users retain the right to produce a limited number of printed copies for personal use (Max Planck Society 2003). The significance of OA lies not only in reducing barriers of sharing knowledge, but more importantly, in promoting the development of science (Martin-Martin et al. 2018). Particularly, the global pandemic of COVID-19 has highlighted the importance of data sharing in solving the big challenge of our time (Berry et al. 2020; Xu, Kraemer, and Open 2020). High-quality OA publishing is expected to be a mainstream publishing model, which contributes to establishing a fair, affordable, equitable and diverse research landscape, and accelerating the implementation of open science (Zhang et al. 2021). The global COVID-19 pandemic has underscored the significance of both data sharing and OA publishing in addressing a major contemporary challenge (Berry et al. 2020; Xu, Kraemer, and Open 2020). High-quality OA publishing is anticipated to become a predominant model, fostering a fair, affordable, equitable, and diverse research landscape, and accelerating the implementation of open science (Zhang et al. 2021).

Earlier research has consistently highlighted the advantages of OA publications. OA articles are much more recognized and cited than their subscribed counterparts (Breugelmans et al. 2018; Cintra, Furnival, and Milanez 2018; Piwowar et al. 2018; Wang et al. 2015). In addition, the OA impact is further expanded to social media impact (Cintra, Furnival, and Milanez 2018; Wang et al. 2015). Therefore, the academic impact of researchers and institutions rises with an increased number of published OA papers (Antelman 2004). Additionally, OA publishing contributes to enhancing the efficiency of academic communication and positively affects journals by increasing publication output, normalized impact factor, average relative citations, and improving academic influence and the degree of internationalization (Moed et al. 2020; Momeni et al. 2021).

A series of policies including the Budapest Open Access Initiative (BOAI 2002), Bethesda Statement on Open Access Publishing (2003), Berlin Declaration (2003), and the Plan S (2018), advocate for the advancement of OA movement. From 2015, more than 1,000 journals are added in the Directory of Open Access Journals (DOAJ), an online directory of peer-reviewed OA journals every year, and there are 20,151 journals indexed in the DOAJ database, among which 13,538 (67.2%) journals do not impose any article processing charge (APC) (see DOAJ, https://doaj.org/ accessed on 20 November 2023). OA publishing has received great support from large publishers. For example, BioMed Central and the Public Library of Science (PLoS), as the pioneer OA publishers, were founded in the early

2000s (Tennant et al. 2016). Springer Nature, one of the world's greatest publishers, declared that it reached the major milestone of publishing one million gold OA articles by 2021, bringing it closer to the vision of a fully OA future (Springer Nature 2021). A study examined the growth of OA to journal articles by authors affiliated with German universities and non-university research institutions from 2010 to 2018 (Hobert et al., 2021). The findings revealed that 45 percent of all articles considered during the observed period were openly accessible at the time of analysis. In addition, a large-scale quantitative study found that 54.6 percent of new articles included in the Web of Science (WoS) were freely available in some form of OA via Google Scholar (Martin-Martin et al. 2018). In the Middle East, it has been reported that two-thirds of the journals are published in Iran, with the majority being OA journals (Habibzadeh 2019). In Latin America, OA initiatives were underway even before the Budapest Open Access Initiative (da Costa and Leite 2016). Projects such as the Scientific Electronic Library Online (https://scielo.org) and the Caribbean and Spain and Portugal Scientific Journals Network (www.redalyc.org) have been significant contributions to promoting OA.

In 2004, China's scientific institutions signed the "Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities" and played an active role in the OA movement (Guo, Xue, and Li 2014). According to the analysis report of Chinese academic journals based on the Scopus database statistics, the number of China's OA journals indexed in the Scopus increased from 58 in 2017 to 170 in 2021, accounting for 3.3 percent of the total number of OA journals included in the database. The CiteScores of China's OA journals surpass the global OA journal mean value as reported by Scopus China Academic Committee Office (2022). However, a notable disparity persists in the availability of world-class journals in China when compared to western regions such as the US and UK. In response, the Chinese government has initiated a series of projects aimed at bolstering journal development. Notable initiatives include the *Project for Enhancing the International Impact of China STM Journals*, the *China Scientific Journal Dengfeng Action Plan*, the *Excellence Action Plan of China's Science, Technology, and Medicine Journals 2019* (referred to as the Plan 2019 hereafter), among others.

The Plan 2019, the most extensive initiative comprising seven sub-projects, namely *Leading Journals, Key Journals, Echelon Journals, New Journals with High Starting Point, Cluster Pilot, International Digital Publishing Service Platform*, and *Selecting and Cultivating High-Level Publishing Talents*, holds a prominent position. This study aims to conduct a comprehensive and data-driven comparison of the scientific performance of the *Leading Journals* supported by the Plan 2019, particularly those employing the OA publication mode, with that of top international OA journals. The overarching goal is to contribute to a nuanced understanding of the global scholarly publishing landscape, pinpointing areas for improvement in Chinese journals. As such, this study addresses the following three research questions:

(a) What is the gap in academic influence between Chinese Open Access journals and globally recognized Open Access journals?

(b) What is the level of internationalization of Chinese Open Access journals, including the rate of international collaboration and the index of national orientation?
(c) What are the distinctions in publishing modes between Chinese Open Access journals and globally recognized Open Access journals?

The insights generated from this analysis are intended to serve as a valuable reference for policymakers.

LITERATURE REVIEW

English-language scholarly journals have long served as the primary platform for global scholarly communication. According to the STM Report published by the International Association of Scientific, Technical, and Medical Publishers, as of 2021, there were approximately 48,000 active scholarly peer-reviewed journals across all languages. Notably, over 35,000 of these journals were published in the English language (STM 2022, p.15). In recent years, the Chinese government has put in place a number of good policies and funding projects to support the development of China's own English-language journals, with the determination to expand the international influence of science, technology and medicine (STM) journals, ultimately enhancing the country's standing within the global scientific community. From 2019 to 2022, there was a noticeable growth of China's English-language journals indexed in the Science Citation Index (SCI) from 252 to 449 journals (JCR web, https://jcr.clarivate.com/jcr/home). However, it is crucial to observe that the disparity between the advancement of English STM journals and the increasing output of English STM papers in China is still widening. It has been reported that 552,600 papers from China were included in the SCI database in 2020, with only 25,100 papers were published in local journals in China, accounting for 4.5 percent of the total papers (Ren et al. 2022). In addition, according to SCI database statistics, China's SCI journals published only 1.45 percent of the global SCI papers in 2020, and the output scale was greatly smaller than that of the US, Germany, Dutch and other countries (China Association for Science and Technology 2022, p.3).

