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Citation Impact of Health and Medical Journals in Africa: Does Open Accessibility of Journals Matter?

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ABSTRACT
This study was conducted to examine whether open accessibility of medical journals published in Africa may influence the journals' citation impact. An evaluative informetric research approach was used to compare 134 health and medical journals hosted in the African Journal Online (AJOL) database. Harzing's Publish or Perish (PoP) software was used to extract the following publication and citation data from Google Scholar: citation counts, number of papers, and the h-index of the journals. Three null hypotheses were tested using the t-test. The findings reveal that non-open access health and medical journals performed poorer in terms of citations than their OA counterparts. The t-test analysis of the findings led us to conclude that there is a very high significant difference between the research impacts of OA and non-OA health and medical journals published in Africa.

Keywords: open access, journal evaluation, citation analysis, bibliometrics, scholarly communication.

INTRODUCTION

Open access (OA) publishing is currently providing a new platform for scholarly communication among researchers in different fields. Apart from researchers, communities of practice that rarely produce but are consumers of the research results benefit immensely from open access publishing (Davis, 2011). For the researcher, and his affiliations that often fund the research, the greatest concern is to make the work available to global scientific community and then to enhance its impact and global visibility, a situation that will, by extension, improve the impact and visibility of both the authors and the institution. Consequently, journals that would enable high impact and wide visibility are usually selected as publication outlets by many researchers. . Today, scholarly publishing has moved to online platforms. The concept of OA has become a buzz word in scholarly publishing. OA , as it is commonly abbreviated, entails online free availability of research literature using two "G" approaches – the gold and green routes. The gold model relies on the traditional journal publication system, but shifts the

financial burden to the authors or research funders; while the green model relies on authors archiving their publications in repositories in the form of pre-print or post print (Antelman 2004; Craig, Plume, McVeigh, Pringle & Amin 2007; Turk, 2008). Therefore, open access proponents argue that journals that are freely available to researchers attract more readerships and by extension more citations, while critics of open access model argue that there is no evidence to support this claim as established non-OA journals would continue to attract readership and citations (Aronson, 2005; Eysenbach, 2006). Recent studies however, indicate that open access publishing enhances research and citation impact of journals (Ezema & Ugwu 2013; Atchison & Bull 2015) making research grantors to support the publication of funded research in open access outlets (Bjork & Solomon, 2012). Advocates of OA publishing also argue that OA increases authors' citation impacts and equally contribute in reduction of cost of subscribing to journals (Atchison & Bull, 2015) in many disciplines including health sciences and medicine.

Health and medical research is critical in the overall national development of developing economies like Africa. Access to research findings in the field is of great interest to medical and health scholars and practitioners. The journal remains the single most important channel through which research is communicated, disseminated and consumed. We believe that OA publishing in health and medical research is critical in scholarly communication and diffusion of knowledge and bridging the information gap between the developed and developing countries (Mann, von Walter, Hess & Wigand, 2009). OA scholarly publishing in the subject domain is also critical in terms of medical and health practice, especially in countries which do not have access to research findings published and indexed in restricted databases. Since health and medical research require free flow of information, it is necessary to investigate the research impact of OA journals in the field in relation to non-OA counterparts. The study intends to examine the influence of OA on the research and citation impact of health and medical journals in Africa. The specific objectives of the study are to:

a. Determine the geographical distribution of OA and non-OA health and medical journals in Africa
b. Examine the citation impact of the journals using various citation data.
c. Determine whether there is any significant difference between research and citation impact of OA and non-OA journals published in Africa.

The study's null hypotheses were:

i. There is no significant difference between the h-index of OA and non-OA medical journals in Africa.
ii. There is no significant difference between the citation counts of OA and non-OA African medical journals.
iii. There is no significant difference citation per paper (cite/paper) of OA and non-OA health and medical journals in Africa.

LITERATURE REVIEW

It is well acknowledged that citations are a good indicator for measuring the performance of journals and diffusion of knowledge (Garfield, 1955) and acknowledgment of scholars (Cronin, 1995) as well as reward for professional

contributions (Franck, 1999 & Biagioli, 2003). Evidently, citations accrue to articles over time, but subject variations also influence citation impact of articles (Moed, 2005). With the advent of open access publishing, the belief is that open access journals have citation advantage over subscription-based journals (Craig, Plume, McVeigh, Pringle & Amin, 2007; Wagner, 2010; Davis, 2011). The authors argue that subscription-based journals constitute a barrier to free flow of scientific information, while open access journals promotes free access and citation penetration of the journals and assist in free access to research literature in low income countries (Evans & Reimer, 2009). This was also highlighted in the study of Mann, von Walter, Hess & Wigand (2009) in their report that 94% of their respondents agree that open access publishing would be beneficial to developing countries. As a result of this, many researchers are inclined to publish or archive their papers in open access platforms to attract increased citations (Hajjem, Harnad & Gingras, 2005, Turks, 2008). The correlation between citation counts is important to scholars because according to Turks (2008) it provides a measure of value to articles and journals.

