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A 20-year Bibliometric analysis of Hepatitis B Virus Research and African researchers' visibility

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Abstract
Purpose: According to World Health Organization, Africa occupies the second highest position in the prevalence of Hepatitis B virus (HBV) with 6.1% of its adult population infected. However, little is known about HBV research on Africa and the extent of involvement of African scholars. This study is a bibliometric analysis of HBV literature on Africa published between 1999 and 2018.
Methodology: A total of 866 articles were retrieved from PubMed. Article and journal details were extracted from each article, while citations were extracted from Harzing Publish and Perish and Google scholar.
Findings: There was an increase in HBV literature during the period and over 65% were by Africans. About 60% of the journals were located in USA and UK, and only 12.8% in Africa. Only 15.7% of articles by African authors were published in African journals. Linear regression result shows the probability of articles increasing yearly ($\beta = 4.672$, $p = 0.000$) as positive. Chi square results also show a moderate association between number of authors and author's affiliation (X^2 (5, N = 866) = 46.558, p = .000) and a weak association between citations received and author's affiliation (X^2 (6, N = 866) = 13.154, p = .041).
Originality/Value: The study showed that African researchers are visible in HBV research on Africa, however, most African authors preferred to publish in foreign journals which are mostly not accessible to Africans.

Keywords: Hepatitis B virus, Bibliometric analysis, African authors, co-authorship, PubMed

Introduction

As research in different fields continue to advance, bibliometric analysis has played an active role in identifying key papers and authors that have contributed to an understanding of knowledge in many scientific and medical fields (Connelly, Devane, Kelly, Wrafter, & Messaris, 2016; Jani, Prabhu, Zhou, Alan, & Agarwal, 2020; Parmar, Ganesh, & Mishra, 2019). In the field of medicine, one of the diseases on which bibliometric analysis has been carried out is Hepatitis. According to World Health Organization (2019), the five types of hepatitis viruses are A, B, C, D and E. However, of these five types, B and C are the most fatal and leading cause of cancer of the liver and cirrhosis (WHO, 2019). Most studies on bibliometric analysis on hepatitis literature have focused on Hepatitis C (Alvi, Vinitha, & Ravanan, 2014; Siva, Vivekanandhan, & Rajendran, 2019; Thavamani, 2013). On the other hand, Schmidt, Bundschuh, Scutaru, Klingelhoefer, Groneberg and Gerber (2014) carried out a scientometric review of the quantity and quality of literature on Hepatitis B virus (HBV). The study which covered 1971 to 2011 was a global review of literature on HBV published by 250 countries. It should however be noted that little is known about bibliometric analysis of literature on HBV carried out on Africa. This is especially of concern considering the fact that according to World Health Organization (2020), the prevalence of HBV is second highest in WHO African Region where 6.1% of adult population is infected (WHO Western Pacific Region is the highest with 6.2%). This situation thus raises some fundamental questions such as: To what extent are researches being carried out on HBV with focus on Africa? Where are output of these

studies published? How actively are African researchers involved in these studies?

Literature review

About two decades ago, Sumathipala, Siribaddana, and Patel (2004) examined the contribution of the developing world, especially Africa to medical literature. The study reported that researchers in the developing world were under-represented especially in high impact journals. A plausible explanation for this finding is the inequality in allocation of research resources wherein less than ten percent of such resources are allocated to regions, specifically developing countries where 90% of the world's mortality are reported (Davey, 2004). Many years thereafter, the underrepresentation of Africans in science continues to be a cause for concern (North, Hastie, & Hoyer, 2020; Okeke, Babalola, Byarugaba, Djimde, & Osoniyi, 2017), despite the fact that the continent has the second largest population of over 1.2 billion (UNDESA, 2019). The persistence of such lack of international impact by African scientists can ultimately have a global impact on knowledge generally (Okeke et al., 2017). The significance of scientific literature to the academic sphere cannot be overemphasized as they continue to serve as a means through which ideas are exchanged and new knowledge disseminated among scholars. Knowledge shared through scientific literature constitutes evidence of a scientist's contribution to knowledge in a particular field (Nwagwu & Egbon, 2011) and bibliometric analysis has proved to be an effective means of understanding the pattern and influence of such contributions in the scientific community. Moreover, bibliometric analysis is a useful guide for researchers and funding bodies in determining areas requiring increased research actitivity (Khan et al., 2017). Bibliometric analysis systematically uses a combination of different methods, usually quantitative and statistical analysis, to evaluate the quality and quantity of research output and study research trends, authorship, citation analysis, publications and journal impact as well as scientific contribution at both national and international levels in a particular field (Chiu & Ho, 2005; Nafade et al., 2018; Sweileh et al., 2017; Železnik, Blažun Vošner, & Kokol, 2017).