The emergence of OA publishing has offered a great opportunity for journals to be recognized by the scientific community. China's OA movement can be traced back to the establishment of the Sciencepaper Online (SPO) in 2003, which is a major OA project sponsored by the Chinese Ministry of Education. SPO has adopted a "publish first, peer-review later" model that provides academics with the opportunity to protect themselves against plagiarism by providing authoritative evidence of first publication (Ren and Montgomery 2015). To date, SPO has released over 106,000 preprints spanning almost all discipline areas as a preprint platform. Additionally, it has incorporated 850 journals (comprising both Chinese and English journals) with a total of 1.3 million documents as part of its open resource platform (SPO web, accessed November 3, 2023, http://en.paper.edu.cn/). In May 2004, the Chinese Academy of Sciences and the National Natural Science Foundation of China signed the Berlin Declaration. In October 2010, the

China OA Journals (COAJ) platform went online, currently providing access to more than 1300 OA journals and 9.99 million papers (COAJ web, accessed November 3, 2023, https://doaj.istic.ac.cn/#/). In 2017, the National Science Library, Chinese Academy of Sciences and National Science and Technology Library respectively signed the Expression of Interest for OA2020 Initiative, which aimed to promoting the transition of scholarly journals from subscription to OA. By January 2020, a total of 19 organizations had signed the OA2020 Initiative. More importantly, the Law of the People's Republic of China on Scientific and Technological Progress was revised for the second time in December 2021, which requires promoting the development of open science, indicating that China has officially set open science, including OA, as one of the development directions of national science and technology (CAST and STM 2022, p.24-26).

Most of the newly-launched journals in China adopt OA publishing mode. For instance, in 2021, among the 42 China's newly-established English-language science and technology journals, 40 adopted the OA model, and the other two adopted the hybrid publishing mode. According to the JCR 2022 data, 449 journals from China were included, among which 197 journals were OA journals, with an OA percentage of 43.9 percent, which is significantly higher than that of the global average level (26.3%) (JCR web, accessed on November 3, 2023, https://jcr.clarivate.com/jcr/home). Li et al. (2016) investigated the regional differences in OA among China, US and Japan, and they found that the ratio of papers published by Chinese scholars in OA journals was higher compared with that by scholars from US and Japan, indicating a notable acknowledgment and acceptance of OA journals within the Chinese scholarly community. Indeed, the China Association for Science and Technology (CAST) team conducted a questionnaire survey on the attitudes of researchers in China towards OA. The results, derived from 1,768 valid questionnaires, indicated strong support for OA, with 81.56 percent of the respondents expressing favorable views (CAST and STM 2022, p.34).

Liu and Yin (2023) analyzed the academic influence of China's Science Citation Index Expanded (SCIE) journals with different publishing modes, including 121 OA journals and 153 non-OA journals (62 toll access journals and 91 hybrid journals). They found that 88.4 percent of the OA journals were in JCR Quartile 1 (Q1) and Quartile 2 (Q2), and the ratio of hybrid journals and subscription journals was 75.5 percent and 29.0 percent, respectively. About 59.5 percent of OA journals had a Journal Impact Factor (JIF) greater than 1, and the ratio was also obviously higher than that of non-OA journals (34.1% in hybrid journals, and 6.5% in subscription journals). These findings suggest that the promotion of OA journals in China has achieved a certain level of success.

Considering the Chinese government's ongoing commitment to promoting the advancement of STM journals and fostering the growth of world-class publications, this study specifically examines the disparity between national top OA journals. Using the *Leading Journals* selected under the national journal development initiative, the Plan 2019, as illustrative examples, the analysis aims to identify areas for further development by comparing them with international world-class OA journals.

MATERIALS AND METHODS

The data for all sampled journals in this study were sourced from Clarivate Analytics embedded in the InCites platform. The OA status of each journal was determined using the DOAJ list, specifically focusing on gold OA journals. Analysis focused on the 14 China-based *Leading Journals* (referred to as Chinese journals hereafter) selected under the Plan 2019, all of which were freely accessible. These journals published in English are already hold top rankings in their respective disciplines within the Chinese Mainland. They are also included in significant international databases such as Scopus and WoS (Web of Science), with their main citation index positioned in the top 50 percent of the discipline. The categories of these Chinese journals were identified based on WoS, including Optics, Biochemistry and Molecular Biology, Pharmacology, Engineering, Nanoscience, Plant Science, Medicine, Agriculture, etc. The journals selected as the counterparts should meet the following criteria: (a) indexed in the Science Citation Index (SCI) database and in the first quartile (Q1) of the JIF rank; (b) not China-based journals, and (c) OA journals. The comparison items were selected individually based on the WoS categories. When there were more than two journals meeting the aforementioned criteria, the top two were chosen based on the "average JIF percentile." Ultimately, 22 international journals were selected as the comparative subjects (see Table 1 in Appendix).

All searches were conducted in April 2022, utilizing the JCR 2020 release as the dataset to retrieve relevant data. The examination of Chinese journals' publication productivity, scientific performance, and internationalization involved a comparative analysis with international journals. The following bibliometric parameters were extracted from the JCR database: number of documents, times cited, percentage of documents cited, number of top 1% most highly cited documents, category normalized citation impact (CNCI), Eigenfactor, international collaboration rate, Index of National Orientation (INO), publisher, APC, among others.

The percentile of a paper reflects its relative citation performance within the same discipline, publication year, and document type, making it a normalized indicator. The top 1% most highly cited documents are regarded as the forefront of scientific contributions. INO, introduced by Moed (2005), is defined as "the share of papers from the country most frequently publishing in a journal, relative to the total number of papers published in the journal. A purely national journal would have an INO value of 100 percent" (p. 131-132). INO is negativley correlated with the internationalization degree of journals.

The data analysis utilized the Statistical Product and Service Solutions (SPSS) 23.0 software. A single-sample Kolmogorov-Smirnov (K-S) test was conducted to assess the normality of the data. For normally distributed data, the mean±SD was presented, and between-group comparisons were performed using independent-samples t-tests. Non-normally distributed data were presented as median and quartiles, and between-group comparisons were conducted using two-independent-samples nonparametric tests. The Kruskal-Wallis H test was employed to analyze the change trend over the years (from 2018 to 2020).

