

Who Publishes in “Predatory” Journals?

Authors

Jingfeng Xia *

Associate Professor, Department of Library and Information Science, School of Informatics & Computing, Indiana University, Indianapolis

Jennifer L. Harmon

MLS student, Department of Library and Information Science, School of Informatics & Computing, Indiana University, Indianapolis, Email: jenjemey@iupui.edu

Kevin G. Connolly

MLS student, Department of Library and Information Science, School of Informatics & Computing, Indiana University, Indianapolis, Email: kevgconn@iupui.edu

Heather A. Howard

Circulation Supervisor, Irwin Library, Butler University, Indianapolis, IN 46208, Email: hahoward@butler.edu

Ryan M. Donnelly

MLS student, Department of Library and Information Science, School of Informatics & Computing, Indiana University, Indianapolis, Email: rmdonnel@umail.iu.edu

Mary R. Anderson

MLS student, Department of Library and Information Science, School of Informatics & Computing, Indiana University, Indianapolis, Email: mra4@iupui.edu

* Corresponding author: 755 W. Michigan St. UL 3100B, Indianapolis, IN 46202, Email: xiaji@iupui.edu, Phone: 317-278-2178

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Abstract: Many open access journals have a reputation for being of low quality and being dishonest with regard to peer review and publishing costs. Such journals are labeled “predatory” journals. This study examines author profiles for some of these “predatory” journals, as well as for groups of more recognized open access journals. We collect and analyze publication record, citation count, and geographic location of authors from the various groups of journals. Statistical analyses verify that each group of journals has a distinct author population. Those who publish in “predatory” journals are, for the most part, young and inexperienced researchers from developing countries. We believe that economic and sociocultural conditions in these developing countries have contributed to the differences found in authorship between “predatory” and “non-predatory” journals.

Introduction

A report published by *Science* in early October 2013 triggered intense discussion among scholars and publishers on the issue of open access (OA) publishing and quality control (Bohannon, 2013). The author of this report, John Bohannon, conducted an experiment by submitting a fabricated article with a deliberately flawed research design to a group of more than 300 selected OA journals. He wanted to check if the article would pass what some individuals believe to be a lax peer-review process for many OA journals. The results supported the author’s presumption because more than half of the journals accepted the article and failed to notice or address the intentional flaws.

In recent years, we have seen the creation and growth of many OA journals. Various forms of publishing practices have been adopted. Some newly created OA journals lack transparency and do not identify an editorial board. Many require considerable article processing charges for authors. Such journals are considered to be primarily interested in making quick money and paying little or no attention to peer review (Beall, 2012a). Jeffrey Beall at the University of Colorado Denver library has called these “predatory” journals and has maintained a list of hundreds of such journals based on his set of criteria. His goal is to raise awareness of dishonest publishing practices.

Although there has been much discussion about the definition of “predatory” journals (Anderson, 2012; Poynder, 2013), it is clear that the quality of OA journals varies considerably. Many journals, including the ones on Beall’s list, demonstrate low standards for article

acceptance. While it is ideal to determine the merit of these journals by assessing the quality of their articles, such an evaluation is difficult to implement and can easily become too subjective. Instead, we choose to examine author profiles of these “predatory” journals, concentrating on their publication and citation history and geographic location. We select seven journals from Beall’s “predatory” journal list in the area of biomedical science, collecting data for a total of 324 articles and 941 authors. We also consult *Web of Science* for each author’s total number of publications and citations as an indicator of academic reputation. The dataset is then compared to that of authors in various groups of other OA journals. One group includes journals that rejected Bohannon’s fake article and are not listed by Beall; another group includes journals with recognized prestige as indicated by their high journal impact factors. The purpose of this study is to determine whether the different groups of OA publications have attracted different types of authors, or, in other words, if author profiles can indicate the scholarly standards of OA journals.

Background

There are very few scholars who have not received email spam from new OA journals and conferences attempting to recruit articles, solicit participation, or that contain invitations to participate in the journal’s review or become members of the journal’s editorial team. Some OA publishers have been so aggressive in their marketing efforts that scholars may easily become overwhelmed by the frequency of such emails, and as a consequence, may grow skeptical about OA publishing. Beall began investigating OA publishers and created a blacklist of what he calls “predatory” journals and publishers that are considered to be dishonest and of low quality. Journals that are included on Beall’s list may be known to quickly accept submissions with little peer review, publish hoax or nonsensical papers, require a processing fee after a publishing agreement is signed, appoint fake scholars to the editorial board, and/or mimic the name of more recognized journals.

Bohannon, a journalist for *Science*, took a different route verifying the quality of OA publishing. He used a fake name and fictitious institution to submit 304 copies of a paper about a “wonder drug” to selected open access journals, while the paper itself contained an experimental design “so hopelessly flawed that the results are meaningless” (Bohannon, 2013, p. 60). At the time of publication of his study in *Science*, Bohannon’s flawed paper had been accepted 157 times and rejected 98 times. His other submissions were either still

under review or had yet to receive a response. Of the 255 acceptances and rejections, 60 percent did not show any evidence of peer review; of those that did, not all of the peer review focused on the scientific soundness of the bogus study.

Bohannon's research received immediate attention and criticism in the media. Many blog entries started discussing the report as soon as it became available, attracting hundreds of responses (e.g., Eisen, 2013; Taylor, Wedel, & Naish, 2013). While many people supported his "sting operations" on potentially dishonest OA publishers, some criticized his methods, arguments, and ethicality of his conduct. Below are some examples of the critiques:

Bohannon's experiment, like his fabricated paper, did not include a control group. He targeted OA journals without bringing subscription-based journals into the study. Lax control of publication quality is not unique to OA; rather it is a problem that has been in existence in scholarly communication for a long time (Bornmann, 2011; Lee, Sugimoto, Zhang, & Cronin, 2013). In fact, as early as 1996, Alan Sokal conducted a similar test, known as the Sokal Affair, by submitting a questionable article to *Social Text*, a leading scholarly journal in the U.S. in the area of postmodern cultural studies (Sokal, 1996a). On the date of the article's publication, Sokal indicated the article was a hoax in several other journals (Sokal, 1996b, c). There are also a number of comparable experiments on non-OA journals as well as OA journals (see en.wikipedia.org/wiki/Sokal_affair; scholarlyticken.org; Gilbert, 2009; Peters & Ceci, 1982).