The number of publications in a particular discipline can be an indicator of productivity and the productivity pattern in scientific literature has been studied using attributes such as number of publications, journal of publications and location, journal publishers among others (Nwagwu & Egbon, 2011). Most bibliometric studies on medical literature have reported increases in annual growth rate of publications in the different fields of study. For example, in using bibliometric analysis to examine article productivity pattern, Kolle, Vijayashree, and Shankarappa (2017) carried out an analysis of highly cited articles on malaria research between 1991 and 2015. Findings showed an increase in the number of articles published between 1991 and 2005, and the highly cited articles published within this period represented 77.44% of the total highly cited articles published between 1991 and 2015. Similarly, Okoroiwu, López-Muñoz, and Povedano-Montero (2018) reported a linear growth in the number of Lassa fever research articles between 1970 and 2017. The study further reported that it took 9.19 years for publication of Lassa fever articles to double during this study period. The annual growth rate in the publication of articles on lifestyle-based preventive cardiology also increased globally between 1996 and 2017 (Manyangu, Dineen, Geoghegan, & Flaherty, 2019).

The number of authors contributing to scholarly publications in terms of authorship pattern is also an instructing part of any bibliometric study (Khaparde & Pawar, 2013). A count of the number of authors contributing to articles offers some indication to the degree of collaboration between authors. Collaborative research improves productivity and scientific efficiency (Parish, Boyack, & Ioannidis, 2018) and both early

and latter biliometric studies continue to suggest steady increase in multiple authorship in scientific research (Fanelli & Larivière, 2016; Ramakrishnan & Babu, 2007). For example, in the field of medicine which is the focus of this study, Ramakrishnan and Babu (2007) conducted a study on bibliometric analysis of the literature on hepatitis between 1984-2003, using data from three databases. Findings from the study revealed articles with more than five authors (32.91%) were the highest followed by those with single authors (14.5%). The study vividly revealed that there exists a higher level of degree of collaborative research on Hepatitis. A decade after this study by Ramakrishnan and Babu (2007), higher percentage of multi-authored articles have been reported.

One of such studies was conducted by Kolle et al. (2017) which investigated the co-authorship pattern of highly cited malaria articles and reported that 76.33% of the articles were written by more than four authors. Sweileh et al. (2017) also reviewed the authorship pattern of worldwide scientific literature on mobile-health. The study reported that out of 5465 articles between 2006 and 2016, 84.9% were multi-authored publications. A high level of degree of collaboration was also reported by Nafade et al. (2018) in a bibliometric analysis of tuberculosis research between 2007 and 2016. More recently, Pathak and Kumari (2020) reported very few single authored articles (24 articles) in a bibliometric analysis of quassinoids research publications. The study reported that four-authored articles (18.15%) were the highest followed by two authors (17.02%). Using Web of Science and Scopus databases, Sobral and Pestana (2020) also carried out a bibliometric review of virtual reality and dementia research between 1998 and 2018. Findings showed that most documents in Web of Science had four authors (14.56%) while most documents in Scopus had three authors (18.18%).