RESULTS

Publication Productivity

During the period from 2018 to 2020, 14 Chinese journals published a combined total of 4,663 documents (comprising articles and reviews) with a cumulative citation count of 90,924. In comparison, 22 international journals published 52,641 documents during the same period, accumulating a substantial citation count of 1,262,001. As shown in Figure 1, there was a significant difference between the two groups in the number of published documents per journal [302 (243, 352) *vs*. 739 (467, 2,010), *P*=0.001]. Next, an analysis was conducted to examine the changes in publication productivity over the years.

The findings indicated a gradual increase in publication productivity per journal for Chinese journals from 2018 to 2020 [73 (45, 92) *vs*. 98 (66, 111) *vs*. 141 (112, 176), *P*=0.002], Similarly, the publication productivity of the control journals also exhibited an increase, but the difference was not statistically significant [182 (97, 479) *vs*. 240 (132, 665) *vs*. 350 (147, 939), *P*=0.450].

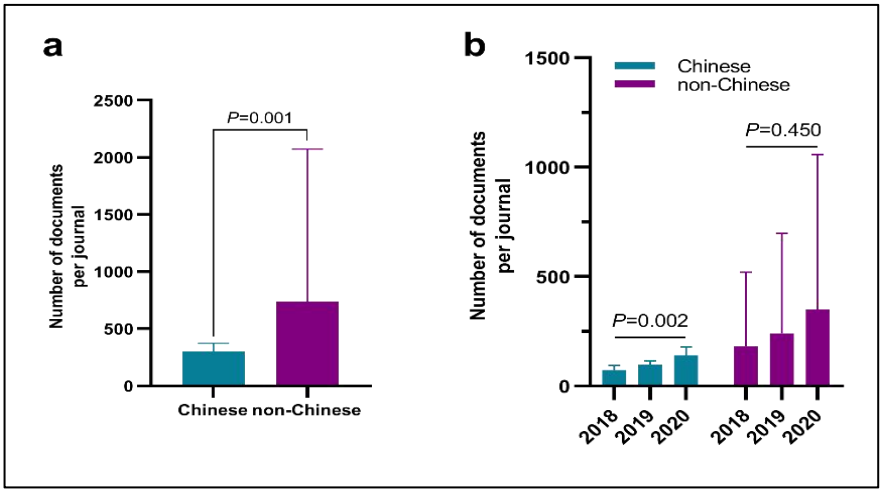

Figure 1: Publication productivity of journals. (a) Comparison of the number of published documents between the two groups of journals; (b) Changes of the number of published documents per journal from 2018 to 2020

Scientific Performance

Figure 2 illustrates the journal citations. The average citations per document were not statistically different between the two groups [18 (11, 33) *vs*. 18 (11, 29), *P*=0.987]. The percentage of cited documents was also not statistically different [98.0% (96.9%, 99.4%) *vs*. 98.4% (96.2%, 99.1%), *P*=0.860]. The average citations per document decreased in both groups from 2018 to 2020. However, a statistical difference was observed only in the international journals [Chinese: 24 (16, 35) *vs*. 19 (14, 28) *vs*. 14 (7, 22), *P*=0.209; non-Chinese: 28 (16, 46) *vs*. 21 (13, 33) *vs*. 11 (8, 16), *P*=0.000]. This decline can be attributed to the insufficient citation of recently published papers.

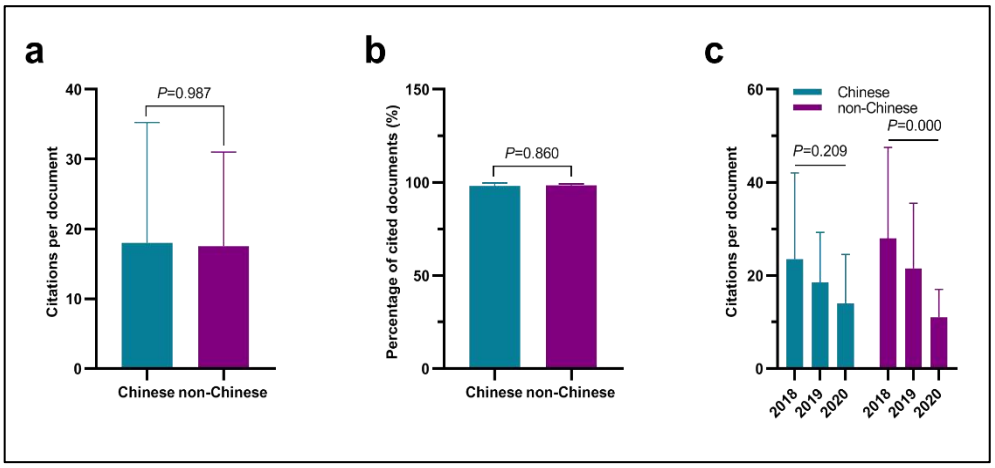

Figure 2: Citations of journals. Comparison of (a) citations per document and (b) the percentage of cited documents between the two groups of journals; (c) changes of the citations per document of the journals from 2018 to 2020

As shown in Figure 3, the Eigenfactor score of Chinese journals was lower than that of the international journals [0.005 (0.003, 0.007) *vs*. 0.016 (0.006, 0.059), *P*=0.007]. The CNCI of the two groups was not statistically different [2.2 (1.4, 3.0) *vs*. 2.0 (1.3, 3.0), *P*=0.761]. From 2018 to 2020, no significant change was found in the Eigenfactor score [Chinese: 0.002 (0.002, 0.005) *vs*. 0.004 (0.002, 0.007) *vs*. 0.006 (0.003, 0.008), *P*=0.205; non-Chinese: 0.019 (0.006, 0.045) *vs*. 0.019 (0.006, 0.047) *vs*. 0.016 (0.006, 0.059), *P*=0.950] and CNCI [Chinese: 1.9 (1.4, 2.1) *vs*. 2.2 (1.5, 2.5) *vs*. 2.2 (1.4, 4.0), *P*=0.351; non-Chinese: 2.0 (1.3, 3.1) *vs*. 2.0 (1.3, 3.3) *vs*. 1.9 (1.4, 2.6), *P*=0.808].

