Status and quality of open access journals in Scopus

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Abstract

Purpose – This study aims to provide an extensive overview of OA journals’ status and quality in 27 research areas based on all Scopus-indexed journals. It shows the volume of OA journals, proportion of publications in OA journals and the quality of these journals in comparison with subscription-based counterparts.

Design/methodology/approach – This research investigated 22,256 active peer-reviewed journals indexed by Scopus in 2015. Data were gathered using the Journal Metrics website. The current research adopted four indicators to compare the quality of OA and non-OA journals indexed in Scopus under each subject area, namely citedness rate, CiteScore, SNIP and SJR.

Findings – OA journals comprised approximately 17 per cent out of the total journals indexed by Scopus in 2015. The results revealed an uneven spread of OA journals across disciplines, ranged from 5.5 to 28.7 per cent. Studying the quality of journals as measured by CiteScore, SJR SNIP leads us to the finding that, in all research areas, except for health profession and nursing, non-OA journals attain statistically significant higher average quality than do OA journals.

Originality/value – Although OA publishing improves the visibility of scholarly journals, this increase is not always coupled with increase in journals’ impact and quality.

Keywords Scopus, Open access journals, CiteScore, Journal quality, Non-open access journals, SJR

Paper type Research paper

Introduction

First, scholarly journals appeared in mid-sixteenth century in Europe as mediums for scientific communication (Solomon, 2014). Over the years, many features of scientific journals have changed, of which electronic dissemination of journals was among the most significant and revolutionary ones. Open access (OA) publishing of journals started in late 1980s with the development of the World Wide Web. According to Harnad (1999), the first open access scholarly journal was published in 1989. From that time, OA journals have received considerable attention in the scientific community as an important channel of scholarly communication.

Budapest Open Access Initiative (2002) defines OA journals as one that is:

[. . .] freely availability on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself.

Poulin and Tomaszewski (2014) believe that a significant proportion of scientific articles are being published in OA journals. In December 2016, the Directory of Open Access Journals (DOAJ) listed more than 9,400 fully OA journals, and this increasing trend is expected to continue. Besides these gold OA journals, many publishers provide free access to papers after a certain period of time (delayed OA). Moreover, green OA journals permit authors to self-archive their pre-print or post-print copy of articles in subject and institutional repositories or authors’ personal web pages.

Many advantages of OA publications are mentioned in the literature, including unrestricted free and permanent access to the results of public funded research, broader dissemination of research findings, more production capability, rapid distribution of scholarly content over the internet as well as higher visibility, findability and accessibility (Antelman, 2004; Solomon, 2014; Swan, 2010; Chen et al., 2016). Besides the aforementioned advantages of OA, greater likelihood of read, download, use, distribute and cite was also mentioned in previous research, as no price and permission barriers exist for OA articles (Antelman, 2004). Solomon (2014) believes that OA publishing increases the visibility, irretrievability and audiences of a scientific article. Contrary to the advantages of OA journals, some disadvantages have also been discussed, like disappearance of journals over time and emergence of OA predatory and hijacked journals (Chen et al., 2016).

The main objective of the paper is to investigate the current status of gold OA Scopus-indexed journals with regard to volume and quality. It tries to respond to the questions that what proportion of journals and articles in 27 broad research areas are gold OA and how is the quality of these journals compare with non-OA journals in the same area. The current research is not aimed to investigate the impact of green OA or self-archiving of pre-print or post-print articles into institutional or subject-based repositories. The results of the
study can enrich the theory of OA and provide the researcher community with up-to-date information about subject distribution of OA journals.

**Review of the literature**

A review of the literature was conducted to investigate and summarize previous studies with regard to quantity and quality of OA journals. The number of gold OA journals articles was studied by previous research. In one of the first estimations, Harnad (1999) reported that 2.5 per cent out of the total world publication appeared in gold OA journals. In a study conducted in 2010, Yuan and Hua reported that DOAJ listed 68 library and information science journals in 2006, while this number increased to 96 journals in 2008. Björk et al. (2010) studied the availability of OA articles through gold and green roads and found that 20.4 per cent of the sampled articles were freely available (11.9 per cent in websites and repositories, 8.5 per cent in OA journals). In another research, Archambault et al. (2014) reported the annual growth rate of 18 per cent for the number of gold OA journals indexed in Scopus during 1996-2012, which means that the share of papers published in these journals doubles every 4.1 years.

