



# The 100 Top-cited Studies on Ebola: A Bibliometric Analysis

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## ABSTRACT

The achievements in Ebola virus disease (EVD) prevention and control can be reflected by scientific studies, particularly in the top-cited studies. The study thus aimed to identify and characterise the 100 top-cited studies of EVD. The study used a retrospective bibliometric-analysis, which was performed in January 2020. Studies were searched from the Web of Science using keywords: “Ebola” or “Ebola virus” or “Ebola virus disease” to identify the 100 top-cited EVD studies. Studies were analysed for the number of citations, authorship, and journal, year of publication, country and institution. The analyses were carried out using SPSS, HistCite and VOSviewer. The 100 top-cited studies were published between 1977 and 2017, cited from 169 to 808 times and had an average citation of 290.5, and 8 studies were cited more than 500 times. They were published in 31 journals, and the *Journal of Virology* published most of the studies (n=14). They were produced by 33 countries, and the USA published most of the studies (63), followed by Germany (8) and Gabon (6). CDC-USA (26) was the leading institution, while Geisbert TW and Sanchez A were the most productive authors. This study provides insights into the historical advancements reflected by the top-cited studies and has highlighted the leading roles played by various stakeholders in addressing EVD. However, the contribution of African countries is not sufficiently reflected among these studies, and so more focus, funding and involvement in clinical research is needed for effective prevention and control of EVD in Africa.

**Keywords:** Ebola, bibliometric analysis, 100 top-cited, citation classics, Web of Science

## INTRODUCTION

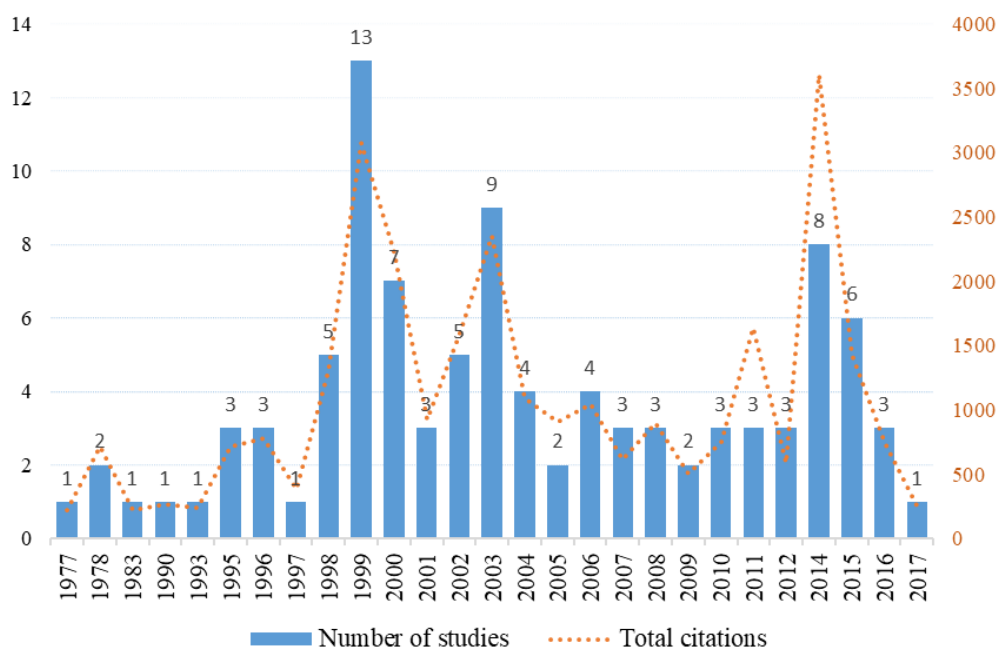
Ebola virus disease (EVD) is a severe, often fatal zoonosis that is highly infectious in humans [1]. It is caused by negative-stranded RNA viruses, belonging to the Filoviridae family, which are endemic to regions of the west and equatorial Africa [2]. The first EVD human case was identified in 1976 in Zaire, the now called the Democratic Republic of Congo (DRC) [3]. Since then, there have been over 30 documented outbreaks with the worst, and most publicised being the 2014 West African outbreak and the recent 2018-2020 Kivu outbreak in DRC [3,4].

The origin of the Ebola Virus is not known, but in most outbreaks, it is suspected to be introduced into the human population via forest bats and other wild animals [5]. EVD is known to present with flu-like symptoms, persistent fever, and severe complications such as respiratory disorders, symptoms of hemorrhagic diathesis, among others [6]. In the previous EVD outbreaks, the case fatality of around 25-90% has been reported [1,2]. The severity of the epidemic has been attributed with the species involved, and the Zaire ebolavirus species is the most lethal strain of the six known Ebola virus sub-strains [3].

Despite the recurrent outbreaks and other challenges, several studies on Ebola have been conducted over time, with remarkable progress in vaccine development [7], as well as prevention and control of EVD [8,9]. The achievements in EVD prevention and control can be reflected by scientific studies, particularly in the top-cited studies [10,11]. Citation analysis, a type of bibliometric analysis involves the evaluation and ranking of an article based on citation count [12]. Identification of milestones in a particular field can be done by analysing the most cited studies, especially the 100 top-cited studies [13-15]. Evaluation of the 100 top-cited studies had been conducted for various medical fields and diseases, including Gastritis [15], Depression [14], Vaccines [16], Arthritis [17], among others. However, there is no such study conducted on Ebola. Thus, we performed this study to identify and characterise the 100 top-cited studies of Ebola virus disease.