The top 1% most highly cited documents of the two groups were further evaluated , and the results in Figure 4 shows that there were less top 1% documents from Chinese journals compared with the control journals [11 (5, 21) *vs*. 40 (13, 67), *P*=0.013]. However, the percentage of top 1% documents per journal was not statistically different [4.8% (1.7%, 5.3%) *vs*. 4.2% (1.9%, 6.9%), *P*=0.936]. The average citations per document for the top 1% documents from Chinese journals were higher than those from non-Chinese journals, although the difference was not statistically significant [110 (68, 166) *vs*. 86 (71, 132), *P*=0.474]. From 2018 to 2020, the percentage of top 1% documents showed an increasing trend in Chinese journals, and a decreasing trend in non-Chinese journals, although the differences were not statistically significant [Chinese: 3.5% (1.1%, 6.1%) *vs*. 3.9% (2.1%, 6.3%) *vs*. 4.1% (2.1%, 6.3%), *P*=0.717; non-Chinese: 5.1% (1.3%, 8.3%) *vs*. 4.1% (1.3%, 8.4%) *vs*. 3.9% (1.5%, 6.0%), *P*=0.647].

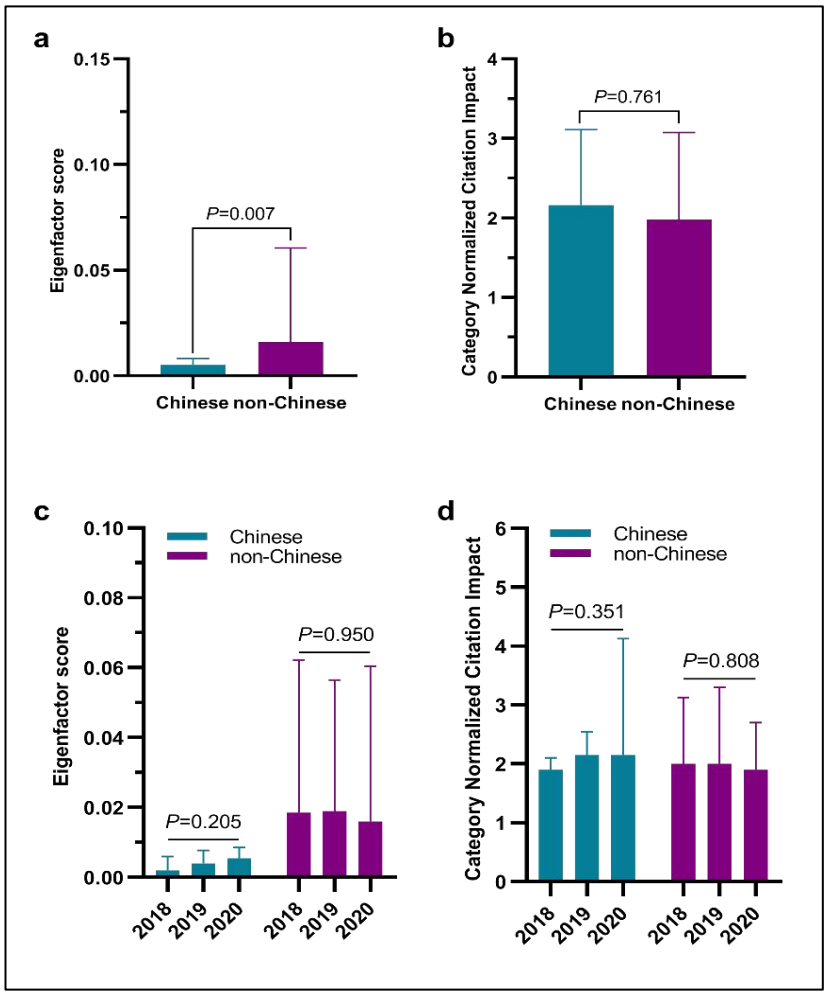

Figure 3: The Eigenfactor score and category normalized citation impact of journals. Comparison of (a) Eigenfactor score and (b) category normalized citation impact between the two groups of journals; changes of (c) Eigenfactor score and (d) category normalized citation impact of the journals from 2018 to 2020

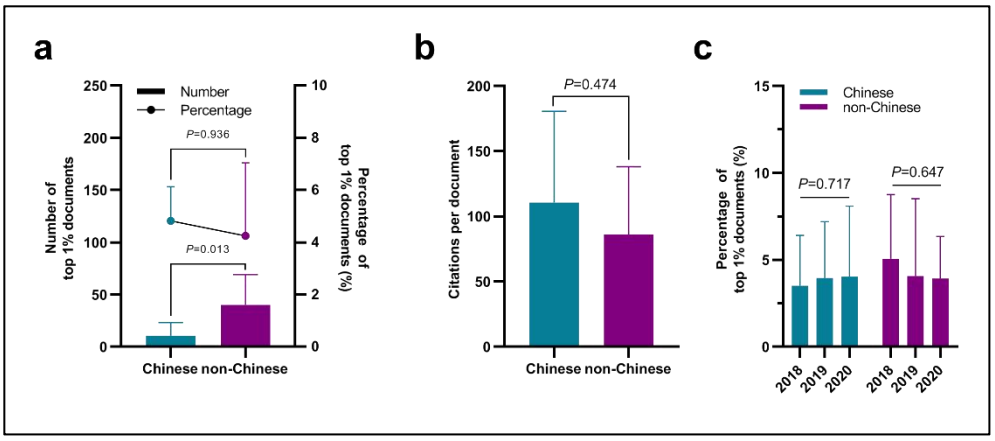

Figure 4: Top 1% documents of the journals. Comparison of (a) the number and percentage of top 1% documents and (b) citations per document between the two groups; (c) changes of the percentage of top 1% documents from 2018 to 2020

Internationalization (International Collaboration and INO)

The international collaboration rate was not significantly different between the two groups (30.9%±11.3% *vs*. 36.8%±14.1%, *P*=0.200), but the INO value of Chinese journals was statistically higher than that of the international journals (65.5%±19.9% *vs*. 47.7%±15.2%, *P*=0.005). The percentage of journals with an INO greater than 80% was 28.6 percent in Chinese journals and 0 in non-Chinese journals. Of the Chinese journals, 92.9 percent (13/14) predominantly published domestic documents, while only 18.2 percent (4/22) of non-Chinese journals did the same. From 2018 to 2020, the international collaboration rate (Chinese: 27.5%±15.5% *vs*. 30.1%±11.9% *vs*. 33.3%±10.8%, *P*=0.502; non-Chinese: 35.4%±16.2% *vs*. 35.3%±14.9% *vs*. 38.5%±14.6%, *P*=0.771) and INO value (Chinese: 58.6%±20.8% *vs*. 62.8%±21.4% *vs*. 71.2%±17.7%, *P*=0.246; non-Chinese: 49.3%±15.5% *vs*. 47.7%±18.6% *vs*. 47.8%±16.9%, *P*=0.941) did not change significantly (see Figure 5).