Some previous studies reported the citation advantage of OA journals as opposed to toll-based journals (Murali et al., 2004; Hajjem et al., 2006; Davis et al., 2008; Joint, 2009; Swan, 2010). The results of the study conducted by Murali et al. (2004) showed that free availability of pharmacy OA journals increased their impact factor in a statistically significant level. Hajjem et al. (2006) studied more than 1,300,000 articles in 10 disciplines and found that OA articles have received 36 to 172 per cent (varies with discipline) more citations compare with non-OA papers published in the same journal. Studying 2,017 articles published in 10 leading journals in four subject categories, including philosophy, political science, electrical engineering and mathematics, Antelman (2004) found that OA articles had higher research impact as measured by citations received in Clarivate Analytics’ Web of Science (formerly Thomson Reuter’s Web of Science). Harnad and Brody (2004) compared citations received by openly available physics article posted in arXiv with those in the same journals that are not OA and reported higher citation counts for freely available articles. In another research, McVeigh (2004) compared 239 natural science journals indexed by Web of Science with regard to their citations, impact factor and immediacy index. The results of this study showed OA advantage in physics, engineering, mathematics and medicine, and not in chemistry and life sciences. By comparing citation impact of one OA and one subscription journals in communication, Zhang (2006) reported that articles published in OA journal received on average two times more citations than articles from the subscription journal. Cheng and Ren (2008) examined 240 Chinese journals in medicine, biology, agricultural sciences and chemistry and resulted two-fold increase in citations for OA journals. Lin (2009) studied two journals in molecular science and reported an increase in journal impact factor after they were made openly accessible. Archambault et al. (2014) reported citation advantage of 40.3 per cent for gold OA and 27 per cent for non-OA publications.

Comparison of journals’ citation impact before and after OA publishing is another topic studied by previous researchers. Sahu et al. (2005) studied the citation rate of a biomedical journal before and after it went OA. The results of the study revealed that transformation to OA increased the citation impact of articles 3 to 4.5 times. Shin (2003) studied the quality of psychology journals before and after becoming freely available and reported greater impact factor for post-OA period compared with pre-OA period. The comparison of open and not open articles published in the same journal regarding citation and usage impact was also studied by previous researchers. In one of these studies, Eysenbach (2006) reported higher average number of citations to OA articles published in *Proceedings of the National Academy of Sciences* compared to non-OA articles of the same journal. Moreover, Gargouri et al. (2010) found that OA articles are cited significantly more often than articles published in the same journal that has not been made OA. Wang et al. (2015) compared OA and non-OA articles published in *Nature Communications* journal considering citation, usage and altmetrics (alternative metrics). The results of the study showed that OA articles have more citations and social media attention than non-OA articles.

The status of OA journals was also investigated in various research fields, such as library and information science (Mukherjee, 2009; Yuan and Hua, 2011; Xia, 2012; Chen et al., 2016), computer science (Lawrence, 2001), psychology (Shin, 2003), pharmacy (Murali et al., 2004), physics (Harnad and Brody, 2004), medicine (Sahu et al., 2005), communication (Zhang, 2006), biology (Frandsen, 2009) and business and management (Lyons and Booth, 2011). Moreover, a considerable number of studies examined the status of OA journals and publishing in specific countries and world regions, like Zimbabwe (Nyangi and Maynard, 2012), South Korea (Shin, 2012), China (Hu et al., 2012), India (Sawant, 2013), the Netherlands (Woutersen-Windhouwer, 2013), Argentina (Miguel et al., 2013) and D8 countries (Ghane and Niazmard, 2016).