## METHODS

The study was a retrospective bibliometric analysis, and no ethical approval was required since the data used was from a



**Figure 1.** Annual trend and citation of EVD publications (1977 to 2017)

public database, and no human or animal subject was directly involved.

### Search Method and Strategy

We performed a search on 13<sup>th</sup> January 2020 using the Web of Science Core Collection database hosted by Clarivate Analytics as the previous studies [14,17]. The Web of Knowledge Core Collection is a multidisciplinary database with searchable author abstracts and fully indexes the major journals, more than 170 subject categories, and thus provides access to current information and retrospective data from 1900 forward. The following keywords were used for searching the relevant studies: “Ebola” or “Ebola virus” or “Ebola virus disease” in the titles or abstracts of the papers. However, based on a pilot search, the authors found that some top-cited articles mentioning the word Ebola in the abstract are not related to the Ebola, and these studies were excluded. The search was also refined to only research articles for a precise evaluation of the top-cited EVD studies; other document types were excluded from the analysis. The identified publications were sorted in descending order of citation times and then downloaded as full records in plain text format for further analysis.

### Data Extraction

The following data were extracted, including the author, affiliation, country, journal, language, document type, research field, publication year, and the number of citations. The journal impact factor was obtained from Journal Citation Reports (JCR) ©Ranking: 2019 [18].

### Bibliometric and Statistical Analysis

The bibliometric indicators of Ebola studies such as trends of publication, distribution of countries, journals, authors, and institutions, total citations, average citations per item, and h-index, were evaluated using HistCite Software [19], and “Bibliometrix app.”— (using R-studio cloud) [20]. Microsoft Excel and VOSviewer (Van Eck & Waltman, Leiden University,

The Netherlands) were used for data mining, mapping and visualisation of the bibliometric networks [21].

Statistical analyses were executed using Statistical Package for the Social Sciences for windows software (version 20.0, IBM SPSS-Chicago, IL: SPSS Inc.). Frequency statistics of the 100 top-cited articles were reported. A nonparametric Spearman correlation ( $r$ ) was used to identify the association between the number of citations and various study variables. A P-value of  $<.05$  was considered statistically significant.

## RESULTS

### Citation Classics of the 100 Top-cited Studies

The 100 top-cited articles are listed in **Appendix 1**. The number of citations ranged from 169 to 808, with a total number of citations equal to 29,026 and average citations of 290.5 per document. Eight studies were cited more than 500 times, and no single-authored paper was noted. The most cited study was published by Aylward B *et al.*, 2014 in the New England Journal of Medicine, with 808 citations.

### Production Trend of the Top-cited Studies

All the 100 top-cited studies were published in the English language. They were published during a span of 40 years from 1977 to 2017; most of the studies were done and published in the late 1990s and 2000s. We found that the highest number of studies was published in 1999 ( $n=13$ ), 2003 (9) and 2014 (8). The annual total citation followed an almost similar trend, with 2014 receiving the highest citations of over 3600 (**Figure 1**).

### Most Productive Journals

The 100 top-cited articles were published in 31 journals, of which 10 journals published more than 1 study. The most productive journals were United States (US) and United Kingdom (UK) journals, which included the Journal of Virology ( $n=14$ , total citation (TC)=3620), followed by Journal of Infectious Diseases (9) and Lancet (9), among others. Overall,

**Table 1.** Journals that published three or more of the 100 top-cited studies

Rank	Journal	Country location	Number of studies	IF (2019)	<i>h</i> -index	Total citations
1	Journal of Virology	United States	14	4.16	14	3620
2	Journal of Infectious Diseases	United States	9	4.73	9	2001
3	Lancet	United Kingdom	9	43.38	9	2857
4	New England Journal of Medicine	United States	9	37.91	9	3094
5	Proceedings of the National Academy of Sciences of USA	United States	9	9.35	9	2605
6	Science	United States	8	41.84	8	2602
7	Nature	United Kingdom	7	24.36	7	3117
8	Nature Medicine	United States	5	22.66	5	1756
9	PLoS Pathogens	United States	4	6.18	4	965
10	Bulletin of the World Health Organization	Switzerland	3	5.94	3	935

**Table 2.** Countries that lead one or more of the 100 top-cited studies of EVD

Rank	Country	Number of studies	Single-country Studies	Multiple Country Studies	Total citations
1	USA	63	32	31	17405
2	Germany	8	4	4	2522
3	Gabon	6	0	6	1663
4	Canada	4	1	3	1006
5	France	3	0	3	621
6	United Kingdom	3	1	2	1409
7	Netherlands	2	2	0	826
8	Switzerland	2	0	2	671
9	Belgium	1	0	1	242
10	Congo	1	1	0	443
11	Japan	1	0	1	227
12	Russia	1	1	0	268
13	Sierra Leone	1	0	1	610
14	South Africa	1	1	0	211
15	Spain	1	1	0	417

**Table 3.** Authors that contributed to at least seven of the 100 top-cited EVD studies

Rank	Author	Author's Affiliation	Number of studies	1st author	2nd author	3rd or Last author	Total citations
1	Geisbert Thomas W	US Army of Medical Research Institute of Infectious Diseases	13	5	4	4	3923
2	Sanchez Anthony	Centers for Disease Control and Prevention USA	13	3	2	8	3561
3	Rollin Pierre E	Centers for Disease Control and Prevention USA	12	0	3	9	3310
4	Jahrling Peter B	US Army of Medical Research Institute of Infectious Diseases	11	2	0	9	2796
5	Peters Clarence J	US Army of Medical Research Institute of Infectious Diseases	11	0	0	11	2622
6	Nichol Stuart T	Centers for Disease Control and Prevention USA	10	0	0	10	2558
7	Gunther Stephan	Bernhard Nocht Institute of Tropical Medicine Germany	8	0	0	8	2731
8	Hensley Lisa E	US Army of Medical Research Institute of Infectious Diseases	8	0	3	5	2130
9	Ksiazek Thomas G	Centers for Disease Control and Prevention USA	8	1	0	7	2026
10	Geisbert Joan B	US Army of Medical Research Institute of Infectious Diseases	7	0	0	7	2028
11	Klenk Hans-Dieter	Philipps University of Marburg Germany	7	0	0	7	2138
12	Volchkov Viktor E	Philipps University of Marburg Germany	7	3	0	4	2022

