Abstract

Ebola virus in humans causes hemorrhagic fever with a case fatality rate of 50% to 90%. So far, there is no specific treatment or vaccine for the Ebola virus. Patients experience uncontrollable bleeding from all body orifices, with intravenous fluid replacement therapy offering little consolation. World Health Organization (WHO) declared this epidemic as an international public health emergency. Moreover, there is now considerable concern that this Ebola outbreak will threaten world security. The proliferation rate of the disease since 2013 is at an alarming rate and is simultaneously found reflected in an abnormal research literature output. A sum total of 2172 publications were captured from the PubMed covering a longer period spanned between 1985 and 2014. While tracing the development trend in both the frequency distribution of the disease and countries affected, the data of research publications in Ebola were subjected to a Scientrometric study to find out if there exists a correlation between the countries affected by a specific disease and countries contributing to Ebola research. As usual in the case of any epidemic, USA leads in Biomedical research nullifying the hypothesis of the present study while the mostly affected African countries were poor in Ebola research contributions.

Keywords: Biomedical Research, Ebola Research, Ebola Virus Disease (EVD), PubMed, Scientrometric

1. Introduction

World Bank Group Ebola Response Fact Sheet released in December 2014 reads that, ‘The World Bank Group is mobilizing nearly $1 billion in financing for the countries hardest hit by the crisis. This includes $518 million for the emergency response, and at least $450 million from IFC, a member of the World Bank Group, to enable trade, investment and employment in Guinea, Liberia and Sierra Leone.’

In 2005, Africa had about 12% of the world’s population with more than 840 million people. Africa also bears 24% of the disease burden but has only 3% of health workers and commands less than 1% of the world’s health expenditures.

Ebola Virus Disease (EVD) is a disease of humans and other primates caused by an Ebola virus (Zaire ebola). Ebola virus in humans causes hemorrhagic fever with a case fatality rate of 50% to 90%. The first ever to discuss a case of Ebola virus infection was reported by Emond et al. The outbreak of Ebola in West Africa is the largest event of this type since the identification of this virus in 1976. Currently, this outbreak has infected the inhabitants of four countries including Guinea, Sierra Leone, Liberia, and Nigeria. Thousands of people have been infected and more than half of the patients have perished from this devastating disease.
Most patients with Ebola die within 48 hours. Death is certain in 50–90% of cases. There is no specific treatment or vaccine for the Ebola virus. Patients experience uncontrollable bleeding from all body orifices, with intravenous fluid replacement therapy offering little consolation.

This epidemic has not shown any tendency to fade since its outbreak in December, 2013, and additional cases may well surface in other countries. Akst reported in the Scientist that, because of its highly contagious nature and extremely high death rate, the World Health Organization (WHO) declared this epidemic as an international public health emergency. Moreover, there is now considerable concern that this Ebola outbreak will threaten world security. The Scientist reported (Sep 2014) that, Liberia has the highest total number of Ebola cases and fatalities, with nearly 2,000 cases and more than 1,000 deaths through September 8. Fourteen of 15 counties in the country have reported infections. More than 150 infections have occurred in healthcare workers, 79 of whom have died. “When the outbreak began, Liberia had only 1 doctor to treat nearly 100,000 people in a total population of 4.4 million people”, the investigators reported. “Every infection or death of a doctor or nurse depletes response capacity significantly”. While confirming the non-availability of any medicine, Tan et al., believe that, “The vaccines for Ebola Virus Disease (EVD) are estimated to become available at the earliest in 2015”.

2. Objectives of the Study

The objectives of the study are to capture data regarding the total research publications output in Ebola disease, find out the annual output and growth rate, contributing countries, countries of publishing, 10 top ranking authors, 10 top ranking journals, continent-wise quantum of contributions and find out the correlation between the Ebola research publications contributing countries and the Ebola affected countries.

3. Data Collection Source and Period of coverage

The data for the present investigation were collected from Pub Med, world’s largest, open source Biomedical database released from the National Library of Medicine (NLM), United States. The period of coverage is between January 1985 and 15th December 2014.