Although many previous studies have reported higher citation impact and recognition for OA articles and journals because of their free accessibility, these kinds of findings are still controversial. In other words, some evidences of OA disadvantage also exist in the literature (Anderson et al., 2001). Hajjem et al. (2006) believe that citation advantage of a journal depends on many other factors besides free availability, including the number of authors, references or pages; institution and country of publication; publisher’s reputation; language of publication; and the type and quality of articles. Studying the papers published in *Astrophysical Journal*, Kurtz and Henneken (2007) found no statistically significant difference between OA and toll-access articles in terms of citations received. Davis et al. (2008) believe that, although OA publishing increases accessibility of journals, it might not be the only cause of the higher research impact of OA articles. Frandsen (2009) studied 119 journals in three science fields and found that the effect of OA publishing on citation impact was negative in pharmacology and neutral in mathematics and biology. Türk (2008) believes that free accessibility of publications itself does not necessarily increase their citation impact. Additionally, Calver and Bradley (2010)
reported that OA had no statistically significant influence on the number of citations per article in six biological science journals.

As can be seen from the review of literature, the current research has two distinct characteristics compared to previous studies done on OA journals: it studied both the quantity and quality of scholarly journals and it studied all peer-reviewed journals indexed by Scopus in all research areas.

Methodology

Scopus was selected as the data source of this study because of its broad coverage and ease of data extraction. Data were gathered using Journal Metrics[2], a free website that provides current and comprehensive data for source titles in Scopus (see Figure 1 for a screenshot from the Journal Metrics). A total of 22,256 active journals indexed in Scopus in 2015 were selected as the research sample; of these, more than 3,800 titles’ articles were free available without any restrictions, identified as OA journals. These journals were considered to be OA if they registered at one or both of the DOAJ and/or the Directory of Open Access Scholarly Resources (ROAD). Scopus considers the following types of journals as OA:

- Gold journals: Journals in which authors pay the article processing charge and anyone wishing to read that article can do so freely. In other words, the articles published in these journals are openly accessible immediately.
- Subsidized journals: Journals in which the publication costs are paid by government, universities and corporate sponsors, instead of authors.

Therefore, hybrid and delayed OA journals, as well as green OA publications (openly accessed articles through personal websites or institutional repositories), were not identified in Scopus as OA, and therefore were not investigated in the current research.

Data collection was conducted during the period of January 5 through January 10, 2017. A complete list of Scopus-indexed journals and all research data was extracted into a Microsoft Excel file. Journals from this list were consequently divided into two groups of OA and non-OA journals for further investigations. Although the volume of OA was investigated in journal and article levels, the quality of journals was studied just at the journal level and not at the article level. Due to difficulty in expressing the quality of scholarly journals by a single measure, the current research adopted four indicators to compare the quality of OA and non-OA journals indexed in Scopus under each subject area, include:

1. Mean citedness rate: The ratio of documents cited at least once to the total documents (Journal Metrics, 2016).
2. Mean CiteScore: Elsevier’s new metric in 2016, CiteScore, measures average citations received per document published in the journal in a three-year window. CiteScore for year Y counts the citations received in Y to documents published in Y-3, Y-2 or Y-1, and divides this by the number of documents published in Y-3, Y-2 and Y-1 (Journal Metrics, 2016).
3. Mean SNIP (Source Normalized Impact per Paper): SNIP measures the actual citations received relative to citations expected for the journal’s subject category. It is defined as the mean ratio of a journals citation count and the citation potential for the journal’s subject category (Journal Metrics, 2016).
4. Mean SJR (SCImago journal rank): SJR expresses the average number of weighted citations received in the selected year by the documents published in the selected journal in the three previous years. It shows a journal’s quality in terms of the number of citations received and the quality of citing journal (Journal Metrics, 2016).

It should be mentioned that categorization of journals is based on Scopus classification that journals were assigned to 27 major categories. Relatively high proportion of journals in Scopus were assigned to more than one subject category, because of their multidisciplinary coverage and scope. Therefore, the sum of journals in 27 subject areas was much higher than the number of unique journals indexed in Scopus. To examine whether statistically significant differences exist between the quality of OA and non-OA journals in different research areas, a number of t-tests were conducted in SPSS version 18 (due to normal distribution of variables).
Findings

Of the 22,256 journals indexed by Scopus in 2015, OA journals comprise approximately 17 per cent. The results of the study showed that the volume of OA journals varied across different research areas, ranged from a high of 28.7 per cent to a low of 5.5 per cent. As can be seen in Figure 2, the subject areas with the highest proportion of OA journals were veterinary (60/209; 28.7 per cent), dentistry (44/164; 26.8 per cent), multidisciplinary (24/98; 24.5 per cent), immunology and microbiology (138/571; 24.1 per cent) and neuroscience (139/592; 23.5 per cent). On the contrary, business, management and accounting (85/1531; 5.5 per cent), economics, econometrics and finance (76/927; 8.2 per cent) and psychology (111/1291; 8.6 per cent) were subject areas with the lowest share of OA journals.

