# Trends in e-literature on cardiovascular diseases: A bibliometric analysis with reference to *ClinicalKey* (2015 -2019)

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**Abstract**

*ClinicalKey* is a clinical search engine that helps doctors and other health professionals to make better decisions anywhere, anytime, in any patient scenario. *ClinicalKey* database provides access to thousands of online resources such as online medical books, e-journals, drug monographs, guidelines, patient education, clinical overviews and multimedia resources. This paper aims to describe the bibliometric study published in *ClinicalKey* from 2015 to 2019 on e-literature on cardiovascular diseases (CVDs) and to explore publishing trends in the relevant field. For the study, the literature was extracted in terms of full-text research articles from *ClinicalKey* covering the period from January 2015 to December 2019. This quantitative study includes the bibliometric methods to analyze original articles and the data has been analyzed using statistical techniques in MS Excel and SPSS. During the period of study, a total of 8193 research articles were published, giving an average of 1639 pieces of literature per year. Results of this study revealed that the year-wise distribution of articles has a mean relative growth rate of 0.90 articles per annum and a doubling time of 2.27 years for the publications at the aggregate level. In the same way, month-wise results for the year 2015 and 2019 are, mean relative growth rate 0.45 and 0.41 articles per month and the doubling time 10.34 and 10.49 months respectively. Relative growth rate and doubling time of retrieved literature from 2015 to 2019 is stable and indicates an exponential growth of literature in the field. The analysis shows that there is a nucleus zone of journals (core journals) publishing cardiovascular diseases research output which is scattered among journals in cardiovascular diseases literature confirm to the Bradford's law of scattering.

**Keywords**: ClinicalKey, Cardiovascular diseases, Heart diseases, Bibliometric analysis, Relative growth rate, Doubling time, Bradford's law of scattering

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## Introduction

Economic development has been associated with transitions in health, notably shifts from communicable diseases to non-communicable, chronic diseases [NCDs] including cardiovascular diseases (Callaham, 2002). Researches done in the field of health is one mechanism to improve population-level health and should generally match the health needs of populations even though cardiovascular diseases (CVDs) is the leading cause of death and disability worldwide.

According to the United States NCI (National Cancer Institute) dictionary, cardiovascular diseases are a type of disease that affects the heart or blood vessels. The risk of certain cardiovascular diseases may be increased by smoking, high blood pressure, high cholesterol, unhealthy diet, lack of exercise, and obesity. The most common cardiovascular diseases is coronary artery disease (narrow or blocked coronary arteries) which can lead to chest pain, heart attacks, or strokes. Other cardiovascular diseases include congestive heart failure, heart rhythm problems, congenital heart disease (heart disease at birth) and endocarditis (inflamed inner layer of the heart) and also called heart disease.

As per the World Health Organization (2020), cardiovascular diseases are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular diseases, rheumatic heart disease and other conditions. Four out of five CVDs deaths are due to heart attacks and strokes and one-third of these deaths occur prematurely in people under 70 years of age. According to the American Heart Association (2019), Cardiovascular diseases is the leading global cause of death, accounting for more than 17.6 million deaths per year in 2016 which is expected to grow to more than 23.6 million per annum by 2030, according to a study in 2014.

Several risk factors such as smoking, high-fat diet, sedentary lifestyle, and psychological factors, including stress, depression, and hostility contributes to cardiovascular diseases (Ajay, 2003). Therefore, there is an upsurge in patients opting for other strategies for a healthy lifestyle and stress management in an attempt to improve health-related quality of life and to prevent recurrent illness

(Daubenmier, 2007). Most cardiovascular diseases can be prevented by addressing behavioural risk factors such as the use of tobacco, unhealthy diet and obesity, physical inactivity and harmful use of alcohol using population-wide strategies. People with cardiovascular diseases or who are at high cardiovascular risk (due to the presence of one or more risk factors such as hypertension, diabetes, hyperlipidaemia or already established disease) need early detection and management using counselling and medicines, as appropriate (World Health Organisation [WHO], 2017).

Bibliometrics is a valuable tool to measure scientific activities by assessing statistics of publications provided by medical databases. It is a commonly used method to identify the development of a certain field (Zeleznik et al., 2017). Pritchard (1969) stated that bibliometrics deals with application of mathematics and statistical methods to books and other media of communication. Bibliometrics has been utilized for evaluating scientific output and the importance of scientific studies. For this research paper, *ClinicalKey* is used as the search engine to evaluate the e-literature on cardiovascular diseases. The Postgraduate Institute of Medicine (PGIM) is the only institute that provides *ClinicalKey* access facility for medical professionals in Sri Lanka.