Previous studies on the citation ranking of open access journals seem to show a low citation rate in relation to subscription journals. For instance, the study of McVeigh (2004) reports a low ranking of open access journals, but a later study of Eysenbach, (2006) using articles published in a hybrid Gold multidisciplinary science journal (*Proceedings of National Academy of Science*) found more average number of citations to OA journals than in subscription based journals. Another study by Lawrence (2001) also reports that open access articles in computer science receive more citations than subscription based articles, while Anderson, Sack, Krause & O'Keefe (2001) found no citation advantage in health and medical research. Shin (2003) found a slight increase in the impact factor of non open access psychology journals within two years period of joining OA publishing. The submission of the study is that there is between 2% and 254% increase in citation impact after changing publication medium depending on the discipline. The study of Harnad & Broody (2004) reports more citations to OA articles than subscription-based articles in Physics and Mathematics, but Kurtz, Guenter, Accomazzi, Grant, Demleitner, Henneken, & Murray (2005) provide a contrary report. Antelman (2004) reports that open access journals in four fields have high citation advantage ranging from 45% in philosophy, 51% in electrical and electronic engineering, 86% in political science, and 91% in mathematics. The study of Harnad & Brody (2004) also showed higher citation counts after comparing over 95,000 preprint manuscripts in physics and mathematics deposited in a subject based repository *arXiv*. A related study by Metcalfe (2006) matched articles from *Solar Physics* published in 2003 with preprint version deposited in the astrophysics section of *arXiv* and found a significant difference in citation counts in favour of those posted in the repository.

We have noted that recent studies report different results on citation advantage of OA journals over non-OA journals despite the increasing awareness of OA (Turk 2008). Using a robot to search articles published in eleven disciplines (biology, psychology, sociology, health, political science, economics, education, law, business, and management), Hajjem, Harnad & Gingras (2005) found a citation variation of between 25% and 250% to OA articles and non-OA articles which were published between 1992 and 2003. Tonta, Yurdagul & Al (2007) also compared the citation impact of natural sciences (physics, mathematics and chemistry) and social sciences and found that OA journals in natural

sciences received more citations than that of the social sciences. In a study by Noriss, Oppenheim, & Rowland (2008) who investigated four disciplines (Economics, Applied Mathematics, Ecology and Sociology) found OA citation advantage across the disciplines with some degree of variation among the disciples. The higher citation impact of natural science disciplines over the humanities and social sciences was attributed to the early adoption of electronic open access publishing by the natural sciences in reaction to the demand of faster communication of research findings in the field (Antelman, 2006). To the best of our knowledge and as reflected in the above mentioned studies, there is no known study on the citation and research impact of health and medical journals emanating from the African continent, hence the current study.

RESEARCH DESIGN

This study adopted evaluative informetrics approach to examine open access health and medical journals found in African Journals Online (AJOL). Diodato (1994:15) explains that informetrics is "the collection of descriptive information about documents to provide bodies responsible for the production and transmission of information; form of transmission; medium of communication; nature of information conveyed and geographical origin." The AJOL database was selected as the source of data for the study because it covers majority of journals published in Africa in all fields of study and spread across several countries in the continent. The study obtained 165 health and medical journals list in the AJOL database, but 20 of them were found not to be core health and medical journals (i.e. journals in health and physical education, counseling, undergraduate journals, etc) and therefore were excluded from the study leaving 145 journals to be assessed. Out of this, 68 journals are open access while 77 non-OA journals. Three of the OA journals and 8 non-OA journals were not recognized by the Publish or Perish software and therefore were excluded leaving 65 OA journals and 69 non-OA journals which were used for final analysis. The details of all the medical and health journals are attached as appendix 1. The bibliometric data for each journal that was obtained from Google scholar using Harzing's Publish or Perish (PoP) included number of papers, total number of citations, number of citations per paper, number of citations per year, and h-index for the period 2010 to 2015. Data was analyzed using Microsoft Excel while the t-test analysis was used to examine the relationship between the citation impact of OA and non-OA journals with a view to determining the influence OA has on journal citation impact. Three indicators of citation impact, namely, the citation count, citations per paper, and the h-index, were used to conduct the t-test analysis.