Bohannon equated low-quality OA publications with open access in general in his argument. However, his approach to data collection is debatable because only OA journals charging a processing fee were included in the experiment. Peter Suber points to the fact that as many as 70 percent of journals listed in the *Directory of Open Access Journals* (DOAJ) in 2013 charged no author-side fees at all (Suber, 2006, 2013). Bohannon's discussion also contradicts itself in that it provides proof that some fee-based OA journals, such as *PLOS One*, did conduct rigorous peer review and rejected his bogus paper.

He received further criticism on an ethical basis because authors are required to guarantee their submission represents a true scientific study. This argument appears to come from irritated publishers who did not appreciate being tricked by Bohannon and the *Science* journal that backed and published the study (Oransky, 2013).

Disagreements aside, nobody denies that there are indeed many weak and dishonest journals. Those dishonest journals have contributed to some individuals having doubts about the reputation of the OA field. Through tracing the Internet Protocol (IP) addresses of journal editors and the location of their bank accounts, Bohannon (2013) found that many of the journals accepting his fake article

were based in developing countries, particularly India. Four major geographical clusters of “predatory” publishers were found in India, Nigeria, the U.S. and the U.K. A common practice has emerged in which many such OA publishers are run in India with branches in the latter two countries. Journals without rigorous quality control are especially harmful for developing countries “where governments and universities are filling up with people with bogus scientific credentials,” according to Paul Ginsparg, founder of the famous physics e-print repository arXiv (cited from Bohannon, 2013, p. 65). Sociocultural and economic factors have played an important role in the geographic formation of this “predatory” OA publishing.

Young researchers and doctoral students in these developing countries are considered to be the major victims of “predatory” journals, a problem catalyzed by an increasing pressure on them to “publish or perish” (Shaw, 2013). They are anxious to expand their publication list and become recognized by the academic community, and are therefore easily attracted by the quick and easy publishing model that these OA journals offer. Presumably, many authors who publish in these dubious “new ‘pay big, publish fast’ e-journals are younger scholars based in the Global South and particularly in the Muslim world” (Truth, 2012, p. 56).

Very few scientific studies have examined “predatory” journals, although there have been informal discussions about this topic on personal blogs (e.g., Taylor, Wedel, & Naish, 2013). Fewer, if any, scientific studies have been conducted to investigate the background of authors of OA journal articles. Our current project on OA authorship in “predatory” journals will shed light on the issues relating to journal quality control and scholar involvement in making contributions to weak and dishonest journals and will help the academic community refine its culture in response to the changing environment of scholarly communication. We study the background variables of those authors who publish in journals that require publication fees so that the findings can be compared to what Bohannon discovered. However, we take a further step to improve our research design by introducing comparable groups, namely authors from established OA journals that also charge author fees, including journals rejecting Bohannon’s fake paper and journals with high status from the PLOS series.

Based on the existing observations and arguments, we build the following hypotheses:

1. *Hypothesis One*: there is no difference in author profiles, regarding their publication and citation history, between the various groups of OA journals if these journals all employ an author-fee model.

2. *Hypothesis Two*: there is no difference in author profiles, regarding their geographic location, between the various groups of OA journals if these journals all employ an author-fee model.

Research Design

Data Collection

We selected a group of 68 journals from Beall's "predatory" journal list to represent low-quality publications in various areas of biomedical science, primarily pharmaceutical science, which is comparable to the subject of Bohannon's fake study. We chose to investigate biomedical science because: (1) open access has been an established practice among biomedical scientists, (2) many biomedical projects are sponsored by grants which could fund OA publishing, making an author-pay model possible and popular, and (3) there are some recognized biomedical journals of the same or similar publishing models that can be used for the purpose of comparison. Of these 68 journals, seven journals were selected for data collection of author profiles because of their focus on pharmaceutical science according to the titles (Table 1). We call this group: Group 1.

Table 1

In order to make the comparisons, two other groups of OA journals were also selected. One group includes journals that rejected Bohannon's fake paper (Table 1). Other criteria used to select these journals are (1) journals that have a substantial review process according to Bohannon, (2) journals that require author payment, (3) journals in the same biomedical areas, and (4) journals that have registered with the DOAJ but are not on Beall's list. The DOAJ aims to "cover all open access scientific and scholarly journals that use a quality control system to guarantee the content" (doaj.org/about). Although these journals have not been rated by popular bibliometric tools such as *Journal Citation Reports* by Thomson Reuters (ISI) or *SCImago Journal & Country Rank*, we consider them to be more rigorous in peer review and represent better quality than the "predatory" journals in Group 1. A total of five journals were selected for the study. Please note that the location data in both tables are for journal editors, as consistent with Bohannon's study. We call this group: Group 2.

The other group contains high-status journals from the PLOS series. PLOS (the Public Library of Science) is a nonprofit publisher with its journals establishing OA "as an effective and sustainable way to share the latest and best research with everyone" (www.plos.org/about/what-is-plos/publishing). Since October 2003, PLOS has initiated seven journals, all of which have been widely

accepted as high-quality publications. Their impact factor and *h*-index values, as shown in Table 2, indicate the popularity of the journals in the scientific world. Of these seven PLOS journals, two were removed from our study (*PLOS Computational Biology* and *PLOS One*) due to their wide coverage of research subjects. These journals all charge publication fees to authors and the cost per article is very high (Table 2). We call this group: Group 3.