In addition to the co-authorship pattern in medical literature, the number of citations received by an article is also widely accepted as an assessment of the academic impact of the article and the research competence of the individual author or research team (Garfield, 1972; Oh et al., 2017) and this has been widely used in various disciplines (Nadri, Rahimi, Timpka, & Sedghi, 2017; Zeleznik et al., 2017). Citation analysis can also be applied in setting research funding priorities. This can especially be a useful guide to researchers and funding bodies in channeling the limited health care resources towards funding areas where increased research activities are necessary (Khan et al., 2017). Not surprising that most journal editors try to increase their journal citations in order to attract researchers who also desire to publish their findings in highly cited journals (Oh et al., 2017), as citations reveal the most cited authors in a discipline, journal and institution.

Statement of Problem

The field of medicine has been in the forefront of knowledge development in bibliometrics (Kokol, Blažun Vošner, & Završnik, 2021) and the contributions of hepatitis research have also been reported (Alvi et al., 2014; Ramakrishnan, & Babu, 2007; Schmidt et al., 2014; Siva et al., 2019; Thavamani, 2013). The current study builds on previous bibliometric studies on hepatitis by Ramakrishnan and Babu (2007) and Schmidt et al. (2014). The major limitation of both studies is their global focus. Ramakrishnan and Babu (2007) carried out a global bibliometric analysis of literature on general hepatitis. Schmidt et al. (2014)'s study on the other hand though focused on HBV was also a global study. Considering Africa's status as the second highest in HBV prevalence, the visibility of African researchers in HBV research is important, but this is largely unknown from these studies. Moreover, bibliometric analysis of HBV literature focused on Africa can lead to the discovery of information about academic trends and such findings can be helpful in

strategic planning efforts at the continental level. Hence, this study carried out a bibliometric analysis of Hepatitis literature focused on Africa, to understand their publication pattern, as well as the visibility of African researchers in this field.

Research objectives

1. To understand the publication productivity pattern of HBV literature on Africa published between 1999 and 2018.
2. To investigate the geographical locations of journals where the articles were published.
3. To examine the citation pattern of HBV articles published during the period.
4. To investigate the relationships among year of article publication, number of articles published, number of authors, author's affiliation and citations received.

Research questions

1. What is the publication productivity pattern of HBV literature on Africa published between 1999 and 2018?
2. Where are the geographical locations of the journals in which authors published their articles?
3. What is the citation pattern of HBV articles published during this period?

The following hypotheses were also tested:

$H0_1$ – There is no significant relationship between year of article publication and the number of articles published

$H0_2$ – There is no significant association between number of authors and author's affiliation

$H0_3$ – There is no significant association between citations received and author's affiliation

Research methodology

Data on HBV literature on Africa was collected from PubMed for the period covering 1999 to 2018 in order to obtain a more realistic overview of patterns in publications, and data collection began in November 2019. Pubmed database was used for this study due to its large coverage of biomedical literature (Lu, 2011). From the homepage of PubMed, an advanced search was carried out using custom settings tools of the database with the search query: (Hepatitis B virus) AND Africa AND (("1999/01/01"[PDat]: "2018/12/31"[PDat])). A total of 1452 articles were retrieved. Since the query is not specific enough, all articles containing at least an occurrence of the words 'Hepatitis B virus' and 'Africa' were retrieved. Hence, data cleaning was manually done to ensure that only Hepatitis B literature on empirical studies on Africa were used for the study. In addition, non-English literature, erratum and reports were excluded. A total of 512 articles were removed because they were not empirical studies on Africa, as many only had the words "Hepatitis B" mentioned; 50 articles were removed because they were written in French; 29 erratum were removed and; 3 reports were also excluded. Only 866 articles were left for analysis after the data cleaning.