*ClinicalKey* is an online search engine launched by Elsevier in April 2012 and it is one of the largest, most comprehensive product, currently available for finding clinical medical information. Moreover it is a clinical insight engine that addresses key clinical research requirements of physicians, medical librarians, and healthcare professionals. Also it draws answers from the largest collection of clinical resources, covering every medical and surgical specialty (www.clinicalkey.com). *ClinicalKey* offers 1362 full-text medical and surgical e-books and access to 862 full-text medical and surgical journals from the Elsevier collection and the Clinics of North America. It has 11200 practice guidelines and more than 2,600 drug monographs. It provides two types of multimedia access to 5726614 images and medical and surgical videos from books and journals. *ClinicalKey* offers more than 15,000 patient education handouts which are provided by the American Academy of Family Physicians, Elsevier Gold Standard, Ferri's Netter Patient Advisor and Interactive Patient Education. 75% of the handouts are available in both English and Spanish. Other languages are Arabic, Bosnian (Bosnia and Herzegovina), Canadian

French, French, HmNai, Haiti Haitian, Korean Polish Poland, Brazil Portuguese, Russia Russian, Somali, Philippines Tagalog, Vietnamese (Viet Nam), S Chinese and T Chinese.

Cardiovascular diseases are a significant and ever-growing problem in the world, accounting for nearly one-third of all deaths and leading to disability worldwide (WHO,2017). The bibliometric analysis of literature in the field on cardiovascular diseases is limited, and no comprehensive study of the bibliometric analysis of trends in e – literature of publications in the field of CVDs is available. The study of this investigation was to bridge this gap and to provide a guide in evaluating the cardiovascular diseases literature. This study will help to overcome the problem to some extent and to understand the nature of the e-literature and relationship within literature. This paper is important to library professionals, medical professionals and medical students to study about literature on cardiovascular diseases and the data generated in this study would be useful to develop a further scientific research on this particular matter.

## Objectives of the study

This study evaluates and measures trends in journals of cardiovascular diseases literature on *ClinicalKey* database. This study is based on quantitative measurements without any qualitative measurements. This bibliometric analysis aims to evaluate the importance and impact of the research articles that have been published with the keyword cardiovascular diseases in the *ClinicalKey* database during the period from 2015 to 2019. The specific objectives of the study are;

- To study the growth of literature in the field of cardiovascular diseases as reflected in the *ClinicalKey* database
- To study the patterns of publishing articles on cardiovascular diseases
- To identify the core journals in the field of cardiovascular diseases

## Literature review

Bibliometric analysis is a reliable tool to evaluate the development and quality of scientific production. Bibliometrics is the quantitative study of literature as reflected in bibliographies. Bibliometric analysis can provide an overall

examination and quantitative viewpoint of a particular research topic supported by a large amount of literature information. In particular, it can put into reviewing the evolution and development trends of a scientific discipline to identify hotspots and emerging ideas of a field and to evaluate the performance of journals (Kolle et al., 2017). Many researchers in different subject areas have carried out the bibliometric analysis. It is a quantitative study of various aspects of the literature on a topic and is used to identify the pattern of publications. This can lead to better organization of information resources which is essential for effective and efficient use (Thanuskodi, 2011). Previously several bibliometric studies had been carried out by the researchers in different areas of cardiovascular diseases. The following are such research outputs.

Shuaib et al. (2015) has researched the bibliometric analysis of the top 100 cited cardiovascular articles. The study examined 100 articles published within a period of five years from 2006 to 2010. His study was to provide readers with a practical guide in evaluating cardiovascular literature. Zheng et al. (2016) revealed an investigation on the literature characteristics and research topics on cardiovascular diseases in the occupational population quantitatively via a bibliometric analysis. The analysis showed that the influencing factors mainly included occupational mental stress, smoking, and working system, and the health outcomes attracting the most attention were hypertension, hand-arm vibration, ischemic heart disease, and myocardial infarction. Donatella (2013) conducted a research study on exploring temporal trends, geographic distribution, and socioeconomic determinants of scientific production in the field of cerebrovascular and cardiovascular diseases (CCDs) rehabilitation and a decrease in the overall IF was observed. The European Union and the United States contributed 3 of every 4 articles in the field although some Asian countries showed promising performance. Sadeer et al. (2015) worked on a bibliometric analysis of cardiovascular diseases research activity. The objective of this study was to quantify the research activity in cardiovascular diseases in the Middle East during the period 2008-2012. Eiman and Daniel (2011) investigated the number of publications in cardiovascular diseases in Latin America and the Caribbean over the last decade. The study discovered that allocating their resources towards national health priorities in Latin American institutions can improve funding while applying research-based evidence that optimizes health benefits for their community.

Tian (2017) conducted a research study titled bibliometric analysis on relations between cardiovascular disease and erectile dysfunction. This study has analyzed the current situation and trend on the relations between erectile dysfunction and cardiovascular diseases through analyzing the epidemiologic research data. Junnan Liu, Xing Zhai and Xianfu Liao (2019) conducted a research study titled Bibliometric analysis on cardiovascular diseases treated by traditional Chinese medicines based on big data (Big data is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software). The findings of study showed the amount of literature in the treatment of cardiovascular diseases by traditional Chinese medicine is on the rise, mainly focusing on the application of traditional Chinese medicine and Chinese herbal compound, acupuncture and moxibustion therapy and other traditional Chinese medicine regimen.