4. Methodology

The present investigation is a Scientrometric analysis. The source for data collection was PubMed, an Online International Biomedical open database release from the National Library of Medicine from the US. The keyword search used a single term Ebola. The data were down-

| Sl. No. | Year Range (5 Years) | No. of Publication | Annual increase % age | Growth Rate (%) |
|--------|----------------------|--------------------|-----------------------|----------------|
| 1.     | 1985 to 1989         | 25                 | 1.15                  |                |
| 2.     | 1990 to 1994         | 48                 | 2.21                  | 92             |
| 3.     | 1995 to 1999         | 285                | 13.12                 | 493.75         |
| 4.     | 2000 to 2004         | 421                | 19.38                 | 47.71929825    |
| 5.     | 2005 to 2009         | 415                | 19.11                 | -1.425178147   |
| 6.     | 2010 to 2014         | 978                | 45.03                 | 135.6626506    |
|        |                      | 2172               | 100.00                | Average Growth Rate = 153.5 |
loaded for the years spanned between 1985 and 2014. The open source statistical software 'R8 was used for computing tables and analysis. Selective Scientometric descriptive indicators were applied to the captured data so as to fulfill the objectives of the study.

5. Analysis and Interpretation

A total of 2172 records were captured from Pub Med with the single keyword Ebola. The records were downloaded in their abstract format and fed into Excel format for data cleaning. Subsequently, the cleaned data were exported into SPSS ver.16.0 for computing and statistical analysis.

Table 1 reveals that between 1985 and 2014 there were 2172 publications nearly half of which appeared between 2010 and 2014. The average growth rate works out to be 153.5%.

| Sl. No. | Country       | No of Publications | Percent |
|---------|----------------|--------------------|---------|
| 1.      | United States | 1054               | 48.53   |
| 2.      | England       | 440                | 20.44   |
| 3.      | Netherlands   | 128                | 5.89    |
| 4.      | Switzerland   | 92                 | 4.24    |
| 5.      | France        | 81                 | 3.73    |
| 6.      | Russia        | 80                 | 3.68    |
| 7.      | Germany       | 75                 | 3.45    |
| 8.      | Japan         | 36                 | 1.66    |
| 9.      | China         | 29                 | 1.34    |
| 10.     | Canada        | 24                 | 0.92    |
| 11.     | Austria       | 19                 | 0.87    |
| 12.     | Sweden        | 18                 | 0.83    |
| 13.     | Australia     | 16                 | 0.74    |
| 14.     | Denmark       | 8                  | 0.37    |
| 15.     | India         | 7                  | 0.32    |

Figure 1. Frequency distribution of Ebola Research Publications and Growth rate.

In total, 43 countries participated in Ebola research publications. USA had a lion’s share with 48.53% (1054) followed by England with 20.44% (440). Netherlands ranked third with 5.89% (128) of the total publications. The remaining 25.14% were contributed by 40 countries including China ranking 9th (9 items), India ranking 15th (7 items), South Africa (5 items), Uganda (5), Kenya (3 items), Tanzania (3), Ghana (1) and Zimbabwe (1) were the six participating nations from Africa in contributing to Ebola research literature though much affected countries belong to Africa.

Table 2. Countries and Contributions to Ebola Research

| Sl. No. | Country       | No of Publications | Percent |
|---------|----------------|--------------------|---------|
| 1.      | North America | 1076               | 49.53   |
| 2.      | Europe        | 975                | 44.88   |
| 3.      | Asia          | 83                 | 3.82    |
| 4.      | Africa        | 19                 | 0.87    |
| 5.      | Oceanic       | 18                 | 0.83    |
| 6.      | South America | 1                  | 0.05    |

Table 3. Ebola research : Place of Publications : Various Regions

| Sl. No. | Region         | Count | Percent |
|---------|----------------|-------|---------|
| 1.      | North America  | 1076  | 49.53   |
| 2.      | Europe         | 975   | 44.88   |
| 3.      | Asia           | 83    | 3.82    |
| 4.      | Africa         | 19    | 0.87    |
| 5.      | Oceanic        | 18    | 0.83    |
| 6.      | South America  | 1     | 0.05    |
|         | Total          | 2172  |         |
Nativity of contributing authors and publishing journals’ nativity happen to be different in most cases. Authors are attracted by journals of higher impact factor in their concerned field as their publications shall have a higher visible index. A look into the place of publications in the context of continental-wise distribution of Ebola research publications, North America leads with a thumping number (1076), followed by Europe (975) while Asia ranks 3rd (83). Africa, the most affected nation could launch 19 publications in journals of African origin.