From each document, article (title, author(s) and affiliation, number of authors, year of publication, number of citations) and journal (name, country) details were collected. The country/region of most journals were retrieved from Journal Citation Reports by Clarivate Analytics, while others were retrieved from the journal website. The analysis of the degree of collaboration by authors was calculated using Subramanyam (1983) formula which is mathematically expressed as:

$$C=Nm/(Nm+Ns)$$

Where,

C= the degree of collaboration in a discipline

Nm = is the number of multi-authored papers

Ns = is the number of single-authored papers

Author's affiliation was based on the first author and the author's affiliation as at the time the article was written. Only one institutional affiliation, usually the first affiliation, was recorded for each author. Data on the total number of citations received by the articles were retrieved from Harzing Publish and Perish and Google Scholar. Data extracted were collated in Microsoft Excel worksheet and arranged according to various fields to allow for proper sorting and analyses. The characteristics of the data were explored in SPSS using descriptive statistics (charts, frequency distributions, percentages and measures of central tendency). Inferential statistics including Chi square and Linear regression analyses were also carried out to test the hypotheses. This study did not require ethical approval since no human subjects were involved.

Results

Article publication pattern

A total of 866 articles on HBV with focus on Africa were analysed. Table 1 presents a breakdown of authors' affiliations.

Authors affiliated to African institutions contributed more articles than authors affiliated to non-African institutions (Table 1). Among African authors, Nigeria contributed the highest number of articles followed by South Africa, Egypt and Ethiopia. The remaining 243 articles which represent 43.01% of the total articles by authors affiliated to African institutions were contributed by authors from 32 other African countries. Also, on the list of authors affiliated to non-African institutions, USA ranked 1st followed by France, United Kingdom and Italy. The 119 articles in the "other" category were contributed by authors affiliated to 27 other non-African institutions.

Table 1: Authors' Affiliations (Country)

	Africa			**Non-Africa**		
S/N	Country	Frequency	%	Country	Frequency	%
1	Nigeria	118	20.88	USA	68	22.59
2	South Africa	91	16.11	France	51	16.94
3	Egypt	69	12.21	United Kingdom	45	14.95
4	Ethiopia	44	7.79	Italy	18	5.98
	Others	243	43.01	Others	119	39.54
	Total	**565**	100.00	**Total**	**301**	100.00
	Overall	**65.24%**			**34.76%**	

Figure 1 also shows the number of articles published annually during the period.

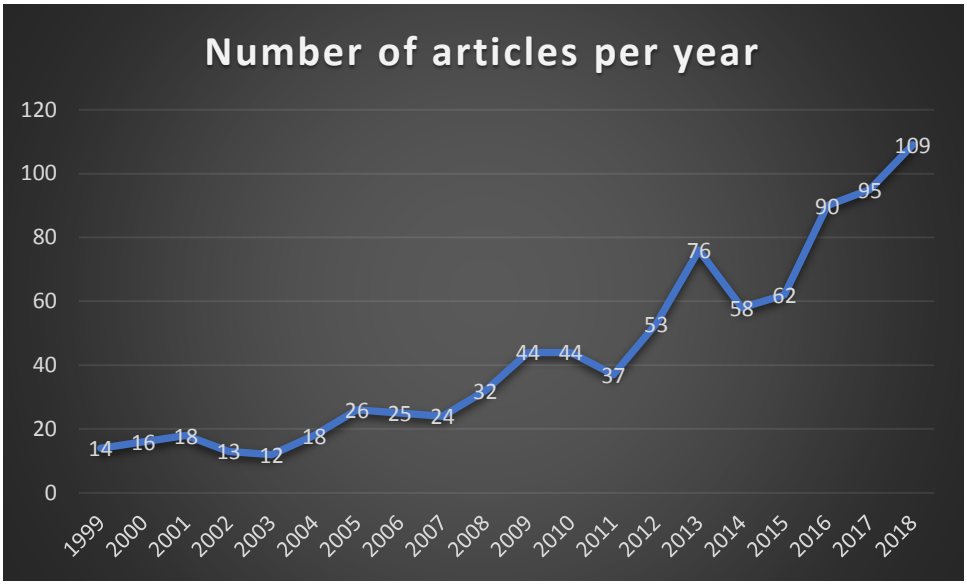

Figure 1. Annual articles published

The highest number in article publication was recorded in 2018 (109) followed by 2017 (95) and 2016 (90), while the lowest number in article publication was recorded in 2003 with 12 articles. It could be observed that generally, article productivity has consistently been on the increase till 2018 despite some drops experienced in 2011, 2014 and 2015. Average article publication was 43.3 per year.