Mohammad-Hossein (2016) conducted a research study to show the trend of global scientific activities in the field of CVDs for 10 years through 2001-2010. It was found in the study that a great number of CVDs is preventable by warning the people about the behavioral risk factors such as heavy smoking, unhealthy food diet, excessive obesity, physical inactivity and consuming of alcohol. Research study of Yuan-hui Liu et al. (2015) provided a historical perspective on scientific progress and the trends in cardiovascular medicine in Mainland, China. The findings of the article revealed that the results offer invaluable insight into the evolution of popular opinion in the field of cardiovascular disease which has undergone considerable change over the years around the world. Ghandour (2009) conducted a research study titled cardiovascular disease research in the Arab world: a scoping review from seven Arab countries (2000–2018). The objective of this study is to map cardiovascular disease research productivity in Arab countries and identify gaps and opportunities that would inform a future research agenda. Findings from this article indicate gaps in robust methods and pertinent themes in CVDs research in the Arab region. Khachfe and Marwan (2018) conducted a research study to measure the activity of cardiovascular disease research via publications that have been released in the Arab World over the last 15 years. The study discovered that Arab countries are still lagging far behind in CVDs research compared to the Western and other regions of the world. Saquib et al. (2017)

conducted a research study titled cardiovascular disease research in Saudi Arabia. This study examined the research productivity trends and characterized the types and focus of all CVDs research studies from Saudi Arabia.
This particular bibliometric analytical study aims at evaluating and measuring the trends of literature based on cardiovascular diseases which have not been attempted by the previous researchers.

## Methodology

The methodology used in the study is bibliometric analysis which is used to study the bibliographic attributes of all research articles on cardiovascular disease published in the *ClinicalKey* during the period from 2015 to 2019. In this study, research articles were identified by searching for the keyword 'Cardiovascular Disease' in the Medical Subject Headings (MeSH) and the total number of 8193 literature were extracted in terms of full-text articles of journals of which the retrieved data have been fed into MS Excel and loaded in SPSS for analysis. The data were analyzed in terms of growth rate and core journals in the field of cardiovascular diseases. Relative growth rate and doubling time of cardiovascular diseases literature have also been calculated. Bradford's law of scattering is used to identify the core journals in the field of cardiovascular diseases.

### *Growth Rate (GR)*

The growth of publications is analyzed by using two parameters relative growth rate and doubling time. The relative growth rate and doubling time model was developed by Mahapatra (1985) and applied to examine the relative growth rate of research publications. Relative growth rate is a measure to study the increase in number of articles of time and the doubling time is directly related to RGR. It is the time required for articles to become double of the existing amount (Mahapatra, 1985).

### *Relative Growth Rate (RGR)*

The relative growth rate is a tool to measure the growth of information when the growth rate of a function is always proportional to the function's current size. Such growth is said to follow an exponential law. RGR is a measure to study the increase in the number of research articles of the time. It is calculated

as the increase in the number of research articles per unit of time. The relative growth rate of articles over the specific period of an interval can be calculated from the following equation;

$$\boldsymbol{RGR = \frac{\log_e W_2 - log_e W_1}{T_2 - T_1}}$$

Where;

$RGR$ = Relative growth rate

$MRGR$ = Mean relative growth rate over the specific period of interval (average of RGR)

$log_e W_1$ = log of the initial number of articles

$\log_e W_2$ = log of the final number of articles after a specific period of interval

$T_2 - T_1$ = the unit difference between the initial time and the final time

$$\log_e W_2 = lnW_2$$
$$log_e W_1 = lnW_1$$

( $ln$ ) is used to denote natural logarithm

***Doubling Time (DT)***

Doubling time is the amount of time it takes for a given quantity to double in size or value at a constant growth rate. There exists a direct equivalence between the relative growth rate and the doubling time (Bradford, 1934). If the number of articles of a subject doubles during a given period then the difference between the logarithms of numbers at the beginning and at the end of this period must be the logarithms of number 2. If natural logarithm is used, this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval for articles can be calculated using the following formula;

$$Consider\ the\ formula\quad RGR = \frac{\log_e W_2 - log_e W_1}{T}\ ,then$$

$$T = \frac{\log_e 2n - \log_e n}{RGR}$$

$$here\quad n = Quantity\ at\ the\ beginning(initial)$$

$$2n = Quantity\ at\ the\ end\ (final)$$

$$T = Doubling\ Time(DT)$$

$$T = \frac{\log_e \left(\frac{2n}{n}\right)}{RGR} \longrightarrow \qquad (DT) = \frac{\log_e 2}{RGR} \qquad here \qquad \mathbf{\log_e 2 = 0.693}$$

$$\therefore \boldsymbol{(DT)} = \frac{\mathbf{0.693}}{\boldsymbol{RGR}}$$

Therefore,

$$Doubling\ time\ for\ articles\ (DT) = \frac{\mathbf{0.693}}{\boldsymbol{RGR}}$$

***Bradford Law of Scattering***

Bradford law of scattering describes how the literature on a particular subject is scattered or distributed in the journals. Bradford (1934) formulated his law as follows (Brookes,1985).

If scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same articles as the nucleus, when the number of periodicals in the nucleus and succeeding zones will be as 1: n: $n^2$, where 'n' is a multiplier.

**Results and Discussion**

The study has extracted all the required information related to the articles, published from 2015 to 2019, from the *ClinicalKey* database. All the details such as year wise distribution, relative growth rate and doubling time, month-wise distribution, subject-wise literature, distribution of articles to journals and

core journals of the literature of all articles have been used for the following analysis.