the 10 top journals published over three thirds (77%) of the top-cited EVD studies. The impact factors (IF) of the top journals ranged from 4.16 to 43.38, while their *h*-index ranged from 2 to 14 (**Table 1**).

### Country Contribution and Most Cited Countries

The top cited studies were produced by 33 countries, of which 15 countries were corresponding author countries that chaired one or more of the 100 top-cited EVD studies. The USA chaired 63 studies, followed by Germany (8) and Gabon (6). Regarding single-country studies (SCS), still, the USA and Germany topped the list with 32 and 4 studies respectively. Only two SCS came from Africa being produced from DRC and South Africa, as shown in **Table 2**. The most cited countries included USA (TC=17405), Germany (2522), Gabon (1663), United Kingdom (1409), among others.

### Most Contributing Authors

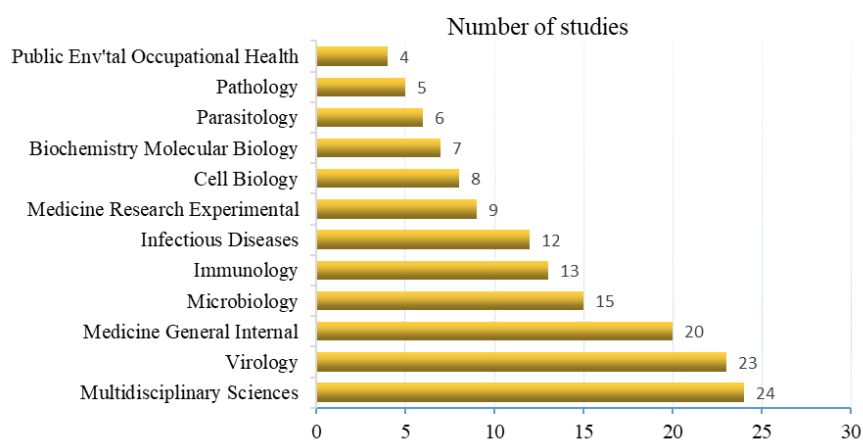
The 100 studies were written by 1028 authors, and 12 authors wrote at least 7 articles. All the 100 studies were done in collaboration amongst different authors, no single-authored study was recorded, and authors per document was 10.3 with a Collaboration index of 10.3. The most productive authors of these studies included Geisbert TW and Sanchez A, both with 13 papers, followed by Rollin PE (12), Jahrling PB (11) and Peters CJ (11), among others. The top productive authors were mainly from the US and Germany institutions such as US Army of Medical Research Institute of Infectious Diseases (USAMRIID), CDC-USA, among others (**Table 3**).

### Most Productive Organisations

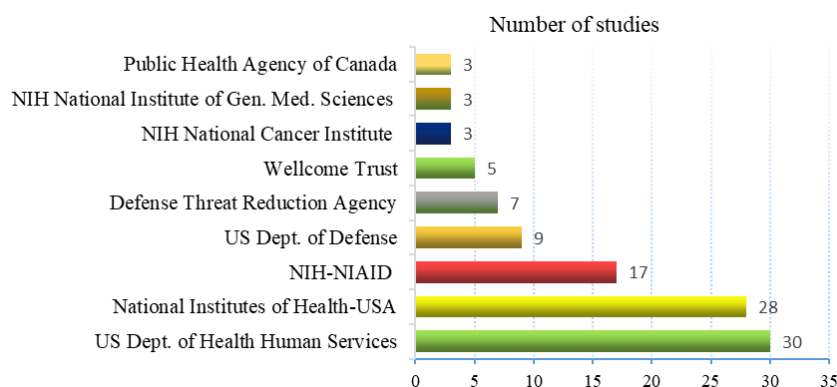
The 100 studies were from 271 institutions, and 14 contributed to five or more studies. The leading productive

**Table 4.** Institutions that produced five or more of the top-cited EVD studies

Rank	Institution	Region/Country location	Number of studies
1	Centers for Disease Control and Prevention USA	United States	26
2	US Army of Medical Research Institute of Infectious Diseases	United States	21
3	Institute Pasteur	France	10
4	World Health Organisation	Switzerland	10
5	Harvard University	United States	9
6	University of Marburg	Germany	9
7	University of Pennsylvania	United States	8
8	Ministries of Health	African countries	7
9	Bernhard Nocht Institute for Tropical Medicine	Germany	6
10	NIH National Institute of Allergy Infectious Diseases	United States	6
11	Franceville International Centre for Medical Research	Gabon	5
12	Public Health Agency of Canada	Canada	5
13	Public Health of England	United Kingdom	5
14	University of Manitoba	Canada	5



(a)



(b)

**Figure 2.** Most crucial Research fields and Funding institutions. (a) Research fields with at least four studies. (b) Institutions that financed three or more EVD studies.