Co-authorship analysis is widely used to understand and assess scientific collaboration patterns. Table 2 presents the co-authorship pattern for the 866 artilcles.

Table 2: Co-authorship pattern

Co-Authorship Pattern	Total	%
1 author	14	1.6
2 authors	42	4.8
3 authors	89	10.3
4 authors	99	11.4
5 authors	104	12.0
6 authors	93	10.7
7 authors	83	9.6
8 authors	67	7.7
9 authors	55	6.4
10 authors	69	8.0
11 authors	45	5.2
12 authors	34	3.9
13 authors	23	2.7
14 authors	14	1.6
15 authors	7	0.8
16 authors	5	0.6
17 authors	9	1.0
18 authors	6	0.7
19 authors	1	0.1
20 authors	1	0.1
22 authors	2	0.2
24 authors	1	0.1
28 authors	2	0.2
53 authors	1	0.1
Total	866	100%

Only 1.6% of the articles were single authored. Five-authored articles (12.0%) were the highest followed by four-authored (11.4%) and six-authored (10.7%) articles. Over 80% of the articles were written by between 2 to 10 authors. Using the Subramanyan (1983) formula for calculating degree of collaboration among authors, the overall average degree of collaboration for the 20-year period was 0.98.

Journal of publications and geographical location

The 866 articles were published in a total of 226 journals which gives an average of 3.8 articles per journal. Fifty-four journals (23.9%) published at least 4 articles each, with 70.8% of the articles in this category. The remaining 29.2% were published in journals with only 3 articles and below. *Journal of Medical Virology*, a USA based journal published 8.5% of the articles, and 52.7% of the contributors were based in African institutions. It was also observed that the journal had more collaborations based on articles written by 7 or more authors as about 60% of the journal articles are in this category. *PLOS ONE* (USA) also published 5.2% of the articles and 48.9% of the authors were affiliated to African institutions. *BMC Infectious Diseases* published 4.4% of the articles and 77.8% of the contributors were affiliated to African institutions. Overall, the top 4 journals had a total of 184 articles and 62.5% of these were written by authors based in African institutions.

The journals where the articles were published are located in 40 countries. Journals from United States of America ranked 1st with 31.4%, followed by United Kingdom with 23.9%. Switzerland ranked 3rd with 4.0% and Nigeria with 3.5%. Only 12.8% of the journals were located in Africa. Of the 565 articles by authors affiliated to African institutions, only 15.7% were published in journals located within Africa, while 3.2% of the 301 articles written by authors affiliated with non-African instituitions were published by journals located within Africa.

Citations received by articles

The total of 36,881 citations were received by the 866 articles as at June 30, 2021. This translates to an average of 43 citations received per article. As shown in Table 3, 68.7% of articles received between 0 to 43 citations, followed by 21.5% of articles that received between 44 to 100 citations. Also, 61.0% (22,506) of the total citations were to articles written by authors affiliated to African institutions.

Table 3. Breakdown of total citations received

No of citations	Freq	%
0 – 43	595	68.7
44 – 100	186	21.5
101 – 200	71	8.2
201 – 300	9	1.0
301 – 400	3	0.3
401 – 500	1	0.1
Above 500	1	0.1