An attempt was also made to capture the amount of OA publications in various research areas. The results of the study revealed that the number of documents published in OA journals varied widely by research areas, with agricultural and biological sciences (25.5 per cent) having the highest proportion of OA publications and business, management and accounting (4.2 per cent) having the lowest. Put it in other words, of the papers appeared in 2,522 agricultural and biological sciences journals in 2015, 195,065 papers were published in OA journals. This proportion was 8,141 out of the total of 185,969 papers for management and accounting journals. As is evident in Figure 3, other areas with the greatest proportion of OA publications were multidisciplinary (23.9 per cent), veterinary (23.1 per cent) and biochemistry, genetics and molecular biology (21.4 per cent). Findings showed that the volume of OA articles was higher in research areas which necessarily do not have the most number of OA journals. Table I below presents data on the absolute number and proportion of OA and non-OA journals and publications in each of the 27 research areas based on Scopus.

Four indicators were utilized in an attempt to compare the quality of OA and subscription-based journals in the same research area based on Scopus data in 2015. As the citation behavior differs among disciplines, we cannot directly compare different research areas according to quality indicators. On the contrary, what we are interested in is to compare OA and non-OA journals in the same area. If we look at the citedness rate of journals, we see that it is greater among non-OA journals than among OA journals in 20 out of the 27 research areas. In other words, OA journals in only seven research areas, including computer science, health profession,
immunology and microbiology, medicine, multidisciplinary, neuroscience and nursing, had equal or higher citedness rate compared to non-OA journals in those areas. The results of running a t-test revealed statistically significant mean differences \( t(26) = -4.260, p < 0.05 \) between OA (M = 41.54, SD = 11.44) and non-OA (M = 47.04, SD = 9.95) journals regarding the citedness rate.

With regard to the CiteScore, non-OA journals showed higher quality than OA journals, except in health profession (1.49 for OA and 1.12 for non-OA) and nursing (1.05 for OA and 0.98 for non-OA). A series of t-tests were used to determine whether the observed differences are statistically significant. The results showed a statistically significant mean difference \( t(26) = -1.146, p < 0.05 \) between OA (M = 1.16, SD = 0.56) and non-OA (M = 1.55, SD = 0.58) journals based on their CiteScore. Considering SNIP and SJR, we observed the same trend as for CiteScore: OA journals had greater quality than non-OA journals only in health profession and nursing. Utilizing a series of t-tests, the study found statistically significant mean differences \( t(26) = -5.750, p < 0.05 \) between OA (M = 0.67, SD = 0.15) and non-OA (M = 0.86, SD = 0.17) journals with regard to their SNIP. Moreover, statistically significant mean differences were observed between OA (M = 0.57, SD = 0.28) and non-OA (M = 0.85, SD = 0.3) journals in terms of their SJR \( t(26) = -7.735, p < 0.05 \). Table II below shows the differences in quality between OA and non-OA journals within each research area.