***Quantum of cardiovascular diseases research productivity***

The research productivity on cardiovascular diseases covered in *ClinicalKey* database for the period 2015 to 2019 is shown in Table 1.

Table 1: Year Wise Distribution of Articles on CVDs

| **Year of Publication** | **No of articles** | **%** |
|---|---|---|
| 2015 | 847 | 10.34 |
| 2016 | 1053 | 12.85 |
| 2017 | 1506 | 18.38 |
| 2018 | 2042 | 24.92 |
| 2019 | 2745 | 33.50 |
| Total | 8193 | 100 |

Total of 8193 records is covered in the *ClinicalKey* database on cardiovascular diseases. The highest percentage of articles was published in the year 2019 comprising 33.50%. The years 2015, 2016, 2017 and 2018 have contributed 10.34%, 12.85%, 18.38% and 24.92% respectively. The year 2019 claims the highest number of publications (2745) among the five years of study. On the whole, it is noticed that from 2015 onwards, there is a gradual increase in cardiovascular diseases research articles productivity every year.

The study of the growth rate of publications on cardiovascular diseases is an important factor in analyzing the research and development in the field. Table 2 shows that the relative growth rate of total contribution published has gradually decreased.

Table 2: Relative Growth Rate (RGR) and Doubling Time (DT) of Publications

| Year of Publication | No of articles | % | Cumulative total of output | $Log_e W_1$ | $Log_e W_2$ | $Log_e W_2 - Log_e W_1$ | RGR | Mean RGR | Doubling time | Mean DT |
|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 847 | 10.34 | 847 | | 6.74 | | | | | 0.68 |
| 2016 | 1053 | 12.85 | 1900 | 6.74 | 7.55 | 0.81 | 0.81 | 0.46 | 0.86 | |
| 2017 | 1506 | 18.38 | 3406 | 7.55 | 8.13 | 0.58 | 0.58 | | 1.19 | |
| 2018 | 2042 | 24.92 | 5448 | 8.13 | 8.60 | 0.47 | 0.47 | 0.44 | 1.48 | 1.59 |
| 2019 | 2745 | 33.50 | 8193 | 8.60 | 9.01 | 0.41 | 0.41 | | 1.70 | |
| Total | 8193 | 100.00 | | | | | | 0.90 | | 2.27 |

Time difference ($T_2$-$T_1$) in the calculations is considered as one year. The overall study period has witnessed a mean relative growth rate of 0.90. Generally, the relative growth rate of publications of cardiovascular diseases output has shown a decreasing trend. It is clear that the relative growth table has [2015 (847)-2019 (8193)] increasing cumulative output trends. The mean relative growth rate for the period 2015 and 2017 is worked out to 0.46 and it is 0.44 for the period 2018 and 2019. Relative growth rate of the first half of the considered period shows an average growth rate as 0.46 and the second half as 0.44. It is very clear that the growth rate of the first half is faster than the second half. The mean doubling time during the period 2015-2019 is 2.27. Perpetually the mean doubling time for publication of research output in cardiovascular diseases has increased from 0.68 years in 2015-2017 to 1.59 in 2018-2019.