Figure 2. Citations received by country of African authors

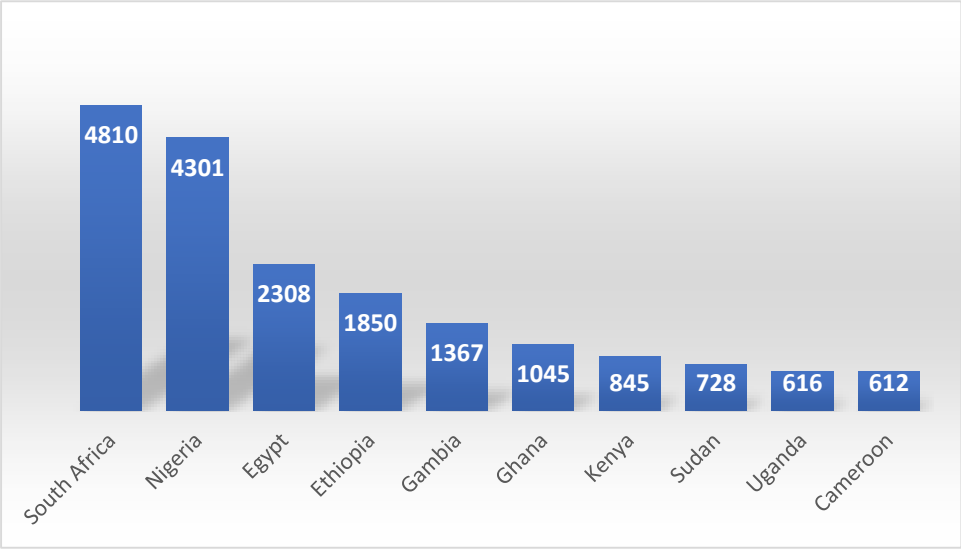

Table 4a: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.928[a]	.861	.853	11.401	.861	111.678	1	18	.000

a. Predictors: (Constant), Year

The average citations received in each year was observed to be higher in the early years despite fewer articles published. Overall, citations received by African authors showed that South African authors received 4,810 (21.4%) of the total of 22,506 citations (Figure 2), followed by Nigeria with 4,301 (19.1%) and Egypt with 2,308 (10.3%). This is surprising considering the fact that authors affiliated to Nigeria had more articles (118) compared with South Africa with 91. It was however observed that 51% of articles by Nigerian authors were published in journals located in Africa compared with South African authors with only 18.7% published articles in journals located in Africa.

Test of Hypotheses

$H0_1$ – There is no significant relationship between year of article publication and the number of articles published

Table 4b: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-9340.774	887.994		-10.519	.000
	Year	4.672	.442	.928	10.568	.000

a. Dependent Variable: No_articles

85% of the top 20 most cited articles were published before year 2010. A breakdown of

Tables 4a and b present result of linear regression analysis for year of article publication and number of articles published.

Table 4a shows that at 0.05 level of significance, the model is significant for establishing the relationship between year of publication and number of articles published ($F = 111.678$; $p = 0.000$). At $R= 0.928$, there is a strong correlation between the observed and the expected values of the variable, number of articles, whereas, 85.3% (Adjusted $R^2 = 0.853$) of the variance for number of articles was accounted for by year of publication. Linear regression result (Table 4b) shows a significant relationship between the year of publication and number of articles. At ($\beta = 4.672$, $p = 0.000$), the probability of article publication increasing in successive years increases by 4.672.

Table 5a: Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	46.558[a]	5	.000
Likelihood Ratio	46.253	5	.000
Linear-by-Linear Association	41.943	1	.000
N of Valid Cases	866		

Tabel 5b: Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.232	.000
	Cramer's V	.232	.000
N of Valid Cases		866	

Table 5c: Number of authors category * Author affiliation Crosstabulation

			Author affiliation		
			Africa	Non-Africa	Total
Number of authors category	1-3	Count	111	34	145
		Expected Count	94.6	50.4	145.0
	4-6	Count	220	76	296
		Expected Count	193.1	102.9	296.0
	7-10	Count	164	110	274
		Expected Count	178.8	95.2	274.0
	11-15	Count	58	65	123
		Expected Count	80.2	42.8	123.0
	16-20	Count	9	13	22
		Expected Count	14.4	7.6	22.0
	21-53	Count	3	3	6
		Expected Count	3.9	2.1	6.0
Total		Count	565	301	866
		Expected Count	565.0	301.0	866.0

$H0_2$ – There is no significant association between number of authors and author's affiliation

Tables 5a-c show the Chi square result for number of authors and author's affiliation.