### Concluding remarks

The current research investigated the coverage of the Scopus with regard to the OA journals and compared the quality of OA with non-OA journals in 27 research areas. The overall OA share was approximately 17 per cent, over 22,256 journals indexed in Scopus in 2015. In comparison with the results of Miguel et al. (2011), who reported the share of 9 per cent for OA Scopus indexed journals in 2011, we can conclude that the volume of OA journals is becoming greater. The results revealed an uneven spread of OA journals across disciplines. The percentage of OA journals in Scopus ranged from 5.5 per cent (business, management and accounting) to 28.7 per cent (veterinary). The proportion of OA journals was found to be higher in physical and medical sciences than that of in social sciences, humanities, and art. The results of the study are somewhat consistent with those of Björk et al. (2010) who reported higher proportion of gold OA journals in medicine, medicine-related areas and molecular biology in comparison with humanities and social sciences. As Becher and Trowler (2001) discuss, the intensity of OA publishing varies in different research areas based on “disciplinary culture” of scholarly communications in that area.
To shed light on the difference between OA and subscription-based journals in terms of quality, the current research utilized four indicators, namely, citedness rate, CiteScore, SNIP and SJR. The higher proportion of cited documents in OA journals compared with non-OA journals was seen in computer science, health professions, immunology and microbiology, medicine, multidisciplinary, neuroscience and nursing. OA journals were found to have statistically significantly lower levels of quality than non-OA journals in the same research area with regard to CiteScore, SNIP and SJR. Of the 27 research areas studied, health professional and nursing were the only two areas with higher quality for OA journals versus non-OA journals based on three aforementioned indicators. This finding, to some extent, may stem from the fact that researchers’ citation behavior varies greatly in different research areas. Moreover, another possible explanation may be that the majority of high-impact and high-prestige journals in different research fields are toll-access ones which attract high-quality articles from top researchers and receive large numbers of citations. We should bear in mind that many gold OA journals are younger and have lower reputation than established subscription-based journals in the same field, which have an adverse effect on the citation rate, and hence on indicators like CiteScore, SNIP and SJR. We can conclude that, although OA publishing may facilitate accessibility and use, it does not necessarily lead to greater quality. The results show that free accessibility to the content of journals is insufficient for attaining higher quality because citations received by journals depend also on the quality of articles.

This research is not without any limitation. Considering the fact that Scopus covers less than half of journals listed in the DOAJ (Archambault et al., 2014), further research may be required to study the quality of other gold OA journals not appeared in Scopus. Also, this research utilized only four indicators to measure journals’ quality. The current research also studied OA journals in 2015 and did not take into account the temporal evolution of journals’ volume and quality. Future research can also examine the evolution of the proportion and quality of OA journals in various research areas over a long period of time. The current research compared the quality of journals based on 27 broad research areas in Scopus. Considering the differences existing among disciplines in the same research area, future studies can broaden the scope of the research to sub-categories under each area. Moreover, further research can compare gold OA journals with other types of OA publishing, like green OA and delayed OA, based on publication and citation patterns.

Table II Quality of OA and non-OA journals in 27 research areas based on Scopus data in 2015