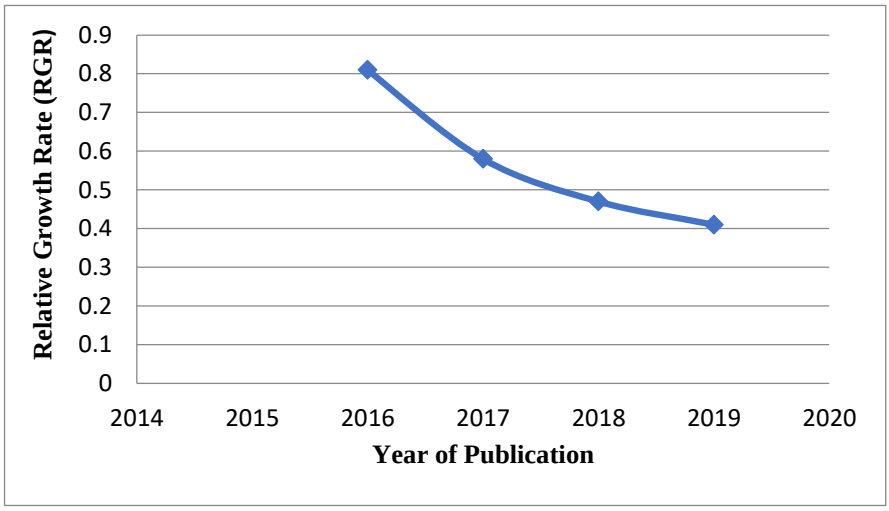


Figure 1: Relative growth rate of publications

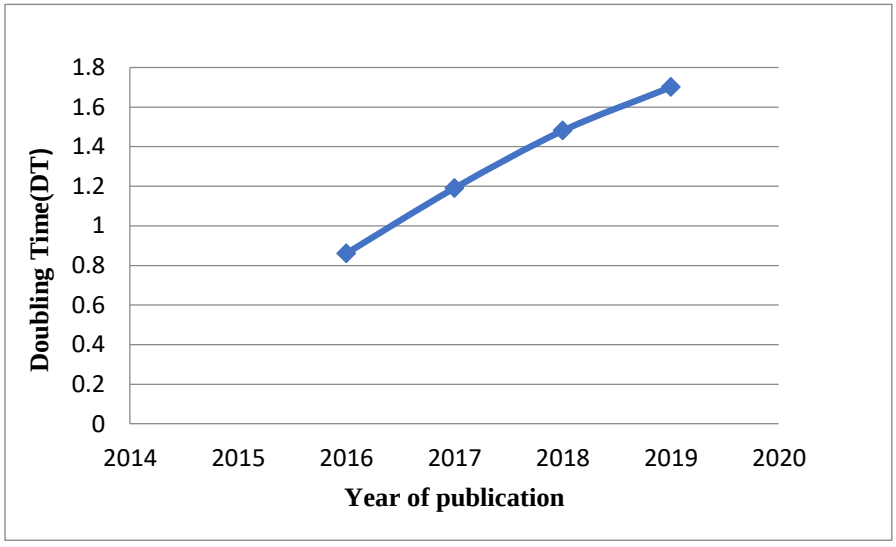


Figure 2: Doubling time of publications

The doubling time (figure 2) for the first half of the considered period is 0.68 and the second half is 1.59 which means that the time towards the doubling time of record is very less for the second half (two years) comparing to the first half (three years) of the period. It is therefore inferred that the growth rate of

the research publications decreases year after year and it takes a long time to double the records, as the research growth rate is in decreasing trend (Figure 1). Hence the doubling time of research literature in cardiovascular diseases is approximately two years.

***Month - wise growth rate of the articles***

According to the year of publications, the lowest number of articles are found in 2015 (847) and the highest number of articles are found in 2019 (2745). Here, an attempt is made to calculate the output of articles in the form of month-wise growth rate during the period of twelve months from January to December on the two specific years 2015 and 2019 respectively. Table - 3 and Table - 4 exhibit the month-wise distribution of the number of articles for the respective years. The average number of article wise publications is 1,639 articles per year.

Table 3 : Month wise distribution for the year 2015

| 2015 year | Total Number of articles | Cumulative total of output | $\text{Log}_e W_1$ | $\text{Log}_e W_2$ | RGR | Mean RGR | Doubling time | Mean DT |
|---|---|---|---|---|---|---|---|---|
| January | 58 | 58 | | 4.06 | | | | |
| February | 98 | 156 | 4.06 | 5.05 | 0.99 | | 0.70 | |
| March | 56 | 212 | 5.05 | 5.36 | 0.31 | 0.35 | 2.26 | 1.79 |
| April | 77 | 289 | 5.36 | 5.67 | 0.31 | | 2.24 | |
| May | 102 | 391 | 5.67 | 5.97 | 0.30 | | 2.29 | |
| June | 92 | 483 | 5.97 | 6.18 | 0.21 | | 3.28 | |
| July | 76 | 559 | 6.18 | 6.33 | 0.15 | | 4.74 | |
| August | 43 | 602 | 6.33 | 6.40 | 0.07 | | 9.35 | |
| September | 66 | 668 | 6.40 | 6.50 | 0.10 | | 6.66 | 8.54 |
| October | 89 | 757 | 6.50 | 6.63 | 0.13 | | 5.54 | |
| November | 39 | 796 | 6.63 | 6.68 | 0.05 | 0.09 | 13.79 | |
| December | 51 | 847 | 6.68 | 6.74 | 0.06 | | 11.16 | |
| Total | 847 | | | | | 0.45 | | 10.34 |

In the study of the year 2015, the month May has more than 100 articles. The remaining eleven months have below 100 articles. It could be deduced that the month May has higher productivity and the month November has lower productivity when compared with other months. Table 3 discussed the relative growth rate of the articles during the months between January and December.

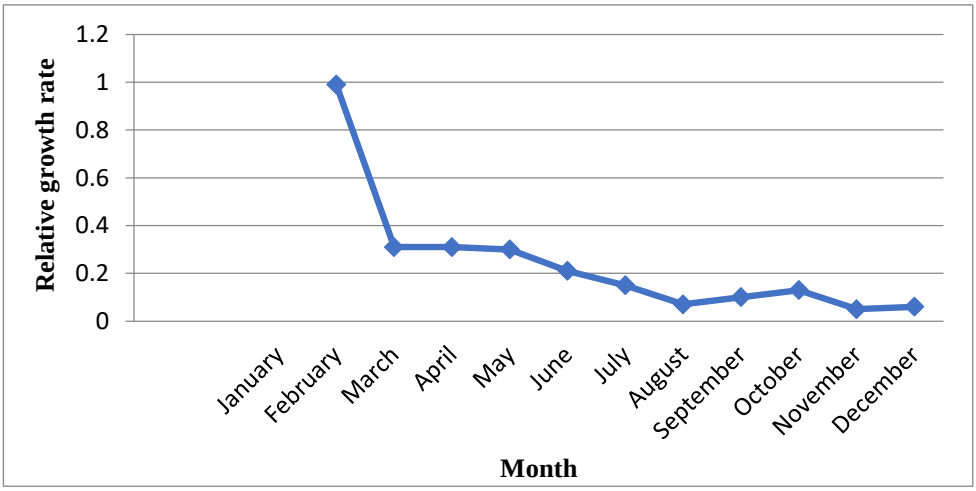


Figure 3: Relative growth rate of publications for year 2015

In year 2015, it shows a mean relative growth rate of 0.45. Significantly, the doubling time for articles output has increased from 1.79 from January to June and to 8.54 in the months July to December. The mean doubling time for articles output in the same year is 10.34 (Figure 3 and figure 4).