Number of authors was recoded as categorical variable, while authors' affiliations were categorised into Africa and non-Africa. Hence, Chi square analysis was carried out to show the association between the two variables. As shown in Table 5a, X^2 (5, N = 866) = 46.558, p = .000, shows a significant association between the two variables. The Cramer's V value of 0.232 in Table 5b shows that the association is moderate. As seen in Table 5c, there is a tendency for African authors to publish articles with between 1 to 6 authors while authors affiliated to non-African institutions

have the tendency to publish articles with more than 7 authors.

$H0_3$ – There is no significant association between citations received and author's affiliation

Tables 6a and b present result of Chi square analysis for citations received and author's affiliation.

Table 6a: Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.154[a]	6	.041
Likelihood Ratio	14.401	6	.025
Linear-by-Linear Association	4.552	1	.033
N of Valid Cases	866		

Table 6b: Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.123	.041
	Cramer's V	.123	.041
N of Valid Cases		866	

Citations received were recoded as categorical variable, while authors' affiliations were categorised into Africa and non-Africa. Hence, Chi square analysis was carried out to show the association between the two variables. As shown in Table 6a, X^2 (6, N = 866) = 13.154, p = .041, shows a significant association between the two variables. However, the Cramer's V value of 0.123 in Table 6b shows that although the association is significant, it is weak.

Discussion of Findings

A 20-year Bibliometric analysis of a total of 866 articles on Hepatitis B with focus on Africa was carried out. With the exception of some slight decline in publication counts for the years 2011, 2014 and 2015, article publication generally increased steadily and result from test of hypothesis indicates that this increase is very likely to continue in subsequent years. This is an indication that research in HBV is a continuous activity and it is consistent with findings by Ramakrishnan and Babu (2007) which reported global increase in Hepatitis publications in 3 databases between 1984 and 2003. Over 60% of the authors were affiliated to institutions based in Africa and majority of these authors were in Nigeria, South Africa, Egypt and Ethiopia and majority of these African authors had the tendency to feature more in articles with between 1 to 6 authors. However, for authors affiliated to non-African institutions, most were from United States of America, France, United Kingdom and Italy, mostly featured in articles with 7 authors and above. Overall, articles written by Nigerian authors were more than any other country and this contradicts previous studies that have reported the dominance of South Africa as the research hub in Africa (Adams, Gurney, Hook, & Leydesdorff, 2014; Onyancha, 2018; Utieyineshola, 2018). Moreover, according to Connelly et al. (2016), geographic location of authors is a factor of disease distribution. The fact that Africa has the second largest number of HBV infected persons justifies the high percentage of African authors represented in HBV literature on Africa.

Findings revealed a high concentration of articles by few journals as less than a quarter of the total journals published over 70% of the articles and of these, *Journal of Medical Virology* had the highest number of articles at 8.5%. A similarity to this finding was reported by Okoroiwu et al. (2018) which showed high publication concentration by few journals in a 47-year bibliometric study of global Lassa fever. Notwithstanding, this current study notes that the involvement of African authors on issues related to HBV in Africa is quite commendable as findings from the top 4 journals (*Journal of Medical Virology, PLOS ONE, BMC Infectious Diseases and The Pan African Medical Journal)* which published over 20% of the

total articles showed that majority of these articles were written by authors affiliated to African institutions. However, a key finding by this study raises an issue on the location of journals where most African authors published.