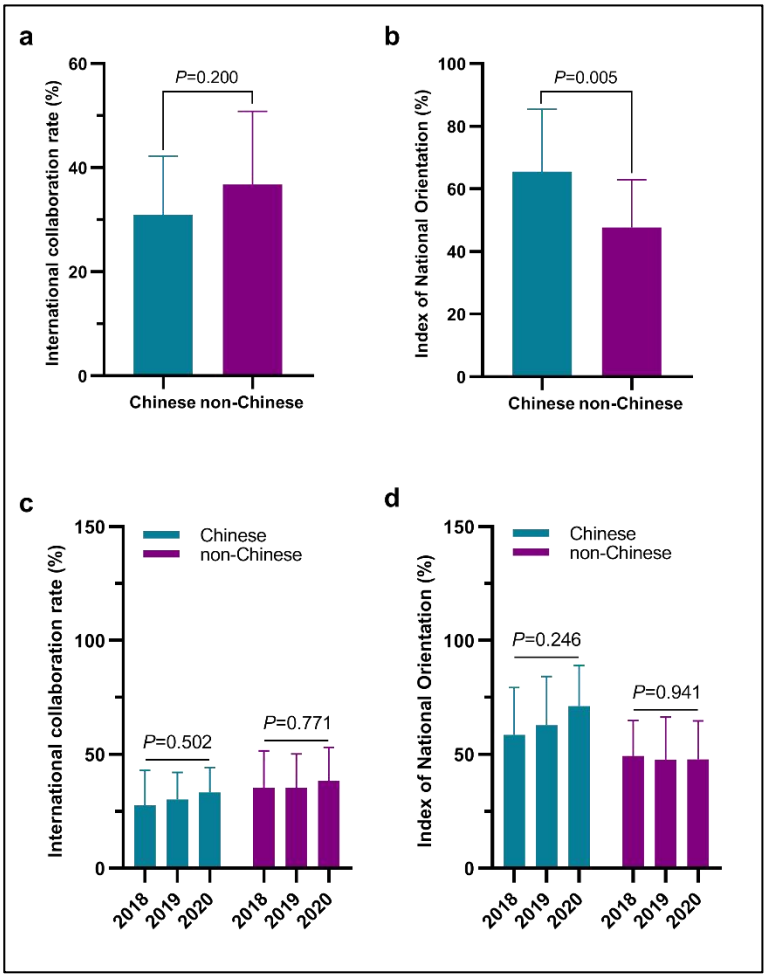

Figure 5: The international collaboration rate and Index of National Orientation of the journals. Comparison of (a) the international collaboration rate and (b) Index of National Orientation of the journals; changes of (c) the international collaboration rate and (d) Index of National Orientation from 2018 to 2020

Publishing Modes (Publishers and APC)

Five out of 14 (35.7%) Chinese journals and 14 out of 22 (63.6%) international journals

commenced operations before 2010. The journals with the longest history started in 1973 and 1908 for Chinese and international journals, respectively. With the exception of one Chinese journal in Q2, all Chinese journals were positioned in the Q1 JIF quartile. Additional details about the journals can be found in the Appendix (Table 1). Most of the journals were produced in partnership with major international publishers such as Springer Nature, Elsevier, BMC, Oxford University Press, and Taylor & Francis. There was no significant difference in the publication period (average time from submission to publication) between the two sets of journals [17 (13, 20) weeks vs. 16 (14, 26) weeks, P=0.360].

Considering that the APC played a significant role in OA publishing, a comparison of the APCs of the journals was conducted. The findings revealed that publishing papers was free of charge in 4 (28.57%) Chinese journals and 2 (9.09%) non-Chinese journals, a practice referred to as diamond OA publishing. The average APC (converted to US dollars) for Chinese journals was lower than that for non-Chinese journals, although the difference was not statistically significant [(1,704±1,336) dollars vs. (2,658±1,589) dollars, P=0.071] (see Figure 6).

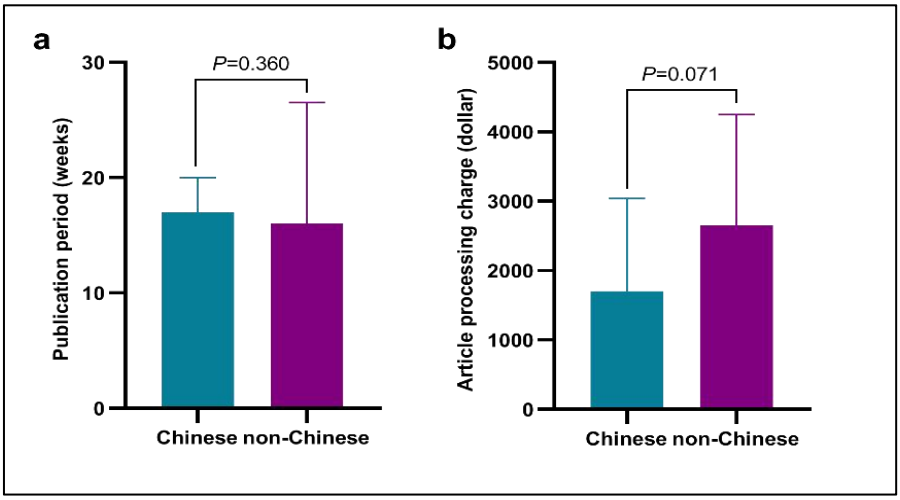

Figure 6: The publication period and article processing charge of the journals. Comparison of (a) the publication period and (b) article processing charge of the journals

DISCUSSION

In this study, an analysis of journal data from the WoS and DOAJ is conducted to compare leading OA Chinese journals with top international OA journals in terms of publication productivity, internationalization, and scientific performance. It is evident that Chinese journals exhibit lower publication productivity. The difference in publication starting time may contribute to this variation. A majority (64.3%) of Chinese journals were established after 2010, in contrast to 36.4 percent in the control journals. A brief history of development can influence the visibility and scientific influence of the journals, potentially

leading to fewer author selections. Additionally, the pursuit of a rapid increase in the Journal Impact Factor (JIF) value by controlling a relatively small denominator (i.e., publication productivity) cannot be ignored.