RESULTS

Table 1: Distribution of the journals based on access method (N=134)

S/N	Country of Origin	No of Journals N=134	OA Journals (N=65)	Non-OA Journals (N=69)
1	Cameroun	2 (1.5%)	1 (1.5%)*	1 (1.4%)+
2	Egypt	8 (6.0%)	6 (9.2%)	2 (2.8%)
3	Eritrea	1(0.7%)	1 (1.5%)	0 (0%)
4	Ethiopia	3(2.2%)	2 (3.1%)	1(1.4%)
5	France	1(0.7%)	1 (1.5%)	0 (0%)
6	Ghana	2(1.5%)	2 (3.1%)	0 (0%)
7	Kenya	8(6.0%)	5 (7.7%)	3 (4.3%)
8	Libya	1(0.7%)	1 (1.5%)	0 (0%)
9	Malawi	1(0.7%)	1 (1.5%)	0 (0%)
10	Mauritius	2(1.5%)	2 (3.1%)	0 (0%)
11	Nigeria	72(53.7%)	22(33.8%)	50 (72.4%)
12	Rwanda	1(0.7%)	0 (0%)	1 (1.4%
13	Sierra Leone	1(0.7%)	0 (0%)	1 (1.4%
14	South Africa	18(13.4%)	14(21.5%)	4 (5.8%)
15	Sudan	3(2.2%)	1 (1.5%)	2 (2.8%)
16	Tanzania	5(3.7%)	1 (1.5%)	4 (5.8%)
17	Tunisia	1(0.7%)	1 (1.5%)	0 (0%)
18	Uganda	2(1.5%)	2 (3.1%)	0 (0%)
19	Zambia	1(0.7%)	1 (1.5%)	0 (0%)
20	Zimbabwe	1(0.7%)	0 (0%)	1 (1.4%
	Total	134 (100%)	65(48.5%)	69(51.5%)

*Percentage of OA journals +Percentage of non-OA

Table 2 reveals that there are more non-OA journals (51.5%) than open access journals (48.5%). Of the journals published in Nigeria, 22 (33.8%) of them are open access journals while 50 (72.4%) are non-OA journals, but South Africa has more open access journals (18) than non-OA journals. Interestingly, Kenya has 5 open access and 4 non-OA journals and Egypt has 6 open access journals and 2 non-OA journals.

Table 2: Citation Penetration of Open Access Journals against Subscription Journals

N = 134 for journals

Type of Access	Number of Journals	Journal percent	Total Papers	Paper/journal	Total Citations	Cite/Journal	Cite/Paper
Open Access	65	48.1	17,570	270.3	34,600	532.3	1.97
None Open Access	69	51.9	7,925	114.9	10,050	145.6	1.27
Total	134	100	25,495	190.3	44,650	333.2	1.75

Table 2 further shows that there are more non-OA journals (51.1%) than OA journals in the field of health and medical sciences and as indexed in the AJOL database. The journals' productivity in terms of paper generation differ a great deal. While OA journals have 17,570 (68.9%), non-OA journals produced a total of 7,925 (31.1%) papers between 2010 and 2015. Similarly, the number of citations to OA journals is higher (i.e. 34,600 or 77.5%) compared with non-OA journals, which received a total of 10,050 (22.5%) citations. Figure 1 provides a clearer picture of productivity and citation impact of the OA and non-OA journals. It is also important to observe that the open access journals have higher cites per paper (1.97) than non-OA journals. Similarly, the number of citations per journal and publications per journal are equally higher with open access journals, despite the fact that there are more non-OA than OA journals.

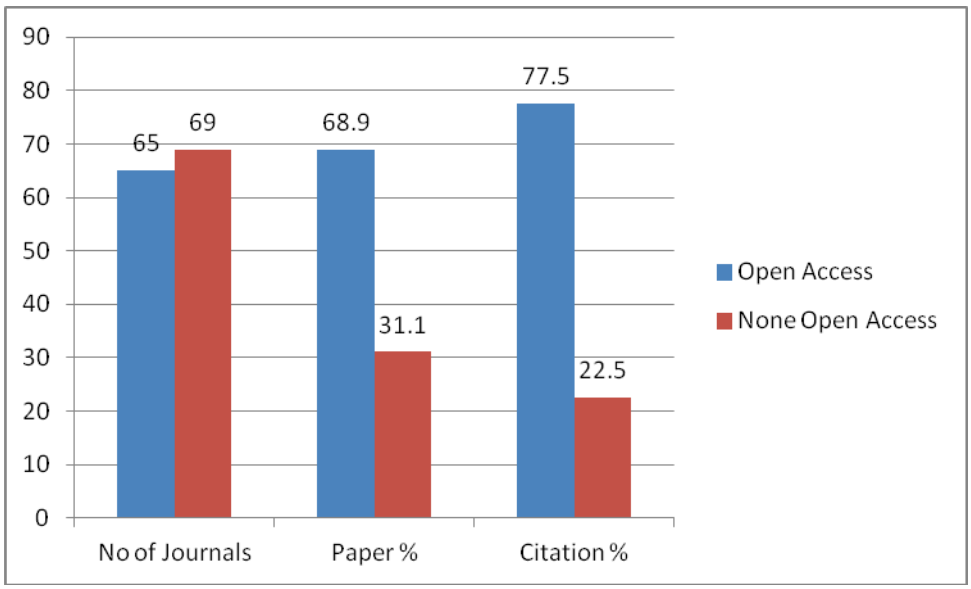

Figure 1: Productivity and citation impact of OA and non-OA health and medical journals in Africa, 2010-2015