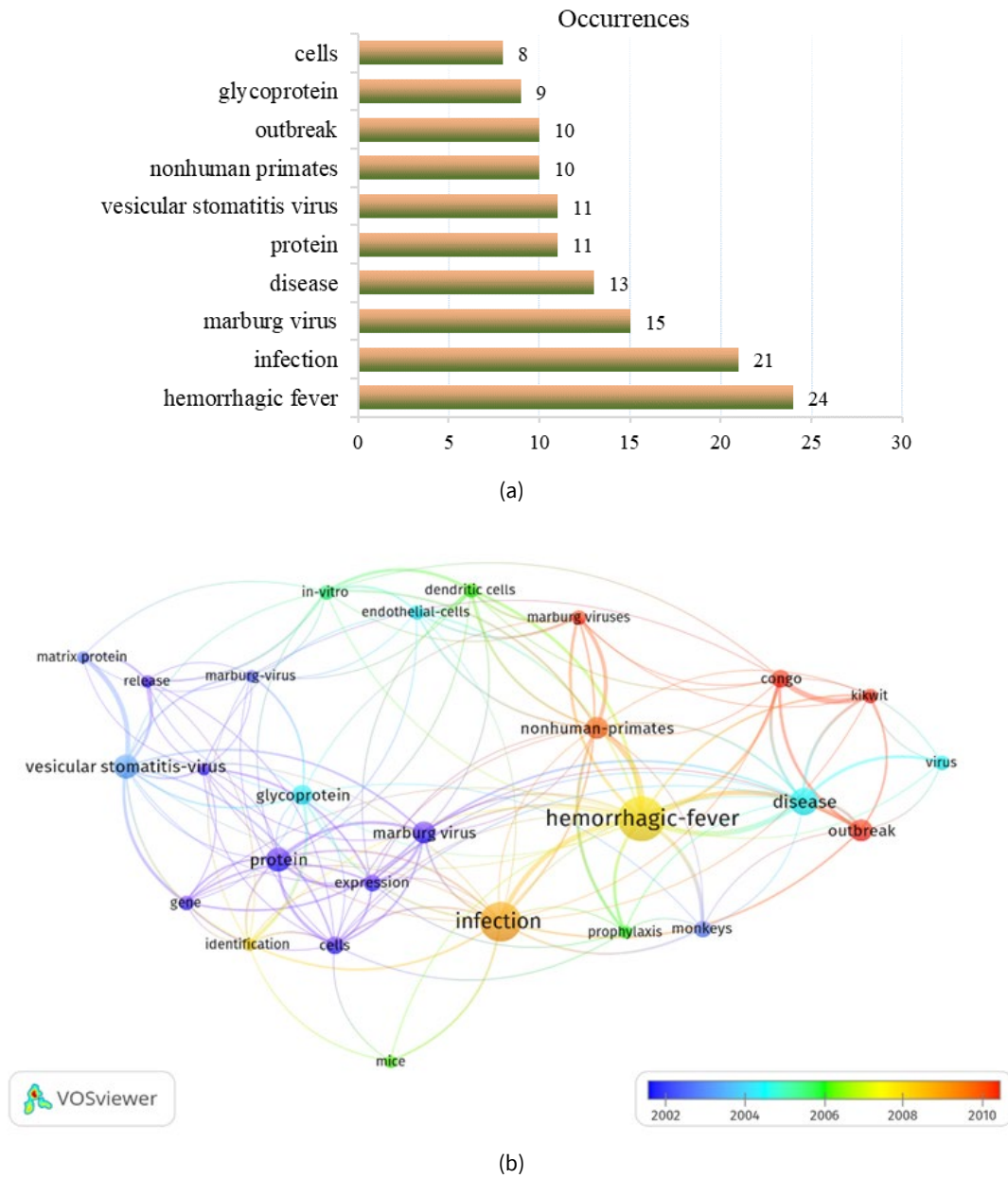
institutions included Centre of Disease Control & Prevention USA (26), US Army of Medical Research Institute of Infectious Diseases (21), Institute Pasteur (10) and World Health Organisation (10), among others. Among African institutions, the International Centre for Medical Research in Franceville Gabon (5) led the list. In addition, Ministries of Health of several EVD endemic African countries also collectively contributed to seven studies, as show in **Table 4**.

#### Most Crucial Research Fields and Funding Institutions

The top cited studies belonged to 17 research fields according to the Web of Science categories, and 12 fields had 4

or more studies. The most popular research field was “Multidisciplinary Sciences” with 24 studies, followed by “Virology” and “Medicine General Internal” with 23 and 20 studies respectively (**Figure 2a**).

The studies were funded by 55 organisations, and 9 institutions financed 3 or more studies. Most of these were USA institutions and included the United States Department of Health Human Services (n=30), National Institutes of Health NIH USA (28), National Institute of Allergy Infectious Diseases NIAID (17), amongst others (**Figure 2b**).



**Figure 3.** Analysis of Keywords. (a) Keywords plus with eight or more occurrence. (b) Overlay visualisation of keywords plus based on occurrence

**Analysis of Keywords**

The studies all together had 48 author keywords and 368 keywords plus. Ten keywords plus appeared more than 8 times, as shown in **Figure 3a**. Co-occurrence analysis showed “hemorrhagic fever” as the most co-occurred keyword plus with 24 occurrences, 21 links and 54 total link strength. This was followed by “infection”, “Marburg virus” and “disease”, among others (**Figure 3b**). Note that a minimum of 5 occurrences was set and 27 keywords plus met the threshold.