Table 2

Aside from the PLOS journals, data for all research articles published in 2013 were collected in a spreadsheet, resulting in a total of 324 articles for Group 1 and 165 articles for Group 2. The data for every author of these articles were manually entered into the spreadsheet, including the author's full name, institutional affiliation, geographical location, academic status, and corresponding authorship. A total of 1,821 authors were collected (Group 1=1,047 and Group 2=774). After removing duplicates, the final number of authors was 1,675 (Group 1=941 and Group 2=734).

Next we searched for each author's publications and citations in *Web of Science*, with the results being further refined by the research area of biomedical science only. In other words, even if an author had published in multiple disciplines, only his or her publications and citations in biomedical science were counted. Given the specialization of biomedical studies, we believe such a refinement will not result in a significant variation of a researcher's overall academic reputation.

The same data collection strategy was applied for authors who published in 2013 in Group 3 journals. For this dataset, we did not select all articles in 2013 due to the large quantity. Instead, we chose the first issue of each journal, following the data collection strategy adopted by Finlay, Ni, Tsou & Sugimoto (2013), and stopped data collection when the number of authors reached 300, a number that we believe sufficient for the purpose of comparison. These samples are roughly evenly distributed across all five journals.

Data Analyses

Publication and citation data for authors in the three groups of journals were categorized into strata so that statistical measurements could be conducted. The strata has an interval of 5, namely, "0," "1-5," "6-10," "11-15," "16-20," "21-30," and "31 & more," according to the nature of the data distribution. The numbers of publications are stratified independently of the numbers of citations.

The chi square test of independence was selected for the analyses in order to evaluate whether paired observations on variables, expressed in a contingency table, are independent of each other between Groups 1 and 2 journals and between Groups 2 and 3 journals. Known also as the test of homogeneity, the test of independence seeks a chi-squared probability of less than or equal to 0.05 to reject a null hypothesis that row variable is independent of column variable. To make reliable statistical tests, we used randomly selected samples and paid special attention to the size of the samples so that no more than 25% of the cells in the contingency table for our chi square calculations have a value lower than 5. This sample size justification made it impossible for us to run statistical analysis against data for journals within a group. For example, we were unable to compare the difference of author profiles among the seven “predatory” journals. Our chi square analyses below are all inter-group comparisons, which is exactly what we need for this study.

Limitations

We recognize the complexity of authorship (Cronin, 2006), particularly in the area of biomedical research. Biomedical papers often contain many co-authors who make varying degrees of contribution. In some cases, a doctoral student, who will need first-authored articles to compete for employment, is listed as the first author of an article even though his/her academic advisor initiated and contributed to the research. As a result, analyses at the level of all individual authors may not paint an accurate picture of authorship. Therefore, we conducted additional analyses by applying chi square calculations against the corresponding authors as a subset of our existing data.

The sample size of this research is relatively small, particularly for the comparison groups. This small size limits our analyses on the data within any group of journals. Although the limitation will not affect inter-group comparisons in this case, future studies may expect to examine more features of OA journal publishing by expanding sample size.

Analyses

All Authors

For a chi square analysis at the level of individual authors, Tables 3 and 4 provide counts of articles by author from the three groups of journals. A statistical analysis at the individual journal level is impossible because of the small numbers in some strata. Table 4 does not

show strata at the journal level, also due to the size of the data. The total numbers of each group, rather than journal numbers, are used for the following calculations:

$$\chi^2 (7, n = 1,675) = 420.339, p <.05 \text{ (Groups 1-2)}$$

$$\chi^2 (7, n = 1,034) = 38.85, p <.05 \text{ (Groups 2-3)}$$

$$\chi^2 (14, n = 1,975) = 619.877, p <.05 \text{ (Groups 1-2-3)}$$

Table 3

Table 4

The chi square test of independence indicates significant differences in the publication records of authors between Groups 1 and 2 journals. The differences reject our first hypothesis. In other words, we are 95% confident that authors of these two groups have different academic reputation. The same interpretation is given to the chi square test between Groups 2 and 3. The testing result also indicates that PLOS authors are significantly different from Group 2 authors based on their publication history. Similarly, the third chi square test serves as supplemental evidence to support the former two sets of calculations. Differences are found between these three groups of authors.

The chi square model is able to test hypotheses to indicate if there is a statistical significance in data by comparing whether the variation in a set of data is due to chance or due to one of the variables being tested. Although it is very powerful and useful for scientific research, the chi square test does not provide necessary information about the reasons for the significance or lack thereof. To better understand the author profiles, we create a simple histogram visualization to check whether certain patterns in the authorship can be detected.

Figure 1 is self-explanatory and illustrates an obvious contrast in author publication records between the two groups. The majority of authors who publish in “predatory” journals have no other publications, while the second largest group consists of authors with fewer than five journal publications elsewhere; very few authors have published more than ten articles. In contrast, the histogram reveals that Group 2 authors, those who publish in OA journals that have a substantial review process and subsequently rejected Bohannon’s fake submission, generally have a stronger publication record. With the exception of a few new authors, the majority of Group 2 authors have published journal articles previously; in fact, some authors have published more than 30 articles.

Figure 1

We attempt to further examine the academic status of Group 1 authors. Yet the data is incomplete because many journals, particularly “predatory” journals, do not provide their authors’ academic rank. A Google search is not helpful because the majority of these authors do not have a personal webpage and their institutional websites are, more often than not, too poorly designed to provide the information. From the data we collected, there seems to be an indication that young researchers, including doctoral students and assistant professors, have fewer publications than authors whose titles are professor. However, the data is insufficient to statistically support the assertion.

Citation counts for the strata are listed in Tables 5 and 6. Table 6 has the citation counts by author for the entire Group 3. A similar chi square test is taken for the citation counts. The results confirm the aforementioned test for publication history and reject our first hypothesis again at the significant level of .05. Based upon this testing result, we are confident there are significant differences in citations among authors of the different groups.

$$\chi^2 (7, n = 1,675) = 307.445, p <.05 \text{ (Groups 1-2)}$$

$$\chi^2 (7, n = 1,034) = 96.326, p <.05 \text{ (Groups 2-3)}$$

$$\chi^2 (14, n = 1,975) = 664.976, p <.05 \text{ (Groups 1-2-3)}$$

Table 5

Table 6

We then follow the procedure used above to create a histogram for Group 1 and Group 2 (Figure 2). The data shows much stronger evidence that authors who publish in Group 2 journals have successfully accumulated more extensive citations than authors in the Group 1 journals. The largest number of citations falls in the stratum “31 & more” for Group 2 authors, while the majority of Group 1 authors still have not received any citations.