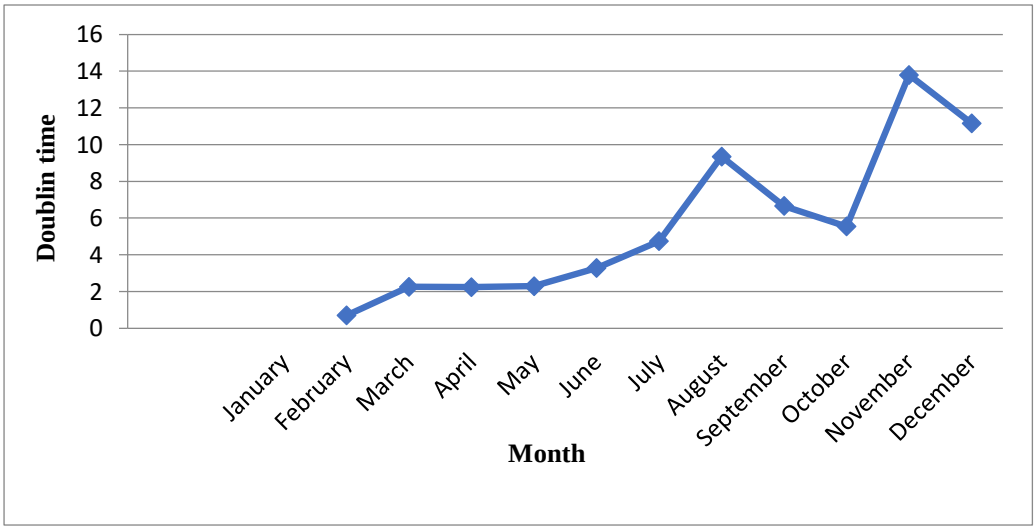


Figure 4: Doubling time of publications for the year 2015

Table 4: Month Wise Distribution for the year 2019

| 2019 year | Total Number of articles | Cumulative total of output | $Log_e W_1$ | $Log_e W_2$ | RGR | Mean RGR | Doubling time | Mean DT |
|---|---|---|---|---|---|---|---|---|
| January | 229 | 229 | | 5.43 | | | | |
| February | 312 | 541 | 5.43 | 6.29 | 0.86 | | 0.81 | |
| March | 167 | 708 | 6.29 | 6.56 | 0.27 | 0.30 | 2.58 | 2.19 |
| April | 243 | 951 | 6.56 | 6.86 | 0.30 | | 2.35 | |
| May | 264 | 1215 | 6.86 | 7.10 | 0.24 | | 2.83 | |
| June | 199 | 1414 | 7.10 | 7.25 | 0.15 | | 4.57 | |
| July | 313 | 1727 | 7.25 | 7.45 | 0.20 | | 3.47 | |
| August | 312 | 2039 | 7.45 | 7.62 | 0.17 | | 4.17 | |
| September | 211 | 2250 | 7.62 | 7.72 | 0.10 | | 7.04 | 8.30 |
| October | 142 | 2392 | 7.72 | 7.78 | 0.06 | | 11.32 | |
| November | 102 | 2494 | 7.78 | 7.82 | 0.04 | 0.11 | 16.60 | |
| December | 251 | 2745 | 7.82 | 7.92 | 0.10 | | 7.23 | |
| Total | 2745 | | | | | 0.41 | | 10.49 |

Table 4 discussed the relative growth rate of the articles during the months between January and December of the year 2019. The months February, July and August have more than 300 articles. The remaining nine months have below 300 articles. It could be deduced that the month July has higher productivity and the month November has lower productivity when compared to the other months.

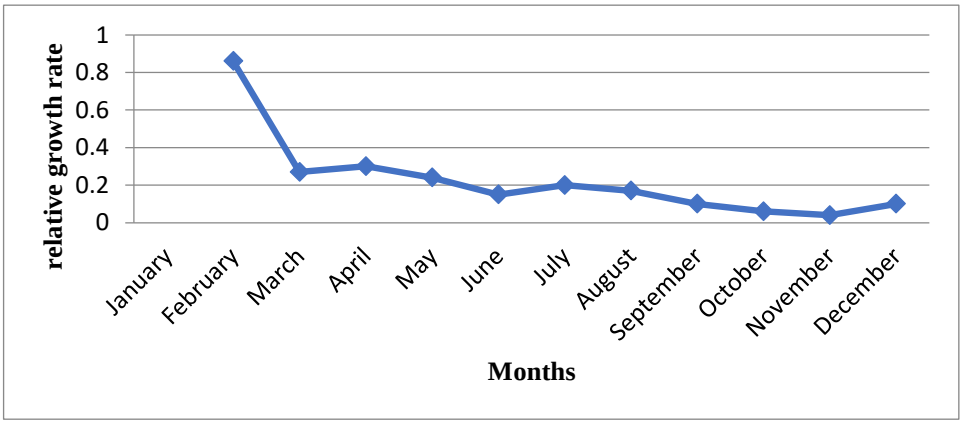


Figure 5: Relative growth rate of publications for the year 2019

The mean relative growth rate for the year 2019 is 0.41. Significantly, the doubling time for article output has increased from 2.19 from January to June and to 8.30 in the months July to December. The mean doubling time for articles output in the same year is 10.49 (Figure 5 and figure 6).