**Possible Factors Influencing the Number of Citations**

The correlation was also calculated to evaluate the potential relationships between the number of citations and the number of authors, journals’ productivity, and years since publication, and countries involved. Significant correlations were noted between the number of citations and the journal’s *h*-index ( $r=0.86, P<0.0004$ ), the impact factor ( $r=0.59, P=0.0446$ ),

**Table 5.** Factors affecting the number of citations

Factor	Spearman’s r	P value
Journal <i>h</i> - index	0.86	0.0004
Journal impact factor	0.59	0.0446
Years since publication	0.31	0.1139
Number of countries	0.86	<0.0001
Number of authors	0.03	0.7657

and the number of countries per study (0.86,  $P=<0.0001$ ) (**Table 5**).

**DISCUSSION**

The present study is the first bibliometric study summarising several features of the most influential studies on EVD. Understanding the characteristics of these studies may be

valuable since these studies cover essential advancements in the EVD research field.

In this analysis, the 100 top-cited studies were conducted between 1977 and 2017, with citations ranging from 169 to 808. Compared to other health fields like cancer [22] and vaccines [17], the citations of EVD studies are less, possibly due to less novelty of this topic in the developed countries. The year of 1999 witnessed the most significant advancements in EVD research with 13 most cited studies. Most of these studies focused on identification and characterisation of the Ebola viruses [23,24], as well as treatment [25,26], prevention and control of Ebola outbreaks [27,28]. Although several recognisable studies have been done since the late 1970s, of which most of them provide recommendations on prevention and control of EVD, Africa in particular still faces recurrent outbreaks of EVD, with the most recent being the 2018-2020 Kivu outbreak. This raises an intriguing question on whether African countries learn from the past outbreaks and effectively implement these recommendations. Besides, Aylward *et al.* had the most cited study and the highest citations could be because it was the first study to account for and give a general insight into the 2014-2016 EVD epidemic in West Africa, which is the biggest EVD outbreak in history [10]. So most of the studies that proceeded cited Aylward's study as one of their references.

The study revealed that most of the top productive journals were virology/ infectious disease-specific journals which implies that the 100 top-cited EVD studies were mostly published in subject-specific journals rather than just high impact factor journals. However, it was noted that no single African journal published any of the top-cited EVD studies. Given the fact that citation score is the most used index for recognition of published studies, this reveals that despite EVD being endemic to Africa, most, if not all, of the top quality studies are published in foreign journals. Moreover, the accessibility to these journals by African scientists and community, in general, is questionable. This could suggest that the control and prevention recommendations made from these studies just remain on paper/online if not fully accessed by African communities.

The 100 most-cited studies were produced in collaborations among different authors, countries and institutions. The analysis revealed that most of the productive authors are Western or foreign scientists, mainly from the USA and Germany. This questions the active role of African scientists in the top recognised studies, especially in the field of infectious diseases, which is the most significant public health challenge of Africa. Moreover, the USA was the most productive country contributing to 63 studies, followed by Germany and Gabon. The dominance of USA is also highlighted in other research fields [29]. Although several African countries including Guinea, South Africa and Gabon had a significant contribution, it was mainly in collaboration with other countries, with only two single-country studies from Africa. In one perspective, this would imply the role of collaborative efforts and partnerships in achieving research advancements in this field. However, African countries need to set up and strengthen their own research facilities to enable them to carry out independent and recognisable research.

In addition, these studies were mainly produced by US and European institutions, with only one African institution singly contributing to five studies. Although the role of international agencies like WHO and governments of the EVD affected

countries, including their ministries of health cannot be underestimated, it is not exhaustively reflected in the top-cited EVD studies. Besides, the funding of these studies also mainly came from USA institutions, which included the US Department of Health Human Services and NIH-USA. Therefore, public institutions in Africa and governments, in general, should increase their involvement and funding of clinical research as well as the publication of findings. This would enable evidence-based policy and decision making, especially when it comes to managing and controlling infectious diseases.

The analysis of keywords showed that the studies covered various key aspects of EVD research, including laboratory studies of the virus, its origin, transmission, as well as infections and outbreaks. Hemorrhagic fever is also highlighted as the keyword with most co-occurrence among the EVD studies. This is due to the characteristic hemorrhagic manifestation of EVD [2,6], and so the term appears in most of the top-cited studies. However, studies examining the effect of EVD in particular groups of people like pregnant mothers and children were not reflected in keyword analysis nor in the research fields. This field should be thoroughly researched on to enable formulation of targeted interventions in future outbreaks.

Like other previous bibliometric analyses, our study also has some limitations [16,17]. First, citation analysis was based on one database, the Web of Science; thus, some essential papers indexed by other databases might have been missed [16,22]. The citation numbers therefor might be misleading [30], owing to self-citations, time of publications, among other factors. Thus, further studies are required using different databases to validate these findings. However, it should be noted that although citation analysis is a good measure of recognition, it is not the best index for evaluating quality or importance of scientific research [22]. Besides, since old studies have more citation than new ones, citation analysis tends to undervalue newly published studies, for example, the achievements in EVD vaccine development within the recent years are not captured in this analysis.

## CONCLUSIONS

The study has characterised, and provided insights into the historical advancements of EVD research reflected through the 100 top-cited studies. The study has highlighted the leading roles played by various stakeholders, as well as the collaborative efforts exhibited not only among authors but also among countries and institutions in addressing EVD. Besides, the study has revealed that Africa's role in EVD research is lacking. Thus there is a need for African countries to invest more in clinical research and to strengthen local publication databases and journals. This would facilitate dissemination as well as more access to the valuable information contained in such prestigious studies. Given the infectiousness and severity of EVD, it remains a significant research area calling for a collaborative response, especially in times of outbreaks.

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**Declaration of interest:** No conflict of interest is declared by authors.

**Availability of data and materials:** All the data supporting the results of this study are included in the article and the supplementary file. The

raw data can also be directly obtained from the Web of Science Core Collection using the appropriate search query.