Figure 2

Corresponding Authors

Due to the complexity of co-authorship in biomedical sciences, corresponding authors may not be the first author (Riesenberg & Lundberg, 1990; Shapiro, Wenger & Shapiro, 1994). Yet we believe they usually play an important role and typically make intellectual contributions to a study. Most importantly, they may be the most senior researcher of a group and decide where to submit a research

article. Their publication history may offer important information in understanding why a particular OA journal is selected, or in other words, what relationship may exist between the status of a journal and its authorship. Since many journals in our samples have a limited number of articles and corresponding authors, we will not present data for individual journals (Tables 7 and 8). There are some variations in the data, e.g., certain articles have more than one corresponding author, and some articles are shared by the same corresponding authors. These variations, however, are few and will not affect our test at the group level. The chi square testing results below also reject our first hypothesis and show significant differences among authors of the different groups.

$$\chi^2 (7, n = 489) = 236.141, p < .05 \text{ (Publication numbers between Group 1 and Group 2)}$$

$$\chi^2 (7, n = 489) = 245.242, p < .05 \text{ (Citation counts between Group 1 and Group 2)}$$

Table 7

Table 8

Figure 3 and Figure 4 demonstrate different patterns of publication and citation distributions across the strata for authors in each group. We especially note the considerable citation counts in the stratum “31 & more” for authors in Group 2 (Figure 4). Evidently, the corresponding authors in Group 2 have received far more citations than those in Group 1.

Figure 3

Figure 4

Author Geographic Locations

A total of 23 countries are represented in the selected “predatory” journals of Group 1 (Table 9). Most authors are concentrated in a few countries, such as India (725), Nigeria (80), and Pakistan (44). This is in contrast to authors in Group 2 who are mostly from Korea (438), U.S. (76), and Italy (59). Authors in the PLOS journals of Group 3 are mainly from U.S. (142), U.K. (62), and Australia (26). Some authors provide multiple locations, which is especially common in the PLOS journals. For authors with multiple countries listed, we read the section “About the Authors” and used the first affiliation of the author as his/her country.

Table 9

Each group of journals shows a distinct trend in the geographic locations of the authors. For example, authors of Southeast Asian countries are found extensively in Group 1, but are absent in Groups 2 and 3. Due to varying sample sizes, we categorized all countries by region and calculated percentages for each region. Figure 5 is a visual presentation of the percentages. An occurrence becomes apparent in that authors in each group are clustered in different geographic regions, e.g., Group 1 authors are mainly in South Asia and Africa, Group 2 authors are mostly in East Asia, and Group 3 authors are largely in North America and Europe.

In order to conduct a chi square analysis, we re-classify the numbers so that many zeroes can be removed. In the re-classification, Middle East, which is not presented in Groups 2 & 3 at all, is merged into Africa; Southeast Asia, which is not found in Groups 2 & 3, is combined with East Asia; and South America, which contains Brazil only and is presented merely in Group 2, is combined with North America to become Americas (Tables 10 & 11).

Table 10

Table 11

The chi square tests of independence indicate significant differences in author geographical origin among the groups. All three tests at the significant level of .05 reject our second hypothesis that there is no difference on author profiles, regarding their geographical location, among the various groups of OA journals. The statistical testing results are consistent with our casual observation in Figure 5.

$$\chi^2 (5, n = 1,675) = 1153.826, p < .05 \text{ (Groups 1-2)}$$

$$\chi^2 (5, n = 1,034) = 375.294, p < .05 \text{ (Groups 2-3)}$$

$$\chi^2 (10, n = 1,975) = 2075.907, p < .05 \text{ (Groups 1-2-3)}$$

Figure 5

There is another difference among the three groups regarding the geographic location of multiple authors. In Group 1, when the primary or corresponding author of an article is not from a developed country, which is standard, other co-authors are typically also not from developed countries. For Group 3 journals, research collaborations between developing and developed countries are common. Group 2 is in between the two groups.

Discussion

Bohannon started his experiment with the viewpoint that OA journals are dishonest and of low quality. He attempted to prove this and focused his discussion in his *Science* paper on the negative aspects of OA publishing. The fact is that although 60% of the OA journals accepted his fake research, 40% of OA journals rejected the article. He did not pay attention to different OA practices, but instead singled out the validity of Beall's judgment for being "good at spotting publishers with poor quality control" (Bohannon, 2013, p. 64).

We utilize Bohannon's results, not his conclusions, to stratify the OA journals for author profiles with the purpose of making statistical comparisons. Our analyses cannot reveal the level of quality of articles or journals. Yet we are able to discover significant differences among various groups of OA journals with regard to authors' publication and citation history. One of our findings is that authors who publish in so called "predatory" journals have little to no history of previous publications and citations. This may indicate that they are young researchers, which is indeed supported by the author information.

Both Bohannon's study and Beall's criteria for filtering "predatory" journals, as well as numerous blog posts on similar subjects, have discussed OA practices from a publisher's perspective. Open access contributors have been largely ignored in this discussion. Knowing who publishes in "predatory" journals will be useful. Our data, for both corresponding authors and other co-authors, indicates that these researchers are young, inexperienced, and often located in developing countries. The fact that they have paid various amounts in article processing charges to publish their articles in new and low prestige OA journals signifies their eagerness to build publication records. We believe that sociocultural and economic conditions in the countries where most of these authors reside have played a critical role in shaping the authorship landscape.