Table 3: Test of significance between h-index of OA and non-OA journals

Access Type	Mean ($\bar{X}$)	Standard deviation	Number	df	t	Significance
OA journals	7.615	5.30	65	67	13.67	.000
Non-OA journals	3.184	3.54	69			

From table 3, there is a high significant difference between the h-index of OA and non-OA health and medical journals in Africa ($t = 13.67$, $p < 0.05$). Since "p" value is .000 which is less than 0.05, the null hypothesis is rejected. The table also clearly shows that the mean h-index of OA journals is greater than that of non-OA journals, which implies that OA journals have a higher research impact than the non-OA journals (see appendix 1 for details).

Table 4: Test of significance of citation counts of OA and non-OA journals

Access Type	Mean ($\bar{X}$)	Standard deviation	Number	Df	T	Significance
OA journals	532.325	919.33	65	67	5.40	.000
Non-OA journals	145.652	383.62	69			

Table 4, just as table 3, reveals a high significant difference, in number of citations counts between the OA and non-OA health and medical journals ($t = 5.40$, $p < 0.05$) and therefore, rejects the null hypothesis since 'p' value .000 is less than 0.05. The absolute citation counts of the of the OA journals is tellingly higher than that of the non-OA journals, indicating that OA health and medical journals have greater citation impact than their non-OA counterparts (Appendix 1 provides detailed information on the citation impact).

Table 5: Test of significance of citation per paper of OA and non-OA journals

Access Type	Mean ($\bar{X}$)	Standard deviation	Number	Df	T	Significance
OA journals	1.81	1.35	65	64	7.46	.000
Non-OA journals	0.71	0.91	69			

Table 5 also shows a very high significant difference in terms of the average citations per paper (cite/paper) between OA and non-OA journals in the field of health sciences and medicine ($t = 7.46$, $p < 0.05$), so the null hypothesis is rejected as "p" value is .000 which is less than 0.05, the significance. A close observation of the table and the appendix 1 also reveals a higher mean cite/paper for OA journals than non-OA journals. The test clearly shows that OA journals has a higher citation advantage than non-OA journals.

DISCUSSIONS

The distribution of the journals indicates that only twenty African countries contribute health and medical journals as indexed in AJOL. This constitutes about 28% of health and medical journals published in Africa (see Ulrich's' Global Serials Directory https://ulrichsweb.serialssolutions.com/). Nigeria and South Africa contribute over 79% of both OA and non-OA journals, a situation that reflects earlier studies of AJOL database (Ezema, 2010a). It is a source of worry that many African countries are yet to submit their journals for indexing in Africa's most popular database, which indexes all journals from different disciplines. It is even more worrying that, of the twenty countries that have presence in the database, nine have only one journal each in the field of health and medicine. With about 56 independent countries, it means that only about 35.7% of the countries have journals in the database. This is not a good picture about the continent's status in health and medical research. Several studies (e.g. Ezema, 2010b; Mouton 2010; Onyancha 2016) have also indicated that Africa's share of the world research is very low.

The findings of the study, in terms of citation impact using the h-index and citations per paper and journal, offer a relatively strong case for OA scholarly publishing of health and medical research in Africa. Though most of the journals investigated have high citation counts (see appendix1), it is clear that OA journals have greater citation counts as indicated in table 2 and figure 1. The citation percentage of OA journals is 77.5% as opposed to 22.5% for non-OA journals. This is in line with earlier findings in extant literatures (see Lawrence, 2001; Harnad & Broody 2004; Antelman 2004; Hajjem, Harnad & Gingras, 2005; Yurdagul & Al 2007; Noriss, Oppenheim, & Rowland 2008), but refutes the findings of Anderson, Sack, Krause & O'Keefe (2001) who found no citation advantage in OA health and medical journals. Although many of the studies referred are not in health and medical field, some of them are in disciplines related to medicine such as ecology, psychology and biology. The study of Turks (2008), using eleven disciplines including health sciences also shows a citation advantage in favour of OA journals. Anderson, Sack, Krause & O'Keefe (2001) may have found no citation advantage because of lack of interest in OA publication within the early period of OA publishing.