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## APPENDIX 1

### The 100 Top-cited Studies in EVD Research

Rank	Title and Journal	First Author	Publication year	Number of Authors	Total Citations
1	Ebola Virus Disease in West Africa - The First 9 Months of the Epidemic and Forward Projections N ENGL J MED	Aylward B	2014	61	808
2	Emergence of Zaire Ebola Virus Disease in Guinea N ENGL J MED	Baize S	2014	31	728
3	Ebola haemorrhagic fever LANCET	Feldmann H	2011	2	672
4	Genomic surveillance elucidates Ebola virus origin and transmission during the 2014 outbreak SCIENCE	Gire SK	2014	58	610
5	Ebola virus entry requires the cholesterol transporter Niemann-Pick C1 NATURE	Carette JE	2011	15	600
6	HIV-1 and Ebola virus encode small peptide motifs that recruit Tsg101 to sites of particle assembly to facilitate egress NATURE MEDICINE	Martin-Serrano J	2001	3	533
7	Reversion of advanced Ebola virus disease in nonhuman primates with ZMapp NATURE	Qiu XG	2014	26	533
8	Endosomal proteolysis of the Ebola virus glycoprotein is necessary for infection SCIENCE	Chandran K	2005	5	515
9	Development of a preventive vaccine for Ebola virus infection in primates NATURE	Sullivan NJ	2000	5	488
10	Ebola Hemorrhagic-Fever in Zaire, 1976 - Report of an International-Commission BULL. WORLD HEALTH ORGAN	Burke J	1978	47	443
11	Efficacy and effectiveness of an rVSV-vectored vaccine expressing Ebola surface glycoprotein: interim results from the Guinea ring vaccination cluster-randomised trial LANCET	Henao-Restrepo AM	2015	28	418
12	C-type lectins DC-SIGN and L-SIGN mediate cellular entry by Ebola virus in cis and trans J. VIROL.	Alvarez CP	2002	6	417
13	Structure of the Ebola virus glycoprotein bound to an antibody from a human survivor NATURE.	Lee JE	2008	6	410
14	The virion glycoproteins of Ebola viruses are encoded in two reading frames and are expressed through transcriptional editing P NATL ACAD SCI USA	Sanchez A	1996	5	396
15	Rapid detection and quantification of RNA of Ebola and Marburg viruses, Lassa virus, Crimean-Congo hemorrhagic fever virus, Rift Valley fever virus, Dengue virus, and Yellow fever virus by real-time reverse transcription-PCR J CLIN MICROBIOL	Drosten C	2002	7	388
16	Live attenuated recombinant vaccine protects nonhuman primates against Ebola and Marburg viruses NATURE MEDICINE	Jones SM	2005	14	388
17	A system for functional analysis of Ebola virus glycoprotein P NATL ACAD SCI USA	Takada A	1997	7	384
18	Real-time, portable genome sequencing for Ebola surveillance NATURE	Quick J	2016	102	381
19	Defective humoral responses and extensive intravascular apoptosis are associated with fatal outcome in Ebola virus-infected patients NATURE MEDICINE	Baize S	1999	10	374
20	Multiple Ebola virus transmission events and rapid decline of central African wildlife SCIENCE	Leroy EM	2004	12	374
21	Pathogenesis of Ebola hemorrhagic fever in cynomolgus macaques - Evidence that dendritic cells are early and sustained targets of infection AM. J. PATHOL	Geisbert TW	2003	10	373
22	Small molecule inhibitors reveal Niemann-Pick C1 is essential for Ebola virus infection NATURE	Cote M	2011	11	362
23	Accelerated vaccination for Ebola virus haemorrhagic fever in non-human primates NATURE	Sullivan NJ	2003	9	343
24	The Ebola virus VP35 protein functions as a type IIFN antagonist P NATL ACAD SCI USA	Basler CF	2000	8	338
25	Lipid raft microdomains: A gateway for compartmentalized trafficking of Ebola and Marburg viruses J. EXP. MED.	Bavari S	2002	10	329
26	Crystal structure of the Ebola virus membrane fusion subunit, GP2, from the envelope glycoprotein ectodomain MOLECULAR CELL	Weissenhorn W	1998	5	327