Let us take a look at the two countries with the most authors who publish in "predatory" journals. In India, a long-standing digital divide has created an imbalance of information access and dissemination within the scholarly community (Ghosh & Das, 2007). While a rapid growth of the economy has helped construct necessary facilities for elite institutions and universities to support research and teaching in recent years, other institutions have been struggling to amass new technologies and research sponsorship. There has been a shortage of platforms to fulfill the demands of scholarly publishing. The publishing market is traditionally not a huge economic entity in many developing countries, which has given open access initiatives sufficient space to expand in these areas. As the second most populous nation in the world, India has about 300 universities and nearly the same amount of government-funded research laboratories. Yet its research output in science and technology, according to *Web of Science*, was only about 2.5% of the world's journal literature in 2006

(Arunachalam, 2006). In a geographic analysis of scholarly publishing, Haider (2005) found that India was ranked 12th in general journal publishing, and 18th in publishing of online content among the top 25 publishing countries. By 2008, India was ranked 5th in open access journal publishing, with a total of 150 OA journals (Nazim & Devi, 2008). For researchers and scholarly publishers, “there are enormous rewards of sheer recognition and access to a broad and diverse audience; these factors overcome economic and financial inhibitions to publish on the Web with open access” (Abraham & Minj, 2007).

The expansion of OA journal publishing in India has been very rapid since then. Today, India is ranked 10th in number of papers and 16th in number of citations according to *SCImago Journal & Country Rank* (www.scimagojr.com/countryrank.php), while the country is ranked 4th in OA journal publishing, with 593 OA journals appearing in DOAJ and 604 OA journals according to *Ulrichsweb*.

The condition of scholarly publishing in Nigeria can also help explain why so many inexperienced authors choose easy-to-publish OA journals. Research in Nigeria has been strongly recommended for advancement in academia and other research institutions (Adomi & Mordi, 2003; Mordi, 2002). Many Nigerian universities and research institutions require their staff to publish a specific proportion of their journal articles in foreign journals as a condition of career advancement. International visibility is considered important to help enhance the reputation of both the researcher and his/her institution. These requirements can be difficult to fulfill due to the country’s long standing economic and political instability.

Since the 1970s, the quantity and quality of scholarly publishing output in Nigeria have been deteriorating (Olukoju, 2004). The virtual collapse of the currency and the devastation caused by military powers and their civilian collaborators has led to a diminished standard of scientific conduct. Several noticeable consequences in scholarship are: (1) publishers have struggled to survive and production of many reputable journals could not be sustained, (2) scholars have been faced with many distractions and their focus on scientific studies has waned, and (3) the old generations of scholars “did not produce or hand over to a younger generation of successors” (Olukoju, 2004, p. 367), creating “a lack of confidence in the ability of the younger generation” (Olukoju, 2004, p. 367). This latter situation is especially relevant to our finding that a great number of young Nigerian authors are publishing in the “predatory” journals. In response to these challenges and pressures, some Nigerian scholars have created “emergency” publications—new journals with minimum quality control that are likely unable to last more than a few issues. The younger generation of scholars has also developed alternative pay-to-publish strategies by collecting monetary contributions from authors to finance publications, a strategy that may have been in practice before the

gold OA model. Scholars have also sought sponsorship from social clubs, wealthy individuals, or relevant organizations to support their publications in foreign journals.

The demands stimulate a multiplying of new OA journals, particularly in developing countries. A low submission acceptance standard provides an opportunity for non-elite members of the scholarly community to survive in the “publish or perish” culture found in both the West and many developing countries. Most of the “predatory” journals initiated and operated in the developing countries charge a fee affordable to local submissions (see Table 1), enabling researchers to publish quickly. Publishing in such journals is much less costly than conducting expensive studies and attempting to publish without fees in a prestigious foreign non-OA journal. This is by no means only an open access problem, but is a prevalent dilemma in the current scholarly communication system. OA publishing is just by chance at the forefront of digital changes and is unfairly blamed. Our statistical tests confirm that OA journals have attracted various levels of authors in regard to the publication and citation history of the authors. We call for reformation of scholarly communication and believe that this restructuring is the best approach for raising the level of OA journal quality and eliminating unprofessional practices.

Many blog entries have suggested possible methods of optimizing the OA publishing market (e.g., Taylor, Wedel, & Naish, 2013). In addition to DOAJ’s sustained efforts to maintain a quality control system for open access journals, the Open Access Scholarly Publishers Association has promoted “a uniform definition of OA publishing, best practices for maintaining and disseminating OA scholarly communications, and ethical standards” (oaspa.org/about/mission-and-purpose). Building an audit and reward system will be helpful in creating an environment that promotes higher quality amongst scholars and OA journals. The American Chemical Society recently did implement such a system on November 1, 2013 by providing a “stimulus program” with monetary credits to encourage authors to publish in its new OA journal (Bernstein, 2013). Someone has made a suggestion to Beall to create a white list of “transformed predatory OA publishers” so that “other lower quality predatory OA publishers will learn how to improve (if they really want to do so) and will learn how to get out of Beall’s ‘bad list’” (Khan, 2013).

Harnad is among the advocates who propose green open access as a possible solution to raise the level of quality in OA journals (openaccess.eprints.org). He has been constantly promoting globally mandated policies to require all research outcomes to be self-archived in digital repositories for free access and use. Such policies are believed to be able to force “journals to adapt naturally to the online era by cutting obsolete costs, downsizing and converting to Fair Gold. It is the global network of Green OA repositories that will

allow publishers to phase out all the products and services associated with access-provision and archiving, once Green OA mandates fill them” (Harnad, 2013). However, this green OA idea may not eradicate those journals whose publishers only have an interest in financial gain rather than in quality improvement, which seems to be common in current “predatory” publishing. Recently, there is an increasingly popular call for engaging an open peer review process that facilitates online transparency and disclosure of the identities of those reviewing scientific publications (DeCoursey, 2006).