The tests of significance conducted using two null hypotheses indicate a very strong significant difference in the research impact (i.e. h-index and average citations per paper) of OA and non-OA journals; thus rejecting the first hypothesis. This may not be surprising as access usually promotes impact of journals in scholarship as shown in the views of Ezema & Ugwu (2013) and Atchison & Bull (2015). The second hypothesis was also rejected as the test shows a high significant difference between the citation penetration of OA and non-OA journals. The financial constraints of researchers in subscribing to non-OA journals and dwindling library budgets in many parts of the world, and more particularly in Africa, could be attributed to this inclination in open access journals. Apart from this, there has been a sustained campaign among proponents of OA movement in creation of awareness on OA.

CONCLUSION

The debate on citation advantage of OA over non-OA journals has generated a lot of interest resulting to several studies. This study has focused on OA journals in health and medical science of African origin as an extension of such studies. Extant literatures are inclined to favour OA journals because such journals provide free access to research literature. In addition to examining the citation counts of OA and non-OA journals, this study moved further to provide inferential information to establish whether there is any significance difference so as to increase understanding of relationship between the two publication models. The two null hypotheses tested were rejected showing a high significance difference in research impact and citation penetration of the two publication outlets. In conclusion and to answer the research question on whether open accessibility matters as far as citation and research impact of health and medical journals in Africa is concerned, this study has revealed that OA access publishing of the journals greatly influences the citation and research impact of the journals. This pattern is particularly interesting in view of the fact that the coverage of journals published in Africa in foreign citation and bibliographic databases is minimal, (Hendrix, 2008; Ezema 2010a) a situation that limits the journals' visibility and impact status.

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Appendix 1: Rank list and details of all the African health and medical journals used for the study

Rank	Journal	ISSN	Country	Access Type	Papers	Citations	Cites/ year	Cites/ paper	h-index
1	South African Medical Journal	003-8-2469	South Africa	#O/A	1853	5450	1090	4.19	26
2	African Health Sciences	1680-6905	Uganda	O/A	591	3348	669.6	5.66	20
3	Tropical Journal of Pharmaceutical Research	1596-5996	Nigeria	O/A	804	2611	522.2	3.24	20
4	African Journal of Traditional, Complementary and Alternative Medicines	0189-6016	Nigeria	*Non - OA	580	2248	449.6	3.86	19
5	Pan African Medical Journal	1937-8688	Kenya	O/A	2753	2957	591.4	1.07	18
6	Nigerian Journal of Clinical Practice	1119-3077	Nigeria	O/A	588	2437	487.4	4.14	17
7	African Journal of Reproductive Health	1118-4841	Nigeria	O/A	406	1672	334.4	4.19	16
8	Annals of African Medicine	1596-3519	Nigeria	O/A	290	1244	248.8	4.29	15
9	Ghana Medical Journal	0855-0328	Ghana	O/A	205	992	198.4	4.84	15
10	Ethiopian Journal of Health Sciences	1029-1857	Ethiopia	O/A	211	948	189.6	4.49	15
11	African Journal of AIDS Research	1608-5906	South Africa	Non-OA-	207	814	162.8	3.93	13
12	Ethiopian Journal of Health Development	1021-6790	Ethiopia	O/A	188	660	132.0	3.51	13
13	Journal of Medicine and Medical Sciences	1119 - 3999	Nigeria	Non-OA-	867	1565	313.0	1.81	12
14	African Journal of Paediatric Surgery	0189-6725	Nigeria	Non-OA-	418	1095	219.0	2.62	12
15	Annals of Medical and Health Sciences Research	2141-9248	Nigeria	O/A	244	807	161.4	3.31	12
16	Libyan Journal of Medicine	1819-6357	Libya	O/A	182	738	147.6	4.05	12
17	South African Journal of Clinical Nutrition	003-8-2469	South Africa	O/A	200	537	107.4	2.69	12
18	West African Journal of Medicine	0189-160X	Nigeria	O/A	288	648	129.6	2.25	11
19	Tanzania Journal of Health Research	0856-6496;	Tanzania	O/A	224	642	128.4	2.87	11