Table 4. Prolific Authors and their Number of Publications on Ebola

| Rank | Author Name | Country     | Institution                                                                 | Total Count |
|------|-------------|-------------|------------------------------------------------------------------------------|-------------|
| 1    | Feldmann H  | USA         | Laboratory of Virology, Division of Intramural Research, National Institute of Allergy and Infectious Diseases, National Institutes of Health. | 146         |
| 2    | Geisbert TW | USA         | Department of Microbiology and Immunology, Galveston National Laboratory, University of Texas Medical Branch, Galveston, Texas, USA.     | 80          |
| 3    | Sanchez A   | USA         | Special Pathogens Branch, Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, GA 30333, USA | 50          |
| 4    | Chepurnov AA| Russia      | Institute of Clinical Immunology Russian Academy of Medical Sciences, Siberian Branch, Novosibirsk, Russia                              | 41          |
| 5    | Bray M      | USA         | Biodefense Clinical Research Branch, 6700A Rockledge Drive, Room 5128, Bethesda, MD 20892, USA                                      | 39          |
| 6    | Takada A    | Japan       | Division of Global Epidemiology, Hokkaido University Research Center for Zoonosis Control, Kita-20, Nishi-10, Kita-ku, Sapporo 001-0020, Japan | 38          |
| 7    | Leroy EM    | France      | Institut de Recherche pour le Developpement (IRD). Montpellier, France        | 35          |
| 8    | Volchkov VE | France      | Human Virology Department, Universite de Lyon, Claude Bernard University Lyon-1, EcoleNormaleSuperieure de Lyon, Lyon, France         | 34          |
| 9    | Warfield KL | USA         | Integrated Bio Therapeutics, Inc., Gaithersburg, USA                          | 32          |
| 10   | Marzi A     | Germany     | Laboratory of Virology, Division of Intramural Research, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Rocky Mountain Laboratories, Hamilton, Montana 59840, MT, USA | 25          |
Table 5 reveals the 10 top ranking authors, their research institutions’ address, country of affiliating and the number of publications. The contributions are either single authored or collaborative. The point to be noted is that, though USA is accredited with the highest number of publications, all those contributors did not belong to USA but to different countries in the world. Every author is unique in their affiliation to a distinct research institute. No two or more proliferating authors in this list belong to the same research institute. It is also to be noted that a majority among the 10 top ranking prolific authors and their institute of research belong to USA.

It can be inferred that there is no correlation between the quantum of disease occurrence and the quantum of research publications in that disease or at least in the case of Ebola here.

Table 5 reveals the 10 top ranking journals that brought out Ebola research publications from 1985 to 2014. The language of all the journals found in the table is found to be in English. A majority of them belong to USA. Nature and Science belong to general science while PLoS is an open access, peer reviewed journal. None of the 10 top ranking journals were from Africa. The two leading journals among the 10 belong to the subject virology.

**Table 5.** 10 Top Ranking Journals - Frequency of Publication on Ebola

| Sl. No. | Name of the Journal                                    | Frequency of Publications |
|--------|--------------------------------------------------------|--------------------------|
| 1.     | Journal of virology                                   | 180                      |
| 2.     | The Journal of infectious diseases                    | 139                      |
| 3.     | BMJ (Clinical research ed.)                           | 72                       |
| 4.     | Virology                                              | 71                       |
| 5.     | Lancet                                                | 59                       |
| 6.     | Voprosyvirologii                                      | 50                       |
| 7.     | Science (New York, N.Y.)                              | 41                       |
| 8.     | PloS one                                               | 38                       |
| 9.     | Nature                                                 | 37                       |
| 10.    | Proceedings of the National Academy of Sciences of the United States of America | 37                       |

**Table 6.** Countries with Frequency of Ebola disease incidence against Frequency distributions of Research Publications from various countries

| Sl. No. | Country          | No. of Reported Incidents (1985 to 2014) | Research Output | Percent of Total Publication |
|--------|------------------|-----------------------------------------|-----------------|-----------------------------|
| 1.     | Liberia          | 3929                                    | 0               | 0                           |
| 2.     | SIERRA LEONE     | 2246                                    | 0               | 0                           |
| 3.     | GUINEA           | 1199                                    | 0               | 0                           |
| 4.     | Dem. Rep. of Congo | 611                                    | 0               | 0                           |
Table 6 reveals the frequency distribution of research publications against the frequency distribution of the Ebola disease. It is evident from the table that research publications from the countries affected with Ebola virus disease was very much negligible. Among the many countries affected in the African continent, less than five countries participated in contributing to Ebola virus research literature that even in meager number. USA leads always in medical research whether there is any incidence or not. But, in the case of Ebola, there was an incidence secondary in nature, carried over by a traveler into USA from Africa.

6. Conclusion

Quantum of publications in Ebola virus research did not have any correlation to the countries having higher frequency of incidence of the disease. Though USA scores the highest in Ebola virus research publications, it is in terms of the origin of journals that attracted maximum number of publications from other countries besides its own. The 10 top ranking authors belong to various nations drawn from various countries, majorities belong to USA. India, though ranked 15th quantum of publications-wise, lags behind.

7. References

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