This study also finds that there is no significant difference in the citations per document, CNCI and even the percentage of top 1% documents between the two groups of journals. However, the Eigenfactor score of Chinese journals is significantly lower than that of international journals. Eigenfactor, originally developed by West and his team (West, Bergstrom, and Bergstrom 2010), has several advantages over raw citation counts (Ali 2021; Franceschet 2010). Notably, it assigns weights to journal citations based on the influence of the citing journals, giving more significance to citations from highly-ranked journals compared to those from lower-tier journals. The Eigenfactor metric utilizes the entire citation network, as it is recursively defined in terms of the scores of the citing journals and its computation involves the propagation of the journal scores over the entire citation graph. Besides, it excludes journal self-citation. The lower Eigenfactor score of China's leading journals indicates that its academic influence has not yet reached the international top level.

While the international collaboration rate of the two groups of journals does not show a significant difference, the INO for Chinese journals is notably higher. This implies that the internationalization degree of Chinese journals is relatively low. A high INO will be certain to affect the international publicity and academic influence of the journals (Moed et al. 2020). The analysis result shows that domestic papers are the main publication sources for most Chinese journals. This could be attributed to, in part, to China surpassing the US as the global leader of scientific research output in terms of the number of articles (STM 2022). Indeed, out of the 22 international journals, 10 published the highest number of articles originating from China. Nevertheless, the expansion of English-language journals has not matched the rise in academic output. According to Scopus data as of March 1, 2021, the UK boasts the highest count of English-language journals at 5,856, followed by the US at 5,712, while China ranks sixth with 637 journals (STM 2022, p.16). English STM journals serve as a crucial platform for researchers to exchange and collaborate with the global academic community. They also function as a significant window to showcase a nation's scientific and technological accomplishments and capabilities. Hence, there is a need to enhance the development and support of STM journals. Improvements in their quality, editorial standards, peer review efficiency, and dissemination capabilities, are essential to elevate their international influence and recognition. This effort aims to attract more contributions from distinguished international researchers for publication in these English-language journals from China. At the same time, it is also necessary to strengthen the publicity and promotion of Chinese English STM journals, to enable a broader international academic audience to comprehend and pay attention to China's advancements and contributions in the field of STM.

In the case of Chinese journals, while there has been an increase in publication productivity over the years, there is room for further expansion, and maintaining a consistent and

steady pace is unlikely to lead to a decrease in JIF, as indicated by Zhang (2021). However, it is imperative to ensure this expansion is carried out under the premise of maintaining and assuring publication quality. On one hand, employing scientific databases for analyzing research focal points and emerging trends across various disciplines can offer valuable insights into prominent areas of study and help identify influential experts. This information serves as a crucial resource for selecting topics and soliciting contributions. On the other hand, peer review, a key component of the scientific process aiding journal editors' decision-making, is critical to ensuring scientific quality and establishing/maintaining a journal's reputation (Shoham and Pitman 2020). Traditional peer review forms have faced criticism for their drawbacks, including issues such as discrimination based on attributes other than scientific merit in single-blind peer review, and challenges in identifying conflicts of interest and assessing effectiveness in double-blind peer review (Halder, Tyrer, and Casey 2021; Shoham and Pitman 2020). Its implementation enhances the visibility of reviewers, holding them more accountable for their comments (Godlee 2002). A study suggests that OPR exhibits higher quality when compared to anonymous reviews (Walsh et al. 2000). Additionally, it has been found to increase citation counts compared to blind peer review (Zong, Xie, and Liang 2020). A recent study revealed that the reliability of the reviewing process and usefulness of reviewers' feedback significantly influence researchers' journal choice (Rowley et al. 2020). Thus, OPR may not only attribute to the quality assurance of journals, but also helps to increase the publication productivity.

This work comes with certain limitations. Firstly, matching the journals based on categories encounters challenges due to variations in categories and a small sample size, leading to considerable data dispersion which may affect the power of statistical test. . Secondly, the inclusion of only two primary types of documents—articles and reviews—may not fully capture the impact of journals, as other document types such as meeting papers, letters, abstracts, and case reports could also contribute to a journal's influence.

CONCLUSIONS

In conclusion, this study highlights the disparity in publication productivity, internationalization, and scientific performance between leading OA Chinese journals and their international counterparts. The analysis underscores the need for strengthening the construction and support of English STM journals in China, and other emerging scientific nations to enhance their international influence. Through collaborative initiatives between the Chinese government and journal editorial boards, China's leading OA STM English-language journals have made notable accomplishments. However, notable challenges persist, including low publication productivity, a predominant reliance on domestic papers, and a limited international academic influence. To address these challenges, efforts should focus on enhancing the journals' capacity to attract high-quality international manuscripts, cultivating a stronger reputation within the global academic community, and improving operational modes and marketization degrees.

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CONFLICT OF INTEREST

The authors have no competing interests to declare that are relevant to the content of this article.

REFERENCES

Ali, M.J. 2021. Understanding the Eigenfactor(TM) Metrics. *Seminars in Ophthalmology,* Vol. 36, no. 3:65-66. Available at: https://doi.org/10.1080/08820538.2021.1913313.

Antelman, K. 2004. Do open-access articles have a greater research impact? *College & Research Libraries,* Vol. 65, no. 5:372-382. Available at: https://doi.org/DOI 10.5860/crl.65.5.372.

Berry, I., Soucy, J.R., Tuite, A., Fisman, D., and Group, C.-C.O.D.W. 2020. Open access epidemiologic data and an interactive dashboard to monitor the COVID-19 outbreak in Canada. *Canadian Medical Association Journal,* Vol. 192, no. 15: E420. Available at: https://doi.org/10.1503/cmaj.75262.

Berlin Declaration. 2003. *Berlin declaration on open access to knowledge in the sciences and humanities.* Open Access Initiatives of the Max Planck Society. Available at: https://openaccess.mpg.de/Berlin-Declaration.

Bethesda Statement on Open Access Publishing. 2003. Available at: http://legacy.earlham.edu/~peters/fos/bethesda.htm.