As an integral part of scholarly communication, journal publishing has been facing a series of challenges in response to the rapid development of digital technologies. Yet reforms at the system-level may provide a more effective solution than changes for individual components. For example, if policies for tenure and promotion that emphasize quality rather than quantity can be implemented universally, “predatory” journals may be significantly improved. Varying political, sociocultural, and economic situations across countries and regions of the world contribute to the scholarly community’s ineffectiveness in adopting the same evaluation criteria. Individual participants in the scholarly communication process must work together and take responsibility for making the appropriate changes.

Conclusions

There are green and gold roads to open access (Harnad et al., 2004, 2008). Many of the gold OA publishers charge an author fee for publication, and a group of questionable journals have been identified for the unprofessional practice of seizing money from authors upon acceptance of their scientific papers while maintaining a low to non-existent standard of quality control (Beall, 2010, 2012b). Beall hopes that his list of “predatory” journals will serve to alert scholars and prevent them from doing business with these journals.

Our attempt to examine author profiles suggests that authors who publish in the “predatory” journals are indeed distinct from authors who publish in OA journals that have a more rigorous review process. Comparisons between the “predatory” journals and two other groups of OA journals, a more-selective group and a most-selective group, have been made based on the fact that they all charge an author fee. Although we are unable to test the statistical differences among selected “predatory” journals in our study, we can confidently state that they, as a group, have published articles by inexperienced authors.

The second group of OA journals for comparison is from Bohannon’s study, containing journals with a substantial review process. Authors who publish in this group of journals have a stronger history in regards to the number of previous published articles and

citations. We consider them to be more experienced authors. However, none of these journals have been indexed by *Journal Citation Reports* or *SCImago Journal & Country Rank*, which indicates the scholarly inferiority of the journals. The occurrence points to the fact that not all OA journals are equal in quality control, and thus challenges Bohannon's claim of the overall low quality of OA journals.

Not surprisingly, the third group of OA journals, namely the PLOS journals, contains the most experienced authors who have the strongest publication and citation history in our study. Their high journal impact factors make them comparable to many other prestigious non-OA journals in the same fields. If one equates a publication fee model to low quality, the author profiles of the PLOS journals will not support the equation.

Authors in "predatory" journals are mostly from developing countries, especially India, Nigeria and some African and Middle East countries. This evidence supports Bohannon's finding of geographic locations of the low quality publishers (Bohannon, 2013, pp. 62-63). Noticeably, researchers from India and Nigeria rarely make their name in prestigious OA journals, while authors from Australia, Europe, and North America have more previous publications and receive more citations. This geographical distribution of OA author profiles reflects the economic and sociocultural traditions of different countries.

The statistical analyses reject both of our hypotheses. Hence, we believe there are differences in author profiles, concerning their publication and citation history as well as their geographic locations, between the various groups of OA journals. In other words, different groups of OA publications do attract different types of authors, and author profiles do indicate the scholarly standards of OA journals.

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	Journal	No Article	No Author	Frequency	First Issue	Location	Per Paper ¹
Group 1	<i>American Journal of Pharmacy and Health Research (AJPHR)</i>	48	102	Monthly	Apr 2013	India	\$16 (\$50) ²
	<i>Indian Journal of Pharmaceutical and Biological Research (InJPBR)</i>	34	70	Quarterly	Jan-Mar 2013	India	\$12 (\$40) ²
	<i>International Journal of Life science and Pharma Research (IJLSPR)</i>	26	65	Quarterly	Oct-Dec 2011	India	Unknown
	<i>International Journal of Medical Sciences and Health Care (IJMSHC)</i>	19	69	Monthly	Jan 2013	U.S.A.	\$200
	<i>International Journal of Pharmaceutical and Biomedical Research (IJPBR)</i>	42	139	Quarterly	Jan-Mar 2010	U.K.	Unknown
	<i>International Journal of Pharmaceutical Sciences and Drug Research (IJPSDR)</i>	24	96	Quarterly	Apr-Jun 2009	India	\$16
	<i>International Journal of Pharmacy (IJP)</i>	131	400	Quarterly	2011	Turkey	\$33 (\$225) ²
Group 2	<i>British Journal of Pharmaceutical Research (BJPR)</i>	84	327	Quarterly	Jan 2011	India	\$500
	<i>Cancer Growth and Metastasis (CGM)</i>	5	11	Rolling	2008	U.S.A.	\$1,699
	<i>Clinical and Molecular Hepatology (CMH)</i>	24	145	Quarterly	1995	Korea	Unknown
	<i>Drugs and Therapy Studies (DTS)</i>	5	22	Rolling	2011	Sweden	\$272
	<i>Frontiers in Pharmacology of Anti-Cancer Drugs (PACD)</i>	47	229	Monthly	Sep 2010	Switzerland	\$2,176 ³
Total		489	1675				

Table 1. Journals selected for the study (Location is for journal editor): Group 1 – “predatory” journals & Group 2 – journals rejecting Bohannon's fake paper
1. Per paper values are presented in US dollars for easy comparisons. Currency conversions were calculated in early January of 2014
2. The first amount is for a local submission or submissions from a few selected developing countries, while the amount in parentheses is for an author in the West
3. This amount is for a regular submission of most types of research papers

Journal	Impact Fact	h-Index	Per Paper
<i>PLOS Biology</i>	12.69	133	\$2,900
<i>PLOS Medicine</i>	15.253	105	\$2,900
<i>PLOS Computational Biology</i>	4.867	72	\$2,250
<i>PLOS Genetics</i>	8.517	93	\$2,250
<i>PLOS Pathogens</i>	8.136	78	\$2,250
<i>PLOS neglected tropical diseases</i>	4.963	40	\$2,250

Table 2. Group 3: selected PLOS journals and their rankings by impact factors and h-indexes (Sources: Thomas Reuter ISI, SCImago Journal & Country Rank, and PLOS)