The issue is the fact that most authors affiliated to African institutions published in articles located in USA, UK and others, while only 12.8% of the 226 journals were located in Africa. Moreover, only 15.7% of the articles by authors affiliated to African institutions were published in these African journals. The trend of African authors having preference for journals outside the region is not new. A probable reason for this is the perception that journals located in the developed countries especially USA and UK are perceived to be more prestigious and with better impact factor than those in Africa. Most authors believe that publishing in those foreign journals would benefit them in terms of academic promotion and improve their visibility as scholars (Sooryamoorthy, 2017). Factors that could have likely fuelled this perception include the high mortality rate of journals in Africa as well as lack of international abstracting and indexing services which limits visibility of authors (Tarkang & Bain, 2019). It should be acknowledged though that the early technological advancement in those developed regions certainly positively influenced their scholarly visibility and recognition compared to the African region where development in internet is less than 3 decades. Another plausible reason for preference in foreign journals is related to the promotion policy in some African academic institutions (Ajao & Ugwu, 2011). Some institutions in Africa, for example, Nigeria, have the policy that certain number of publications for promotion of academic staff must be published in international journals. This is however not an issue of concern in institutions in the developed countries which likely explains the fact that only 3% of the articles written by authors with non-African affiliations were published in journals located in Africa. This can be regarded as a case of subtle foreign dominance on Africa's academic publishing pattern which could continue to undermine the development of Africa's research on HBV especially in relation to knowledge dissemination. For example, a situation where most of the empirical studies on HBV in Africa are published in foreign journals means that output of such research would be lost to the African audience, since many of these international journals are not accessible to Africans due to their high subscription rates.

Also, less than 2% of the articles were single-authored, while five-authored articles were dominant. The average degree of collaboration is 0.98 which shows increasing strong collaborative research in HBV on Africa especially when compared to the average of 0.85 reported by Ramakrishnan and Babu (2007) in the global bibliometric analysis of Hepatitis literature. However, it is important to note that such increasing pattern of the dominance of multiple authorship and strong collaboration has also been reported in literature on m-health (Sweileh et al., 2017), virtual reality and dementia (Sobral & Pestana, 2020), lifestyle-based preventive cardiology (Manyangu et al., 2019) among others. However, beyond medical research, there is increasing global acceptance of research collaboration as a norm rather than an exception (Chen et al., 2016; Witze, 2016). For example, Nguyen, Ho-Le, and Le (2017) reported that 77% of Vietnam's scientific output were international collaborations. Asubiaro (2019) study also showed a decline in single author papers and increase in collaboration in Library and Information Science research between 2006 and 2015. A most probable reason for the increase in multiple authorship over the years is the advancement in global communication technologies which makes collaborative research relatively less cumbersome and more interactive.

Citations received by a publication can be a useful indicator of scientific progress and

recognition of advancement (Sobral & Pestana, 2020). An average of 43 citations were received by the articles and about 70% of articles are in this category. This study in agreement with previous studies on the time effect on publication performance (Manyangu et al., 2019; Van Raan, 2017), noted that 85% of the 20 most cited publications were published earlier which most likely explains the higher number of citations compared to more recent publications which would require more time to garner citation metrics. A breakdown of citations received by African authors showed that articles written by South African authors were most cited. This was surprising considering the fact that Nigerian authors contributed more articles than South Africa. A plausible reason for this is that while more articles by Nigerian authors (51%) were published in journals located in Africa, most South African authors largely published in journals outside Africa and less than 20% were published within Africa. Previous studies have reported the influence of journal location on citations received by a publication (Onodera & Yoshikane 2015; Smith, Weinberger, Bruna, & Allesina, 2014), and a high probability that more visibility is gained by articles published with reputable international journals than those published in institutional or national journals (Khor & Yu 2016; Sooryamoorthy, 2017).

Conclusion and recommendation

This study concludes that African researchers are visible in HBV research on Africa. However, dissemination of research output within the region can be hampered considering the fact that most HBV research on Africa were published in international journals, thus limiting access to research findings by the local audience due to high cost of accessing articles in these journals. The current policy of publishing in international journals as enforced by some universities in Africa needs to be amended to specifically emphasize patronage of journals based in Africa. This however must be matched by an improvement in journal quality by African journals. Publishers of these journals would have to enforce good quality control that can, to a reasonable extent promote publication of journals with high quality. Patronage of African journals will ultimately lead to improvement in their impact factor, reduction of mortality rates and visibility of research output to the local audience can be enhanced.

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