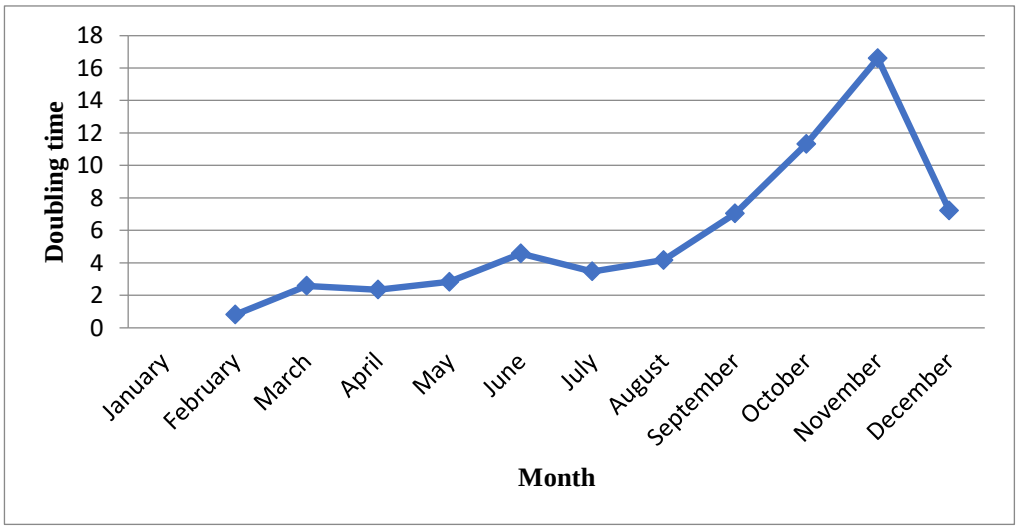


Figure 6: Doubling time of publications for the year 2019

***Highly productive subject areas***

Subject-wise literature growth of cardiovascular diseases articles output for the study period of 2015 to 2019 found a total of 40 specialties. Table 5 shows that top ten high productive subjective areas in research output in cardiovascular diseases research distributions of publication.

Table 5: Subject-wise literature growth

| Specialties | No of articles | % |
|---|---|---|
| Cardiovascular | 2939 | 35.87 |
| Internal Medicine | 1232 | 15.04 |
| Endocrinology and Metabolism | 954 | 11.64 |
| Gastroenterology and Hepatology | 493 | 6.02 |
| Neurology | 340 | 4.15 |
| Psychiatric/Mental Health | 301 | 3.67 |
| Nephrology | 209 | 2.55 |

| | | |
|---|---|---|
| Obstetrics and Gynecology | 203 | 2.48 |
| Medical Education | 198 | 2.42 |
| Surgery | 189 | 2.31 |

The publication output in cardiovascular diseases research during 2015-2019 has been published in the context of subject areas (as reflected in *ClinicalKey* database classification) with highest publication output coming from Cardiovascular (35.87%), followed by Internal Medicine (15.04%) and Endocrinology and Metabolism (11.64%).The lowest contribution of article among the top 10 list of subject occupied in Surgery (2.31%) per publication. From the Subject-wise literature growth analysis, it can be inferred that the most number of publications are made in the Cardiovascular whereas the least number is made in Oncology.

***Distribution of journals***

Total of 8193 records is covered in the 405 journals. Table 6 shows the range of articles distribution of journals.

Table 6: Distribution of articles to journals

| Article range | Number of journals | % |
|---|---|---|
| 200 < | 402 | 99.25 |
| 200 - 400 | 1 | 0.25 |
| 400- 600 | 1 | 0.25 |
| 600> | 1 | 0.25 |
| | 405 | 100 |

It is visible that 402 out of 405 journals have published less than 200 articles such as less than 25 articles in 339 journals, between 25 to 49 articles in 33 journals, between 50 to 74 and between 75 to 99 articles in 8 journals each and greater than 100 articles in 14 journals. Out of the remaining three journals, each has published the number of articles in range 200-400, 400-600 and greater than 600 during the study period.

***Distribution of journals in cardiovascular diseases based on Bradford Law of Scattering***

Bradford's Law of scattering describes a quantitative relationship between journals and the papers they publish. It explains that only a small number of core journals will supply the nucleus of papers on a given topic which accounts for a substantial percentage (1/3) of the articles, to be followed by a second larger group of journals that accounts for another one-third of the articles while the next group contains the remaining one-third of articles.