Rank	Title and Journal	First Author	Publication year	Number of Authors	Total Citations
27	Processing of the Ebola virus glycoprotein by the proprotein convertase furin P NATL ACAD SCI USA	Volchkov VE	1998	4	324
28	Rapid diagnosis of Ebola hemorrhagic fever by reverse transcription-PCR in an outbreak setting and assessment of patient viral load as a predictor of outcome J. VIROL.	Towner JS	2004	13	323
29	Epitopes involved in antibody-mediated protection from Ebola virus SCIENCE	Wilson JA	2000	7	321
30	A PPxY motif within the VP40 protein of Ebola virus interacts physically and functionally with a ubiquitin ligase: Implications for filovirus budding P NATL ACAD SCI USA	Harty RN,	2000	5	319
31	The Ebola virus VP35 protein inhibits activation of interferon regulatory factor 3 J. VIROL.	Basler CF	2003	9	319
32	Clinical Illness and Outcomes in Patients with Ebola in Sierra Leone N ENGL J MED	Schieffelin JS	2014	47	318
33	Newly Discovered Ebola Virus Associated with Hemorrhagic Fever Outbreak in Uganda PLOS PATHOGENS	Towner JS,	2008	18	314
34	Postexposure protection of non-human primates against a lethal Ebola virus challenge with RNA interference: a proof-of-concept study LANCET	Geisbert TW	2010	12	310
35	Comparison of the transcription and replication strategies of Marburg virus and Ebola virus by using artificial replication systems J. VIROL.	Muhlberger E	1999	5	296
36	Identification of the Ebola virus glycoprotein as the main viral determinant of vascular cell cytotoxicity and injury NATURE MEDICINE	Yang ZY	2000	6	285
37	Role of endosomal cathepsins in entry mediated by the Ebola virus glycoprotein J. VIROL.	Schornerberg K	2006	6	282
38	Ebola virus VP35 protein binds double-stranded RNA and inhibits alpha/beta interferon production induced by RIG-I signaling J. VIROL.	Cardenas WB	2006	8	281
39	Ebola virus VP24 binds karyopherin alpha 1 and blocks STAT1 nuclear accumulation J. VIROL.	Reid SP	2006	9	277
40	Ebola Hemorrhagic-Fever In Sudan, 1976 - Report of a WHO International Study Team BULL. WORLD HEALTH ORGAN	Deng IM	1978	26	273
41	GP mRNA of Ebola virus is edited by the Ebola virus polymerase and by T7 and vaccinia virus polymerases VIROLOGY	Volchkov VE	1995	7	268
42	Preliminary-Report - Isolation of Ebola Virus from monkeys imported to USA LANCET	Jahrling Pb	1990	7	265
43	Characterization of Ebola virus entry by using pseudotyped viruses: Identification of receptor-deficient cell lines J. VIROL.	Wool-Lewis Rj	1998	2	264
44	Human asymptomatic Ebola infection and strong inflammatory response LANCET	Leroy EM	2000	10	264
45	Ebola hemorrhagic fever in Kikwit, Democratic Republic of the Congo: Clinical observations in 103 patients J. INFECT. DIS	Bwaka MA	1999	18	257
46	Efficacy and effectiveness of an rVSV-vectored vaccine in preventing Ebola virus disease: final results from the Guinea ring vaccination, open-label, cluster-randomised trial (Ebola Ca Suffit!) LANCET	Henao-Restrepo Am	2017	32	253
47	Tetherin-mediated restriction of filovirus budding is antagonized by the Ebola glycoprotein P NATL ACAD SCI USA	Kaletsky RL	2009	4	252
48	Human Ebola Outbreak Resulting from Direct Exposure to Fruit Bats in Luebo, Democratic Republic of Congo, 2007 VECTOR BORNE ZONOT.	Leroy EM	2009	7	252
49	The reemergence of Ebola hemorrhagic fever, Democratic Republic of the Congo, 1995 J. INFECT. DIS	Khan AS	1999	19	251
50	Treatment of Ebola virus infection with a recombinant inhibitor of factor V <sub>10a</sub> /tissue factor: a study in rhesus monkeys LANCET	Geisbert TW	2003	10	249
51	Impairment of dendritic cells and adaptive immunity by Ebola and lassa viruses J IMMUNOL.	Mahanty S	2003	6	247
52	Treatment of Ebola hemorrhagic fever with blood transfusions from convalescent patients J. INFECT. DIS	Mupapa K	1999	8	242

Rank	Title and Journal	First Author	Publication year	Number of Authors	Total Citations
53	Sequence-Analysis of The Ebola Virus Genome - Organization, Genetic Elements, And Comparison with The Genome of Marburg Virus VIRUS RESEARCH	Sanchez A	1993	4	238
54	Cellular Entry of Ebola Virus Involves Uptake by a Macropinocytosis-Like Mechanism and Subsequent Trafficking through Early and Late Endosomes PLOS PATHOGENS	Saeed MF	2010	4	238
55	DC-SIGN and DC-SIGNR bind Ebola glycoproteins and enhance infection of macrophages and endothelial cells VIROLOGY	Simmons G	2003	13	237
56	Clinical virology of Ebola hemorrhagic fever (EHF): Virus, virus antigen, and IgG and IgM antibody findings among EHF patients in Kikwit, Democratic Republic of the Congo, 1995 J. INFECT. DIS	Ksiazek TG	1999	13	236
57	Isolation And Partial Characterization of a New Strain of Ebola Virus LANCET	Leguenno B	1995	6	235
58	Clinical Presentation of Patients with Ebola Virus Disease in Conakry, Guinea N ENGL J MED	Bah EI	2015	28	235
59	Ebola virus VP40 drives the formation of virus-like filamentous particles along with GP J. VIROL.	Noda T	2002	6	227
60	The Ebola virus VP35 protein is a suppressor of RNA silencing PLOS PATHOGENS	Haasnoot J	2007	6	226
61	Clinical, virologic, and immunologic follow-up of convalescent Ebola hemorrhagic fever patients and their household contacts, Kikwit, Democratic Republic of the Congo J. INFECT. DIS	Rowe AK	1999	13	223
62	Case of Ebola Virus-Infection BRIT MED J	Emond Rtd	1977	4	220
63	Ebola Virus-Disease in Southern Sudan - Hospital Dissemination and Intrafamilial Spread BULL. WORLD HEALTH ORGAN	Baron Rc	1983	3	219
64	Delayed treatment of Ebola virus infection with plant-derived monoclonal antibodies provides protection in rhesus macaques P NATL ACAD SCI USA	Olinger GG	2012	17	218
65	Pathogenesis of Ebola hemorrhagic fever in primate models - Evidence that hemorrhage is not a direct effect of virus-induced cytolysis of endothelial cells AM. J. PATHOL	Geisbert TW	2003	7	217
66	Inflammatory responses in Ebola virus-infected patients CLIN. EXP. IMMUNOL.	Baize S	2002	8	216
67	The basic reproductive number of Ebola and the effects of public health measures: the cases of Congo and Uganda J. THEOR. BIOL	Chowell G	2004	5	216
68	Persistence of Ebola Virus in Ocular Fluid during Convalescence N ENGL J MED	Varkey JB	2015	14	216
69	Lethal Experimental Infections Of Rhesus-Monkeys by Aerosolized Ebola-Virus INT J EXP PATHOL	Johnson E	1995	4	212
70	Clinical Care of Two Patients with Ebola Virus Disease in the United States N ENGL J MED	Lyon GM	2014	12	212
71	Experimental inoculation of plants and animals with Ebola virus EMERG INFECT DIS	Swanepoel R	1996	9	211
72	Apoptosis induced in vitro and in vivo during infection by Ebola and Marburg viruses LAB. INVESTIG	Geisbert TW	2000	6	207
73	Markedly elevated levels of interferon (IFN)-gamma, IFN-alpha, interleukin (IL)-2, IL-10, and tumor necrosis factor-alpha associated with fatal Ebola virus infection J. INFECT. DIS	Villinger F	1999	10	206
74	Distinct cellular interactions of secreted and transmembrane Ebola virus glycoproteins SCIENCE	Yang ZY	1998	7	205
75	Pathogenesis of experimental Ebola virus infection in guinea pigs J. INFECT. DIS	Connolly BM	1999	7	205
76	Core structure of the envelope glycoprotein GP2 from Ebola virus at 1.9-angstrom resolution P NATL ACAD SCI USA	Malashkevich VN	1999	6	205
77	Recovery of infectious Ebola virus from complementary DNA: RNA editing of the GP gene and viral cytotoxicity SCIENCE.	Volchkov VE	2001	7	205
78	Persistence and genetic stability of Ebola virus during the outbreak in Kikwit, Democratic Republic of the Congo, 1995 J. INFECT. DIS	Rodriguez LL	1999	13	203
79	Successful treatment of advanced Ebola virus infection with T-705 (favipiravir) in a small animal model ANTIVIRAL RESEARCH	Oestereich L	2014	6	203