<table>
<thead>
<tr>
<th>Subject area</th>
<th>Mean citedness rate OA</th>
<th>Mean citedness rate Non-OA</th>
<th>Mean CiteScore OA</th>
<th>Mean CiteScore Non-OA</th>
<th>Mean SNIP OA</th>
<th>Mean SNIP Non-OA</th>
<th>Mean SJR OA</th>
<th>Mean SJR Non-OA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural and biological sciences</td>
<td>41.9</td>
<td>49.16</td>
<td>1</td>
<td>1.37</td>
<td>0.64</td>
<td>0.77</td>
<td>0.54</td>
<td>0.73</td>
</tr>
<tr>
<td>Art and humanities</td>
<td>12.1</td>
<td>20.5</td>
<td>0.17</td>
<td>0.41</td>
<td>0.29</td>
<td>0.53</td>
<td>0.16</td>
<td>0.29</td>
</tr>
<tr>
<td>Biochemistry, genetics and molecular biology</td>
<td>60.59</td>
<td>64.6</td>
<td>2.27</td>
<td>2.8</td>
<td>0.77</td>
<td>0.95</td>
<td>1.17</td>
<td>1.62</td>
</tr>
<tr>
<td>Business, management and accounting</td>
<td>28.47</td>
<td>46.31</td>
<td>0.48</td>
<td>1.35</td>
<td>0.48</td>
<td>0.93</td>
<td>0.23</td>
<td>0.85</td>
</tr>
<tr>
<td>Chemical engineering</td>
<td>44.75</td>
<td>54.58</td>
<td>1.28</td>
<td>2.22</td>
<td>0.69</td>
<td>0.91</td>
<td>0.48</td>
<td>0.96</td>
</tr>
<tr>
<td>Chemistry</td>
<td>47.86</td>
<td>58.18</td>
<td>1.48</td>
<td>2.32</td>
<td>0.67</td>
<td>0.89</td>
<td>0.55</td>
<td>0.93</td>
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<tr>
<td>Computer science</td>
<td>51.41</td>
<td>51.5</td>
<td>1.19</td>
<td>1.77</td>
<td>0.88</td>
<td>1.36</td>
<td>0.53</td>
<td>0.8</td>
</tr>
<tr>
<td>Decision sciences</td>
<td>37.97</td>
<td>49.75</td>
<td>0.9</td>
<td>1.54</td>
<td>0.79</td>
<td>1.13</td>
<td>0.52</td>
<td>1.09</td>
</tr>
<tr>
<td>Dentistry</td>
<td>39.64</td>
<td>46.82</td>
<td>0.89</td>
<td>1.22</td>
<td>0.61</td>
<td>0.81</td>
<td>0.37</td>
<td>0.58</td>
</tr>
<tr>
<td>Earth and planetary sciences</td>
<td>44.69</td>
<td>48.98</td>
<td>1.15</td>
<td>1.48</td>
<td>0.65</td>
<td>0.84</td>
<td>0.65</td>
<td>0.9</td>
</tr>
<tr>
<td>Economics, econometrics and finance</td>
<td>26.22</td>
<td>41.69</td>
<td>0.47</td>
<td>1.1</td>
<td>0.54</td>
<td>0.94</td>
<td>0.36</td>
<td>0.95</td>
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<tr>
<td>Energy</td>
<td>43.87</td>
<td>46.29</td>
<td>1.22</td>
<td>1.83</td>
<td>0.67</td>
<td>0.96</td>
<td>0.49</td>
<td>0.85</td>
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<td>Engineering</td>
<td>38.99</td>
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<td>0.39</td>
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<td>Environmental science</td>
<td>48.1</td>
<td>50.61</td>
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<td>1.62</td>
<td>0.78</td>
<td>0.81</td>
<td>0.68</td>
<td>0.77</td>
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<td>42.68</td>
<td>1.49</td>
<td>1.12</td>
<td>1.04</td>
<td>0.7</td>
<td>0.79</td>
<td>0.56</td>
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<tr>
<td>Immunology and microbiology</td>
<td>60.86</td>
<td>60.64</td>
<td>2.26</td>
<td>2.55</td>
<td>0.83</td>
<td>0.9</td>
<td>1.26</td>
<td>1.53</td>
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<tr>
<td>Materials science</td>
<td>44.21</td>
<td>49.97</td>
<td>1.33</td>
<td>1.87</td>
<td>0.76</td>
<td>0.92</td>
<td>0.51</td>
<td>0.84</td>
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<td>Mathematics</td>
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<td>0.89</td>
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<td>0.77</td>
<td>1.08</td>
<td>0.6</td>
<td>0.93</td>
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<td>Medicine</td>
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<td>44.24</td>
<td>1.41</td>
<td>1.53</td>
<td>0.71</td>
<td>0.8</td>
<td>0.67</td>
<td>0.85</td>
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<td>0.96</td>
<td>0.63</td>
<td>0.7</td>
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<td>0.81</td>
</tr>
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<td>62.75</td>
<td>2.51</td>
<td>2.53</td>
<td>0.78</td>
<td>0.94</td>
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<td>1.43</td>
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<td>0.64</td>
<td>0.6</td>
<td>0.53</td>
<td>0.51</td>
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<tr>
<td>Pharmacology, toxicology and pharmaceutics</td>
<td>48.13</td>
<td>53.39</td>
<td>1.54</td>
<td>1.96</td>
<td>0.7</td>
<td>0.73</td>
<td>0.55</td>
<td>0.81</td>
</tr>
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<td>Physics and astronomy</td>
<td>43.03</td>
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<td>1.53</td>
<td>1.8</td>
<td>0.8</td>
<td>1.01</td>
<td>0.75</td>
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<td>0.95</td>
<td>0.34</td>
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</table>
Open access journals in Scopus

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**Further reading**

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