20	Nigerian Medical Journal	N/A	Nigeria	Non-OA-	363	943	188.6	2.60	10
21	Nigerian Journal of Medicine	1115-2613	Nigeria	Non-OA-	438	892	178.4	2.04	10
22	Southern African Journal of HIV Medicine	0038-2469	South Africa	O/A	180	524	104.8	2.91	10
23	South African Journal of Surgery	0038-2361	South Africa	O/A	241	495	99.0	2.05	10
24	Malawi Medical Journal	N/A	Malawi	O/A	287	444	88.8	1.55	10
25	Egyptian Journal of Medical Human Genetics	1110-8630	Egypt	O/A	224	457	91.4	2.04	9
26	African Journal of Biomedical Research	1119-5096	Nigeria	O/A	251	371	71.2	1.48	9
27	Arab Journal of Nephrology and Transplantation	1858-554X	Sudan	O/A	102	303	60.6	2.97	9
28	International Journal of Medicine and Biomedical Research	2315-5019	Nigeria	O/A	90	198	66.0	2.2	9
29	South African Family Practice	1726-426x	South Africa	O/A	1748	1109	229.6	0.63	8
30	East African Journal of Public Health	0856-8960	Tanzania	Non-OA-	278	427	85.4	1.54	8
31	Alexandria Journal of Medicine	2090-2948	Egypt	O/A	262	373	74.6	1.42	8
32	Health SA Gesondheid	1025-9848	South Africa	O/A	153	314	62.8	2.05	8
33	African Journal of Clinical and Experimental Microbiology	1595-689X	Nigeria	O/A	143	262	52.4	1.83	8
34	South African Journal of Sports Medicine	1015-5163	South Africa	O/A	149	220	44.0	1.48	8
35	Journal of Surgical Technique and Case Report	2006-8808	Nigeria	O/A	144	284	56.8	1.97	7
36	South African Journal of Psychiatry	003-8-2469	South Africa	O/A	420	268	53.6	0.64	7
37	South African Journal of Child Health	N/A	South Africa	O/A	197	267	53.4	1.36	7
38	East African Medical Journal	0012 835x	Kenya	Non-OA-	384	257	51.4	0.67	7
39	Journal of Medicine	1596-	Nigeria	O/A	186	237	47.4	1.27	7

	and Biomedical Research	6941							
40	Scientific Medical Journal	1110-5607	Egypt	Non-OA-	479	243	48.6	0.66	6
41	Continuing Medical Education	N/A	South Africa	O/A	743	237	47.4	0.32	6
42	Annals of Nigerian Medicine	0331-3131	Nigeria	Non-OA-	101	151	30.2	1.5	6
43	Nigerian Quarterly Journal of Hospital Medicine	0189 – 2657	Nigeria	Non-OA-	114	128	26.5	1,12	6
44	Journal of Medical and Biomedical Sciences	2026-6294	Ghana	O/A	58	127	25.4	2.19	6
45	Journal of Child and Adolescent Mental Health	1728-0583	South Africa	Non-OA-	125	112	22.4	0.9	6
46	African Journal of Drug and Alcohol Studies	1531-4065	Nigeria	O/A	58	96	19.2	1.66	6
47	Egyptian Journal of Pediatric Allergy and Immunology (The)	2134-8934	Egypt	O/A	111	85	17.0	0.77	6
48	Southern African Journal of Anaesthesia and Analgesia	1027-9148	South Africa	O/A	407	265	53.0	0.65	5
49	Nigerian Journal of Paediatrics	0302-4660	Nigeria	O/A	241	213	42.6	0.88	5
50	Internet Journal of Medical Update – EJOURNAL	1694-0423	Mauritius	O/A	109	193	38.6	1.77	5
51	East and Central African Journal of Surgery	2073-9990	Uganda	O/A	263	158	31.6	0.60	5
52	International Journal of Health Research	1596-9819	Nigeria	O/A	69	138	27.6	2.36	5
53	Sierra Leone Journal of Biomedical Research	2076-6270	Sierra Leone	Non-OA-	61	113	22.6	1.85	5
54	South African Journal of Obstetrics and Gynaecology	0038-2329	South Africa	O/A	114	112	22.4	0.98	5
55	Journal of Medicine in the Tropics	0795-9168	Nigeria	Non-OA-	147	110	22.0	0.75	5
56	Annals of Ibadan Postgraduate Medicine	1597-1627	Nigeria	O/A	79	98	19.6	1.24	5

57	African Journal of Infectious Diseases	2006-0165	Nigeria	Non-OA-	96	91	18.2	0.95	5
58	Nigerian Health Journal	1597-4292	Nigeria	O/A	95	72	14.6	0.76	5
59	African Journal of Health Sciences	1022-9272	Kenya	O/A	45	57	11.4	1.27	5
60	African Journal of Urology	1110-5704	Egypt	O/A	261	120	24.0	0.46	4
61	Nigerian Journal of Surgery	1117-6806	Nigeria	O/A	82	114	22.8	1.39	4
62	Annals of Pediatric Surgery	1687-4137	Egypt	O/A	141	95	19.0	0.67	4
63	Nigerian Journal of Parasitology	1117-4145	Nigeria	Non-OA-	157	70	14.0	0.45	4
64	Journal of Basic and Clinical Reproductive Sciences	2320-2041	Nigeria	O/A	77	69	13.8	0.90	4
65	Southern African Journal of Critical Care	1562-8264	South Africa	O/A	47	60	12.0	1.28	4
66	Clinics in Mother and Child Health	1812-5840	Cameroun	O/A	59	55	11.0	0.93	4
67	Afrimedic Journal	2141-162X	Nigeria	O/A	80	54	13.5	0.68	4
68	Medical Journal of Zambia	0047-651X	Zambia	O/A	111	62	12.4	0.56	3
69	Journal of Pharmaceutical and Allied Sciences	1596-8499	Nigeria	Non-OA-	145	56	11.2	0.39	3
70	Sahel Medical Journal	1118 – 8561	Nigeria	Non-OA-	175	53	10.6	0.30	3
71	Port Harcourt Medical Journal	0795-3038	Nigeria	Non-OA-	178	52	10.4	0.29	3
72	Tropical Journal of Obstetrics and Gynaecology	0189 - 5178	Nigeria	Non-OA-	179	49	9.8	0.27	3
73	Nigerian Medical Practitioner	0189 0964	Nigeria	Non-OA-	132	43	8.6	0.33	3
74	Sudan Journal of Medical Sciences	1858-5051	Sudan	Non-OA-	177	41	8.2	0.23	3
75	East African Orthopaedic Journal	1994-1072	Kenya	O/A	64	41	8.2	0.64	3
76	Obstetrics and Gynaecology Forum	1027-9148	South Africa	Non-OA-	156	39	7.8	0.25	3
77	Benin Journal of Postgraduate Medicine	0795-0268	Nigeria	O/A	10	37	7.4	3.7	3
78	East and Central African Journal of Pharmaceutical	1026-552X	Kenya	O/A	53	35	7.0	0.66	3