Rank	Title and Journal	First Author	Publication year	Number of Authors	Total Citations
80	Human Fatal Zaire Ebola Virus Infection Is Associated with an Aberrant Innate Immunity and with Massive Lymphocyte Apoptosis PLOS NEGL. TROP. DIS	Wauquier N	2010	5	200
81	Ebola outbreak killed 5000 gorillas SCIENCE	Bermejo M	2006	6	199
82	An interferon-alpha-induced tethering mechanism inhibits HIV-1 and ebola virus particle release but is counteracted by the HIV-1 Vpu protein CELL HOST & MICROBE	Neil SJD	2007	4	199
83	Molecular Evidence of Sexual Transmission of Ebola Virus N ENGL J MED	Mate SE	2015	41	199
84	Ebola virus can be effectively neutralized by antibody produced in natural human infection J. VIROL.	Maruyama T	1999	9	196
85	Successful Treatment of Ebola Virus-Infected Cynomolgus Macaques with Monoclonal Antibodies SCI. TRANSL. MED	Qiu XG	2012	11	196
86	Overlapping motifs (PTAP and PPEY) within the Ebola virus VP40 protein function independently as late budding domains: Involvement of host proteins TSG101 and VPS-4 J. VIROL.	Licata JM	2003	6	191
87	Will Ebola change the game? Ten essential reforms before the next pandemic. The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola LANCET	Moon S	2015	22	191
88	A Case of Severe Ebola Virus Infection Complicated by Gram-Negative Septicemia N ENGL J MED	Kreuels B	2014	12	190
89	Ebola virus VP40-induced particle formation and association with the lipid bilayer J. VIROL.	Jasenosky LD	2001	4	188
90	Phase 1 Trials of rVSV Ebola Vaccine in Africa and Europe N ENGL J MED	Agnandji ST	2016	58	188
91	Effective post-exposure treatment of Ebola infection PLOS PATHOGENS	Feldmann H	2007	12	187
92	Analysis of human peripheral blood samples from fatal and nonfatal cases of Ebola (Sudan) hemorrhagic fever: Cellular responses, virus load, and nitric oxide levels J. VIROL.	Sanchez A	2004	7	180
93	Differential N-linked glycosylation of human immunodeficiency virus and Ebola virus envelope glycoproteins modulates interactions with DC-SIGN and DC-SIGNR J. VIROL.	Lin G	2003	11	179
94	Evaluation of immune globulin and recombinant interferon-alpha 2b for treatment of experimental Ebola virus infections J. INFECT. DIS	Jahrling PB	1999	9	178
95	Immunization for Ebola virus infection NATURE MEDICINE	Xu L	1998	7	176
96	Lethal experimental infection of rhesus monkeys with Ebola-Zaire (Mayinga) virus by the oral and conjunctival route of exposure ARCH PATHOL LAB MED	Jaax NK	1996	7	175
97	Ebola virus entry requires the host-programmed recognition of an intracellular receptor EMBO JOURNAL	Miller EH	2012	16	173
98	Two-pore channels control Ebola virus host cell entry and are drug targets for disease treatment SCIENCE	Sakurai Y	2015	10	173
99	Experimental Treatment with Favipiravir for Ebola Virus Disease (the JIKI Trial): A Historically Controlled, Single-Arm Proof-of-Concept Trial in Guinea PLOS MEDICINE	Sissoko D	2016	132	170
100	ISG15 inhibit Ebola VP40VLP budding in an L-domain-dependent manner by blocking Nedd4 ligase activity P NATL ACAD SCI USA	Okumura A	2008	3	169