	Journal	0	1-5	6-10	11-15	16-20	21-25	26-30	31 & More	Total
Group 1	<i>AJPHR</i>	81	16	2	2	1	0	0	0	102
	<i>InJPBR</i>	43	18	3	2	1	0	1	2	70
	<i>IJLSPR</i>	42	17	3	0	1	1	0	1	65
	<i>IJMSHC</i>	44	18	4	0	0	2	0	1	69
	<i>IJPBR</i>	98	41	0	0	0	0	0	0	139
	<i>IJPSDR</i>	56	23	5	2	5	1	0	4	96
	<i>IJP</i>	249	90	46	2	0	0	3	10	400
	Total	613	223	63	8	8	4	4	18	941
Group 2	<i>BJPR</i>	80	127	64	24	0	16	0	16	327
	<i>CGM</i>	2	4	2	0	2	1	0	0	11
	<i>CMH</i>	19	36	8	6	10	16	10	40	145
	<i>DTS</i>	4	4	2	1	2	1	2	6	22
	<i>PACD</i>	36	85	36	18	9	5	0	40	229
	Total	141	256	112	49	23	39	12	102	734
Grand Total		754	479	175	57	31	43	16	120	1675

Table 3. Count of publications by authors in Groups 1 & 2 journals (Journal title acronyms are in Table 1)

Journal	0	1-5	6-10	11-15	16-20	21-25	26-30	31 & More	Total
PLOS Journals	16	108	52	36	13	20	3	52	300

Table 4. Count of publications by authors in Group 3 journals

	Journal	0	1-5	6-10	11-15	16-20	21-25	26-30	31 & More	Total
Group 1	<i>AJPHR</i>	84	14	0	2	0	0	0	2	102
	<i>InJPBR</i>	55	8	2	2	1	0	0	2	70
	<i>IJLSPR</i>	47	9	1	1	0	0	3	4	65
	<i>IJMSHC</i>	50	7	1	1	2	4	3	1	69
	<i>IJPBR</i>	99	11	6	2	1	0	3	17	139
	<i>IJPSDR</i>	64	11	2	2	1	1	0	15	96
	<i>IJP</i>	270	52	14	16	7	5	11	25	400
	Total	669	112	26	26	12	10	20	66	941
Group 2	<i>BJPR</i>	114	74	25	9	16	16	16	57	327
	<i>CGM</i>	3	2	0	0	1	0	0	5	11
	<i>CMH</i>	39	12	8	2	3	3	1	77	145
	<i>DTS</i>	4	1	1	1	1	0	0	14	22
	<i>PACD</i>	44	18	4	18	4	18	13	110	229
	Total	204	107	38	30	25	37	30	263	734
	Grand Total	873	219	64	56	37	47	50	329	1675

Table 5. Count of citations for authors in Groups 1 & 2 journals (Journal title acronyms are in Table 1)

Journal	0	1-5	6-10	11-15	16-20	21-25	26-30	31 & More	Total
PLOS Journals	16	44	21	10	10	8	3	188	300

Table 6. Count of citations for authors in Group 3 journals

	0	1-5	6-10	11-15	16-20	21-25	26-30	31 & More	Total
Group 1 Journals	204	83	23	6	2	0	0	6	324
Group 2 Journals	13	28	32	6	19	13	16	38	165
Total	217	111	55	12	21	13	16	44	489

Table 7. Publication numbers of the corresponding authors

	0	1-5	6-10	11-15	16-20	21-25	26-30	31 & More	Total
Group 1 Journals	233	41	12	6	2	5	10	15	324
Group 2 Journals	15	15	11	4	7	4	8	101	165
Total	248	56	23	10	9	9	18	116	489

Table 8. Citation counts for the corresponding authors

Author Country	
Group 1	Algeria, Bangladesh, Brazil, Cameroon, Egypt, Ethiopia, India, Indonesia, Iran, Italy, Kenya, Lebanon, Malaysia, Malta, Mexico, Morocco, Nepal, Nigeria, Pakistan, Saudi Arabia, Thailand, UAE, UK
Group 2	Australia, Brazil, Canada, Egypt, Germany, India, Italy, Korea, Nigeria, Switzerland, USA
Group 3	Australia, Canada, China, France, Germany, Italy, Nigeria, Switzerland, Tanzania, Uganda, UK, USA

Table 9. Geographic location of the authors

	Group 1	Group 2	Group 3
Africa	0.14	0.08	0.04
Australia	0.00	0.01	0.09
Europe	0.01	0.10	0.33
E Asia	0.00	0.57	0.03
S Asia	0.75	0.07	0.00
SE Asia	0.03	0.00	0.00
N America	0.03	0.16	0.51
S America	0.00	0.01	0.00
Middle East	0.04	0.00	0.00
Total	1.00	1.00	1.00

Table 10. Author origin by region by percentage

	Group 1	Group 2	Group 3
Africa	189	61	13
Australia	0	7	25
Europe	14	76	98
E Asia	29	438	10
S Asia	784	57	1
America	31	135	153
Total	1047	774	300

Table 11. Author origin by region

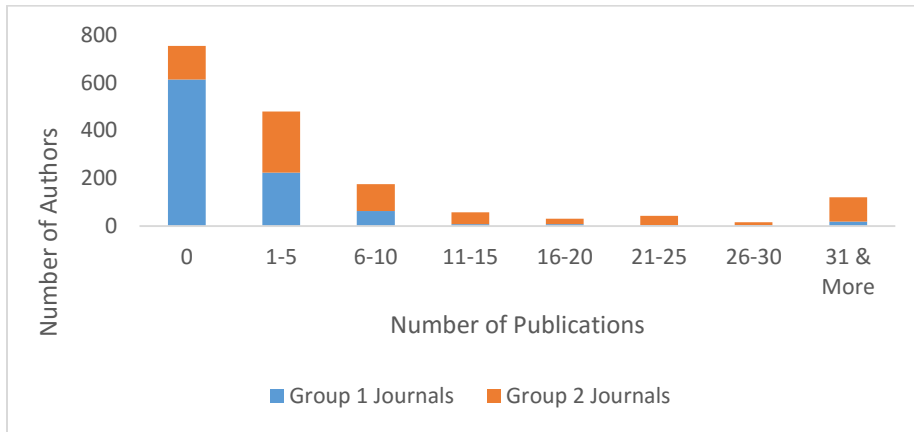


FIG. 1. Comparison of journal groups by number of authors in various publication strata