BOAI. 2002. *Read the declaration: Budapest Open Access Initiative.* Available at: https://www.budapestopenaccessinitiative.org/read/.

Breugelmans, J.G., Roberge, G., Tippett, C., Durning, M., Struck, D.B., and Makanga, M.M. 2018. Scientific impact increases when researchers publish in open access and international collaboration: A bibliometric analysis on poverty-related disease papers. *Plos One,* Vol. 13, no. 9. Available at: https://doi.org/10.1371/journal.pone.0203156.

CAST and STM. 2022. *Open Access Publishing in China 2022 – English*. Beijing: Science Press.

China Association for Science and Technology. 2022. *Blue Book of Chinese Science and Technology Journals-2021*. Beijing: Science Press.

Cintra, P.R., Furnival, A.C., and Milanez, D.H. 2018. The impact of open access citation and social media on leading top Information Science journals. *Investigacion Bibliotecologica,* Vol. 32, no. 77: 117-132. Available at: https://doi.org/10.22201/iibi.24488321xe.2018.77.57874.

da Costa, M.P., and Leite, F.C.L. 2016. Open access in the world and Latin America: a review since the Budapest Open Access Initiative. *Transinformacao,* Vol. 28, no. 1:33-45. Available at: https://doi.org/10.1590/2318-08892016002800003.

Franceschet, M. 2010. Ten good reasons to use the Eigenfactor™ metrics. *Information Processing & Management,* Vol. 46, no. 5: 555-558. Available at: https://doi.org/10.1016/j.ipm.2010.01.001.

Godlee, F. 2002. Making reviewers visible - Openness, accountability, and credit. *JAMA - Journal of the American Medical Association,* Vol. 287, no. 21:2762-2765. Available at: https://doi.org/DOI 10.1001/jama.287.21.2762.

Guo, F., Xue, J.Y., and Li, R.X. 2014. Open Access in China: a study of social science journals. *Journal of Scholarly Publishing,* Vol. 45, no. 4:336-352. Available at: https://doi.org/10.3138/jsp.45.4.02.

Habibzadeh, F. 2019. Open Access journals in the Middle East and Iran. *Journal of Korean Medical Science,* Vol. 34, no. 16. Available at: https://doi.org/10.3346/jkms.2019.34.e123.

Halder, N., Tyrer, P., and Casey, P. 2021. Peer reviewing made easier: your questions answered. *BJPsych Advances,* Vol. 27, no. 4:255-262. Available at: doi: 10.1192/bja.2020.62.

Hobert, A., Jahn, N., Mayr, P., Schmidt, B., and Taubert, N. 2021. Open access uptake in Germany 2010-2018: adoption in a diverse research landscape. *Scientometrics,* Vol. 126, no. 12: 9751-9777. Available at: https://doi.org/10.1007/s11192-021-04002-0.

Li, S., Yu, G., Zhang, W.F., and Tan, S. 2016. Investigation on regional recognition of open access journals. *Proceedings of the 2016 International Conference on Education, Management, Computer and Society,* Vol. 37: 640-643.

Liu, P., and Yin, H. 2023. Study on the effect of open access on enhancing the influence of SCI journals in China. *Science-Technology & Publication,* no. 09: 106-113. Available at: https://doi.org/10.16510/j.cnki.kjycb.20230911.002.

Logullo, P., de Beyer, J.A., Kirtley, S., Schluessel, M.M., and Collins, G.S. 2023. Open access journal publication in health and medical research and open science: benefits, challenges and limitations. *BMJ Evidence-Based Medicine.* Sep 28: bmjebm-2022-112126. Available at: https://doi.org/10.1136/bmjebm-2022-112126.

Martin-Martin, A., Costas, R., van Leeuwen, T., and Lopez-Cozar, E.D. 2018. Evidence of open access of scientific publications in Google Scholar: A large-scale analysis. *Journal of Informetrics,* Vol. 12, no. 3: 819-841. Available at: https://doi.org/10.1016/j.joi.2018.06.012.

Max Planck Society. 2003. Berlin Declaration on Open Access to knowledge in the sciences and humanities. Available at: https://openaccess.mpg.de/Berlin-Declaration.

Moed, H.F. 2005. *Citation analysis in research evaluation*. Dordrecht (Netherlands): Springer.

Moed, H.F., de Moya-Anegon, F., Guerrero-Bote, V., and Lopez-Illescas, C. 2020. Are nationally oriented journals indexed in Scopus becoming more international? The effect of publication language and access modality. *Journal of Informetrics,* Vol. 14, no. 2. Available at: https://doi.org/10.1016/j.joi.2020.101011.

Momeni, F., Mayr, P., Fraser, N., and Peters, I. 2021. What happens when a journal converts to open access? A bibliometric analysis. *Scientometrics,* Vol. 126, no. 12: 9811-9827. Available at: https://doi.org/10.1007/s11192-021-03972-5.

Piwowar, H., Priem, J., Lariviere, V., Alperin, J.P., Matthias, L., Norlander, B., Farley, A., West,

J., and Haustein, S. 2018. The state of OA: a large-scale analysis of the prevalence and impact of Open Access articles. *PeerJ,* Vol. 6. Available at: https://doi.org/10.7717/peerj.4375.

Plan S. 2018. Why Plan S: open access is foundational to the scientific enterprise. Available at: https://www.coalition-s.org/why-plan-s/.

Ren, S.L., Li, X., Yang, H.Y., Ning, B., and Chen, Z. 2022. Review on the development of Chinese English science and technology journals in 2021. *Science-Technology & Publication,* Vol. 41 no. 3: 73-83. Available at: https://doi.org/10.16510/j.cnki.kjycb.20220303.003.

Ren, X., and Montgomery, L. 2015. Open access and soft power: Chinese voices in international scholarship. *Media Culture & Society,* Vol. 37, no. 3:394-408. Available at: https://doi.org/10.1177/0163443714567019.

Rowley, J., Sbaffi, L., Sugden, M., and Gilbert, A. 2020. Factors influencing researchers' journal selection decisions. *Journal of Information Science,* Vol. 48, no. 3: 321-335. Available at: https://doi.org/10.1177/0165551520958591.

Scopus China Academic Committee Office. 2022. Analysis report of Chinese academic journals based on the Scopus database statistics. Available at: https://goingglobal.cnpiec.com.cn/news/info?id=75177ab24fb1469c9c76981c04ab335b.