	Sciences								
79	African Journal of Physiotherapy and Rehabilitation Sciences	2141-8322	Nigeria	O/A	32	35	7.0	1.09	3
80	Annals of African Surgery	1999-9674	Kenya	Non-OA-	130	34	6.8	0.26	3
81	Anatomy Journal of Africa	2305-9478	Kenya	O/A	39	32	6.4	0.82	3
82	African Journal of Neurological Sciences	1992-2647	Cote d'Ivoire	O/A	100	31	6.2	0.31	3
83	Rwanda Journal of Health Sciences	2226-728X	Rwanda	Non-OA-	17	29	9.67	1.71	3
84	Nigerian Journal of Clinical Medicine	2141-1123	Nigeria	Non-OA-	47	22	4.4	0.47	3
85	Jos Journal of Medicine	2006-0734	Nigeria	O/A	96	36	7.2	0.38	2
86	Nigerian Journal of Orthopaedics and Trauma	1596-4582	Nigeria	Non-OA-	90	31	6.2	0.34	2
87	Journal of Community Medicine and Primary Health Care	0794-7410	Nigeria	O/A	49	31	6.2	0.63	2
88	Tropical Journal of Health Sciences	1117-4153	Nigeria	Non-OA-	87	26	5.2	0.30	2
89	Central African Journal of Medicine	0008-9176	Zimbabwe	Non-OA-	38	23	4.6	0.61	2
90	Nigerian Hospital Practice	1597-7889	Nigeria	Non-OA-	88	22	4.4	0.26	2
91	Nigerian Dental Journal	0189-1006	Nigeria	Non-OA-	62	18	3.6	0.2	2
92	Orient Journal of Medicine	1115-0521	Nigeria	Non-OA-	83	17	3.4	0.2	2
93	Nigerian Journal of Ophthalmology	0189-9171	Nigeria	Non-OA-	63	16	3.2	0.25	2
94	Tropical Journal of Medical Research	1119-0388	Nigeria	Non-OA-	80	15	3.0	0.19	2
95	Tanzania Dental Journal	0856-0625	Tanzania	Non-OA-	24	15	3.0	0.63	2
96	Journal of the Nigerian Optometric Association	0795-0039	Nigeria	Non-OA-	9	14	2.8	1.56	2
97	Ethiopian Pharmaceutical Journal	1029-5933	Ethiopia	Non-OA-	28	12	2.4	0.43	2
98	Archives of Medical and Biomedical Research	1694-2078	Mauritius	O/A	17	12	2.4	0.71	2
99	Nigerian Journal of	0794-	Nigeria	Non-	58	11	2.2	0.19	2