Bradford's law of scatters states that documents on a given subject are distributed (scattered) according to a certain mathematical function so that growth in articles on a subject requires a growth in the number of journals. The numbers of the groups of journals to produce nearly equal numbers of articles are roughly in proportion to 1: n: $n^2$, where n is called the Bradford multiplier. Explained in words, Bradford's law states that a small core of, for example, journals have as many papers on a given subject as a much larger number of journals n which again has as many papers on the subject as $n^2$ journals (Rao,1998).

Table 7: Distribution of articles to journals according to Bradford's law

| Zone | Number of journals | % | Number of articles | % |
|---|---|---|---|---|
| Zone 1 | 8 | 1.98 | 2702 | 32.98 |
| Zone 2 | 34 | 8.39 | 2729 | 33.31 |
| Zone 3 | 363 | 89.63 | 2762 | 33.71 |
| Total | 405 | 100 | 8193 | 100 |

As per the Bradford law, the journals are grouped into three zones producing a similar number of articles. First one as the nucleus zone (core journals) which is highly productive, the second zone is the moderately productive zone and the third as the low productive zone.

The distribution of the journal by zone wise is given in Table 7. It is seen from Table 7 that 8 core journals grouped in zone 1 published 2702 articles

accounting for one-third of the total output. Similarly, the second zone comprises of 34 journals and 363 journals are grouped in the third zone. Bradford's law states that the number of periodicals in zones, the first zone, second zone and third zone will be 1: n: $n^2$. Accordingly, the relationship in the zones will be 8: 34: 363. On comparison with the data in Table 7, it is clear that the trend of research publication confirms the implication of Bradford's law.

***Ranking of core journals in cardiovascular diseases***

This type of study using research articles is essential to determine the bibliometric features in a specific subject field. It helps to identify core journals; the journal publishing the maximum number of papers in any area is considered a core journal (Mittal et al., 2006).

Ranking of the core journals on the research output on cardiovascular diseases for the year 2015-2019 is given in Table 8. JACC (Journal of the American College of Cardiology) and Atherosclerosis both published the top two leading journals that publish the maximum number of articles.

Table 8 : Core journals grouped in zone 1

| Serial no | Rank | Name of journal | Frequency |
|---|---|---|---|
| 1 | 1 | JACC (Journal of the American College of Cardiology) | 1107 |
| 2 | 2 | Atherosclerosis | 498 |
| 3 | 3 | International Journal of Cardiology | 254 |
| 4 | 4 | Diabetes Research and Clinical Practice | 193 |
| 5 | 5 | American Journal of Cardiology, The | 168 |
| 6 | 6 | Diabetes & Metabolic Syndrome: Clinical Research & Reviews | 165 |
| 7 | 7 | American Journal of Kidney Diseases | 159 |
| 8 | 8 | Lancet, The | 158 |

## Conclusion

Bibliometric analysis is a reliable tool to evaluate the development and quality of scientific production. It can be inferred from this study that cardiovascular diseases are a developing branch in health sciences. Here in this article, it discussed the contributions made by cardiovascular diseases researchers during 2015-2019 as reflected in *ClinicalKey* database. The data suggest that there was a significant research activity in the field of cardiovascular diseases during the study period. The study quantitatively identifies the cardiovascular diseases literature pattern and trends. During the five year time, the number of publications significantly increased.

The analysis of the growth of cardiovascular diseases reveals that the maximum numbers of articles were published in the year 2019 with 2745(33.50%) articles and the minimum number of articles published in 2015 with 847(10.34%)articles and the relative growth rate has a decreasing trend and doubling time for publications has increased remarkably. The result of the study shows that the relative rate of the growth of publications is gradually decreasing, although the number of publications significantly increased.

The average of the month-wise distribution of articles was 1,639 articles per year. In the years 2015 and 2019, the months May and July respectively has produced the maximum number of articles and the minimum number of articles were published in November for both years. The month-wise mean relative growth rate also shows a decreasing trend. These results reveal that it takes more time to double the number of articles in 2019 (10.49 months) when compared to 2015 (10.34 months).

The highest contribution of articles among the top 10 list of subjects is occupied by cardiovascular specialty (35.87%) whereas the least number is occupied by the Surgery specialty (2.31%). Less than 200 articles were published in 402 out of 405 journals. The highest number of articles was published in the remaining three journals and those three journals are JACC (Journal of the American College of Cardiology), Atherosclerosis and International Journal of Cardiology.

The formulation of the applicability of Bradford's law of scattering in various journals is identified. It is evident that from the classifications of journals according to Bradford distributions reveal the facts that the 19 journals covered 50% of articles.

This study is important to understand the nature of the e-resources in journals on cardiovascular diseases in the *ClinicalKey* database from 2015 to 2019. This paper is useful not only for library professionals in collection development of libraries but also for medical professionals to analyze literature in *ClinicalKey* database. The study is also important for medical students who study on cardiovascular diseases.

*ClinicalKey* is comprehensive coverage of clinical topics and this information is important as clinicians are increasingly striving to assist in educating their patients so that they become actively involved in their healthcare decisions. This review describes the content and major features of *ClinicalKey* and provides information concerning how the system can be enhanced. *ClinicalKey* is a clinical knowledge solution designed to help healthcare professionals and students to find the right answers at the right time through a wide breadth and depth of trusted content.

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