Shoham, N., and Pitman, A. 2020. Open versus blind peer review: is anonymity better than transparency? *BJPsych Advances,* Vol. 27, no. 4:247-254. Available at: https://doi.org/10.1192/bja.2020.61.

Springer Nature. 2021. Celebrating one million gold open access articles. 1Million OA articles. Available at: https://media.springernature.com/full/springer-cms/rest/v1/content/19934578/data/v3.

STM. 2022. STM Global Brief 2021 – Economics and market size. Available at: https://www.stm-assoc.org/document/stm-global-brief-2021-economics-and-market-size-2/.

Tennant, J.P., Waldner, F., Jacques, D.C., Masuzzo, P., Collister, L.B., and Hartgerink, C.H. 2016. The academic, economic and societal impacts of Open Access: an evidence-based review. *F1000Research,* Vol. 5: 632. Available at: https://doi.org/10.12688/f1000research.8460.3.

Walsh, E., Rooney, M., Appleby, L., and Wilkinson, G. 2000. Open peer review: a randomised controlled trial. *British Journal of Psychiatry,* Vol. 176: 47-51. Available at: https://doi.org/10.1192/bjp.176.1.47.

Wang, X.W., Liu, C., Mao, W.L., and Fang, Z. 2015. The open access advantage considering citation, article usage and social media attention. *Scientometrics,* Vol. 103, no. 2:555-564. Available at: https://doi.org/10.1007/s11192-015-1547-0.

West, J.D., Bergstrom, T.C., and Bergstrom, C.T. 2010. The Eigenfactor Metrics™ : A network approach to assessing scholarly journals. *College & Research Libraries,* Vol. 71, no. 3. Available at: https://doi.org/10.5860/0710236.

Xu, B., Kraemer, M.U.G., and Open, C.-D.C.G. 2020. Open access epidemiological data from the COVID-19 outbreak. *Lancet Infectious Disesaes,* Vol. 20, no. 5: 534. Available at: https://doi.org/10.1016/S1473-3099(20)30119-5.

Zhang, G.Y., Wang, Y.Q., Xie, W.X., Du, H., Jiang, C.L., and Wang, X.W. 2021. The open access usage advantage: a temporal and spatial analysis. *Scientometrics,* Vol. 126, no. 7: 6187-6199. Available at: https://doi.org/10.1007/s11192-020-03836-4.

Zhang, T.H. 2021. Will the increase in publication volumes "dilute" prestigious journals' impact factors? A trend analysis of the FT50 journals. *Scientometrics,* Vol. 126, no. 1: 863-869. Available at: https://doi.org/10.1007/s11192-020-03736-7.

Zong, Q., Xie, Y., and Liang, J. 2020. Does open peer review improve citation count? Evidence from a propensity score matching analysis of PeerJ. *Scientometrics,* Vol. 125, no. 1: 607-623. Available at: https://doi.org/10.1007/s11192-020-03545-y.

APPENDIX

Table 1: Overview of the Journals Included in This Study

Journal Title	1st Publication Year	Publisher	Frequency	JIF 2020	JIF Quartile
Leading OA Chinese Journals					
Chinese Medical Journal	1973	Lippincott Williams & Wilkins	Semimonthly	2.628	Q2
Petroleum Science	1998	KeAi Publishing Ltd	Quarterly	4.090	Q1
International Journal of Oral Science	2009	Springer Nature	Continuous publication	6.344	Q1
Journal of Rock Mechanics and Geotechnical Engineering	2009	Science Press	Bimonthly	4.338	Q1
Journal of Animal Science and Biotechnology	2010	BMC	Continuous publication	5.032	Q1
Acta Pharmaceutica Sinica B	2011	Institute of Materia Medica, Chinese Acad. of Medical Sciences	Bimonthly	11.614	Q1
Light: Science & Applications	2012	Springer Nature	Continuous publication	17.782	Q1
Friction	2013	Springer Nature	Quarterly	6.167	Q1
Journal of Magnesium and Alloys	2013	BMC	Quarterly	10.088	Q1
Horticulture Research	2014	Oxford University Press	Continuous publication	6.793	Q1
National Science Review	2014	Oxford University Press	Monthly	17.275	Q1
Engineering	2015	Elsevier	Bimonthly	7.553	Q1
Microsystems & Nanoengineering	2015	Springer Nature	Continuous publication	7.127	Q1
Signal Transduction and Targeted Therapy	2016	Springer Nature	Continuous publication	18.187	Q1
Control Journals					
Poultry Science	1908	Elsevier	Monthly	3.352	Q1
Alexandria Engineering Journal	1958	Elsevier	Bimonthly	3.732	Q1
Japanese Dental Science Review	1964	Elsevier	Continuous publication	5.093	Q1

Nucleic Acids Research	1974	Oxford University Press	Semimonthly	16.971	Q1
Genetics Selection Evolution	1983	BMC	Continuous publication	4.297	Q1
Drug Delivery	1993	Taylor & Francis	Continuous publication	6.419	Q1
Genome Biology	2001	BMC	Continuous publication	13.583	Q1
Molecular Cancer	2002	BMC	Continuous publication	27.401	Q1
Plant Biotechnology Journal	2003	Wiley	Monthly	9.803	Q1
PloS Medicine	2004	Public Library Science	Monthly	11.069	Q1
International Journal of Nanomedicine	2006	Dove Medical Press	Continuous publication	6.400	Q1
Materials	2008	MDPI	Semimonthly	3.623	Q1
Journal of Cachexia Sarcopenia and Muscle	2010	Wiley	Quarterly	12.910	Q1
Nature Communications	2010	Nature Portfolio	Continuous publication	14.919	Q1
Journal of Materials Research and Technology- JMR&T	2012	Elsevier	Quarterly	5.039	Q1
Nanophotonics	2012	Walter De Gruyter	Monthly	8.449	Q1
Photoacoustics	2013	Elsevier	Quarterly	8.484	Q1
Advanced Science	2014	Wiley	Bimonthly	16.806	Q1
Engineering Science and Technology- An International Journal	2014	Elsevier	Bimonthly	4.360	Q1
Optica	2014	Optica Publishing Group	Monthly	11.104	Q1
Energy Reports	2015	Elsevier	Continuous publication	6.870	Q1
Science Advances	2015	American Association for the Advancement of Science	Monthly	14.143	Q1