	Plastic Surgery	9316		OA-					
100	Nigerian Journal of Surgical Research	1595-1103	Nigeria	O/A	14	11	2.2	0.79	2
101	Ebonyi Medical Journal	1597-1260	Nigeria	Non-OA-	66	10	2.0	0.15	2
102	Journal of Medical Laboratory Science	1116-1043	Nigeria	Non-OA-	113	9	1.8	0.08	2
103	Nigerian Journal of Natural Products and Medicine	1118-6267	Nigeria	Non-OA-	30	9	1.8	0.30	2
104	West African Journal of Pharmacology and Drug Research	0303-691X	Nigeria	Non-OA-	18	9	1.8	0.50	2
105	Zagazig Journal of Occupational Health and Safety	1687-8671	Egypt	Non-OA-	2	6	1.2	3.00	2
106	Nigerian Journal of Pharmaceutical Research	0189-8434	Nigeria	Non-OA-	46	20	4.0	0.43	1
107	South African Gastroenterology Review	1812-1659	South Africa	Non-OA-	126	13	2.6	0.10	1
108	Tanzania Medical Journal	0856-0719	Tanzania	Non-OA-	31	10	2.0	0.32	1
109	Nigerian Journal of Gastroenterology and Hepatology	2251-0079	Nigeria	Non-OA-	44	9	1.8	0.20	1
110	African Journal of Anaesthesia and Intensive Care	0794-2184	Nigeria	Non-OA-	43	9	1.8	0.21	1
111	West African Journal of Radiology	1115-3474	Nigeria	Non-OA-	73	8	1.6	0.11	1
112	Journal of the Eritrean Medical Association	1998-6017	Eritrea	O/A	3	8	1.6	2.67	1
113	Savannah Journal of Medical Research and Practice	2276-6839	Nigeria	Non-OA-	37	7	1.4	0.19	1
114	Nigerian Journal of General Practice	1118-4647	Nigeria	Non-OA-	63	5	1.0	0.08	1
115	African Journal of Rheumatology	2307-2482	Kenya	Non-OA-	35	5	1.0	0.14	1
116	Nigerian Journal of Health and Biomedical Sciences	1595-8272	Nigeria	Non-OA-	13	4	0.8	0.31	1
117	Journal of Medical Investigation and Practice	9783-1230	Nigeria	Non-OA-	10	3	1.0	0.30	1
118	IMTU Medical Journal	1821-7613	Tanzania	Non-OA-	38	2	0.4	0.05	1

119	South African Journal of Radiology	0038-2469	South Africa	O/A	35	2	0.4	0.06	1
120	Nigerian Journal of Surgical Sciences	1116-5898	Nigeria	Non-OA-	23	2	0.4	0.09	1
121	Nigerian Endocrine Practice	2251-0362	Nigeria	Non-OA-	21	2	0.4	0.1	1
122	International Journal of Medicine and Health Development	188-2601	Nigeria	Non-OA-	9	2	0.4	0.22	1
123	Sudanese Journal of Dermatology	1815-3941	Sudan	Non-OA-	9	2	0.4	0.22	1
124	Archives of Ibadan Medicine	1467-6958	Nigeria	Non-OA-	1	2	0.4	2.0	1
125	Journal of Experimental and Clinical Anatomy	1596-2393	Nigeria	Non-OA-	45	1	0.2	0.02	1
126	Highland Medical Research Journal	1596-2407	Nigeria	Non-OA-	38	1	0.2	0.03	1
127	Journal of Health and Visual Sciences	1119-2006	Nigeria	Non-OA-	34	1	0.2	0.03	1
128	Nigerian Journal of Family Practice	2141-9884	Nigeria	Non-OA-	16	1	0.2	0.06	1
129	Global Journal of Medical Sciences	1596-2911	Nigeria	Non-OA-	14	1	0.20	0.07	1
130	Revue de Médecine et de Pharmacie	2410-8936	Cameroun	Non-OA-	58	0	0.0	0.0	0
131	Nigerian Journal of Postgraduate Medicine	2006-8530	Nigeria	Non-OA-	6	0	0.0	0.0	0
132	Egyptian Journal of Medical Laboratory Sciences	1110-5593	Egypt	O/A	4	0	0.0	0.0	0
133	International Journal of Malaria and Tropical Diseases (IJMTD)	1596-3381	Nigeria	Non-OA-	1	0	0.0	0.0	0
134	Journal of Biomedical Investigation	1597-0043	Nigeria	Non-OA-	1	0	0.0	0.0	0.0
135@	Journal of Endocrinology, Metabolism and Diabetes of South Africa	003-8-2469	South Africa	O/A					
135@	Journal of Phytomedicine and Therapeutics	1118-1028	Nigeria	Non-OA-					
135@	Journal Tunisien d'ORL et de Chirurgie Cervico-	1737-7803	Tunisia	O/A					

	Faciale								
138@	African Sanguine	1560-8646	South Africa	Non-OA-					
138@	African Journal of Oral Health	0189-5710	Nigeria	O/A					
138@	African Journal of Oral Health Sciences	1608-7232	Kenya	Non-OA-					
138@	Global Journal of Community Medicine	1597-9857	Nigeria	Non-OA-					
138@	Journal of Ethiopian Medical Practice	1560-1560	Ethiopia	Non-OA-					
138@	Journal of the Nigerian Infection Control Association	1119-1716	Nigeria	Non-OA-					
138@	Mary Slessor Journal of Medicine	1119-409X	Nigeria	Non-OA-					
138@	Nigerian Journal of Otorhinolaryngology	978-31230-9-2	Nigeria	Non-OA-					
	Total				25,495	44,658			

@ = Journals that were not recognised by the software

*non-OA = non-open access

#OA = Open Access