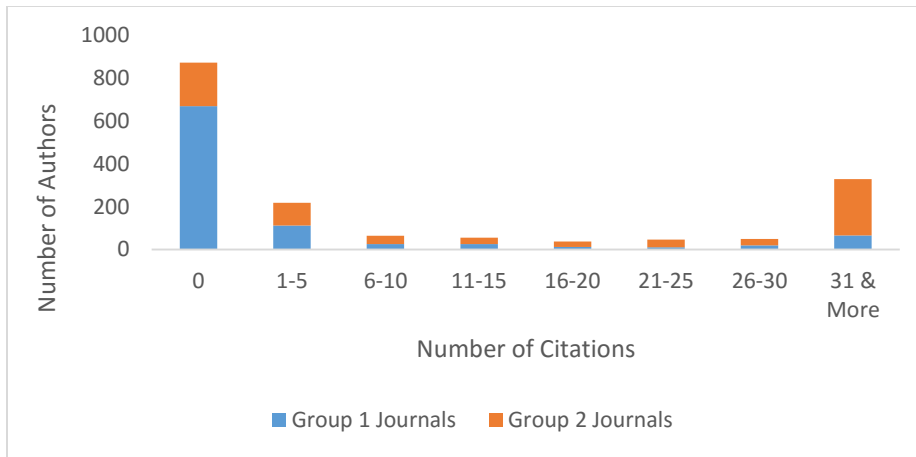


FIG. 2. Comparison of journal groups by number of authors in various citation strata

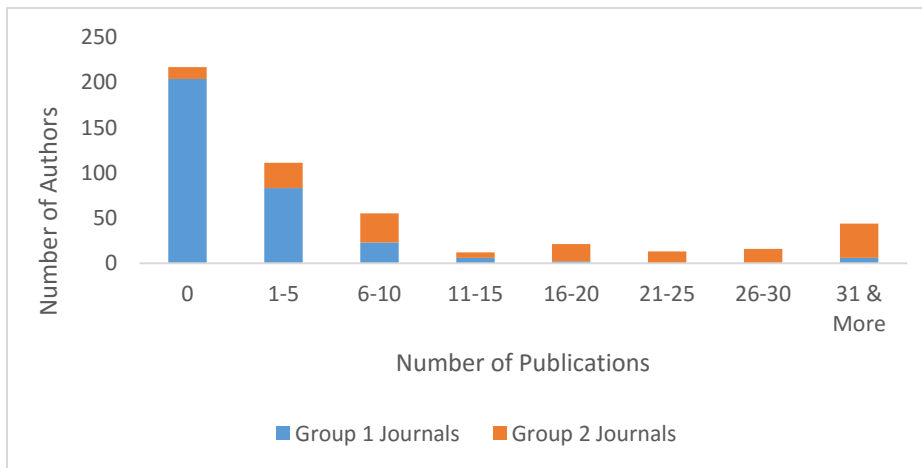


FIG. 3. Comparison of journal groups by number of corresponding authors in various publication strata

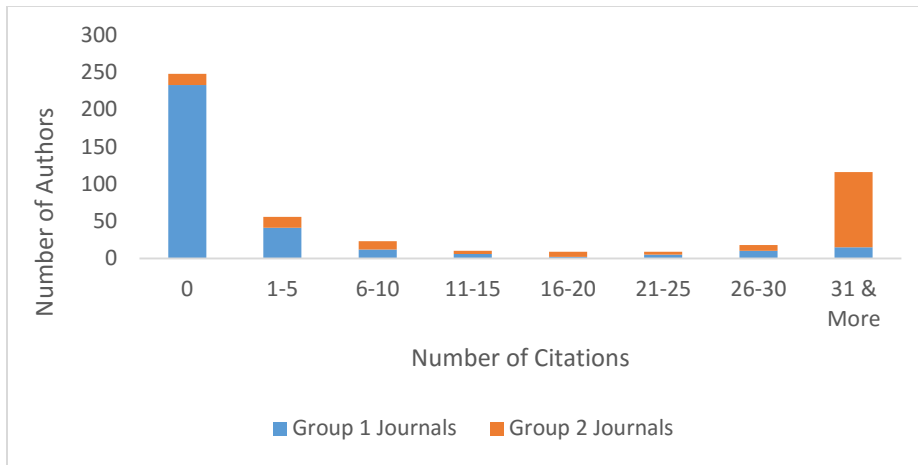


FIG. 4. Comparison of journal groups by number of corresponding authors in various citation strata

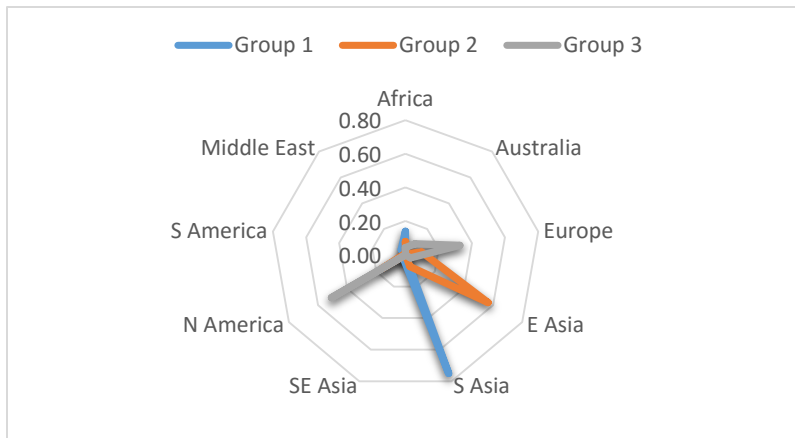


FIG. 5. Comparison of journal groups by geographic location of authors