Studies on Relative Growth Rate and Doubling Time of Publications Productivity of Nuclear Medicine Research

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Authors' contributions

This work was carried out in collaboration between both authors. Author NR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author ST supervised the study. Both authors read and approved the final manuscript.

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ABSTRACT

Scientometrics is a branch of the library and information science. Scientometric tools can be used to quantify and compare the scientific activities at various levels of collection including institutions, sectors, provinces, and countries. They can also be used to measure research collaborations, map scientific networks, and monitor the evolution of scientific fields. Scientometric indicators give policy-makers objective, reproducible, and therefore verifiable information that goes away from the unreliable. Scientometrics is anxious about the quantitative features and characteristics of science and scientific research. Scientometrics is a restraint, which uses statistical and computational techniques to realize the structure and changing aspects of science. The study shows that the Authorship Pattern in Nuclear Medicine literature fluctuates from single-authored publications to 78 authored publications during the study period 1991-2020. As per the analysis of the table, the highest number of research output by single-authored was 14.06% with 1776 contributions followed by double authored contributions was 13.07% (1651) and three authored contributions were 12.59% (1590).

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1. INTRODUCTION

Scientometrics is a new branch of knowledge, which uses bibliometric measurements for the evaluation of scientific progress, level of scientific developments, social relevance, and impact of the applications of science and technology. Many of these studies border on the science of science, science policy, etc. The term scientometrics was derived from the Russian term and is defined as the study of the measurements of scientific and technological progress [1]. Scientometrics is the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities including, among others, publication and so overlaps bibliometrics to some extent [2]. Measuring results and developments of science are called scientometrics and more, in particular, measuring these developments by analyzing articles, books, and journals is called bibliometrics [3]. Application of quantitative techniques (systems analysis, mathematical and statistical techniques, etc) to scientific communications (science output, science policy) Science administration, etc. [4].

1.1 Nuclear Medicine

Nuclear medicine is a field of medicine that develops its name from the utilization of radioactive rays emitted from the atomic nuclei of non-sealed radionuclide for the diagnosis and treatment of diseases. The field is separated into diagnosis and therapy. Diagnostic Nuclear medicine is generally divided into diagnostic imaging, in which biological functions are estimated built on images obtained by external counting of radionuclide-labeled agents, and in vitro testing, in which trace elements in biological samples such as blood and urine collected from living subjects are measured by radioimmunoassay techniques.

Intervention using radionuclide is called “radionuclide therapy”. For instance, Na 131I is used for the treatment of hyperthyroidism and thyroid cancer, 97SrCl2 is used for firing pain in patients with bone metastasis from malignant tumors, and 90Y is used for labeling monoclonal antibodies focused against cancer antigens. The origin of nuclear medicine can be found back in the discovery of X-rays and radionuclide. Three months after the discovery of the X-ray, Becquerel discovered that radioactive rays were produced from uranium. After that natural radionuclides such as polonium and radium were found successively by Pierre and Marie Curie. By 1902, it started that the radioactive rays emitted from radionuclides were γ-rays, β-rays (electrons), and γ-rays (electromagnetic waves). Also, in 1932, positrons were detected from cosmic rays.

1.2 Statement of the Research Problem

The present study is to analyze the scholarly publications of research in the area of Nuclear Medicine for a period of 30 years from 1991 to 2020. This study intends to identify the list of core journal publications, growth rate, research productivity of authors and institutions, the contribution of each country, continent, and various similar aspects at national and international levels in the field of Nuclear Medicine. The present research is entitled “Mapping of Research productivity on Nuclear Medicine: A Scientometric Analysis”.

1.3 Need of the Study

The present study is of much significance, Nuclear Medicine can treat a wide variety of diseases and disorders at the same time it has some controversies. At this juncture, it is necessary to eradicate the misconceptions on Nuclear Medicine and to analyze the quantitative and qualitative research output of literature in Nuclear Medicine by applying Scientometric methods.

1.4 Review of Literature

Vijayakumar, Sivasubramaniyan, and Rao [5] carried out to investigate the “Bibliometrics analysis of the Indian Journal of Nuclear medicine during the period 2014-2018”. The data obtained from the Scopus bibliographic database for the study. The main objectives of the study authorship pattern, the most prolific authors, most productive countries. They reported a total of 513 papers published in the study period. 2017 was the most productive year with 114(22.22%) publications. The highest citation was received in the year 2014 with 195(36.25%). The high frequented keywords are “Human” which is the topper with 434 (84.60%)
publications. The most productive journal in India with publications of 388 (75.63%).

McKellar and Currie [6] evaluated “Publication productivity in Nuclear Medicine from 2009 to 2013”. They obtained the data from the PubMed database; they retrieved 165 documents from the database. The most prolific Radiotherapy author is the highest number of articles42 has the 2nd position. Brennan is the most prolific Radiographer with 58 articles overall in the 1st position.

Rathika and Thanuskodi [7] analyzed “Research output on Encephalitis Literature during the year 2008-2017”. The data were retrieved from the Web of Science database. The adopts various methods like relative growth rate, exponential growth rate, doubling time, etc. The study revealed that Encephalitis published 6,405 articles. The highest number of articles published in the year 2017 followed by 2016. The USA has the highest number of publications with 2,331 (36.39%). The study exposes is clear that the relative growth rate of total research output decreased gradually. The growth rate is 0.29 in 2008 which decreased up to 0.07 in 2017. The mean relative growth rate for the study period from 2007 to 2017 is 0.11. The study that the Vincente. Occupied first position followed by Weaver SC., occupied the second rank in the list.

Garg & Kumar [8] carried out a study on “Bibliometrics of the global Drug Abuse Research Output as Reflected by Coverage in Web of Science Core Collection during 2001-2018” and the data required for the study was retrieved from the Web of Science database. A total of 18, 431 records were retrieved published in the drug cancer. The study revealed that SUA is the most productive country in research related to drug abuse and produced far more scientific papers than European countries. They have been published in 20 different languages. The highest number of papers 16,180 (96.6%) were published in the English language. The University of California System is the most prolific institution of 1002 (5.31%). The top 12 authors published more than 35 papers; the average number of papers is 4.7. Of the top 12 prolific authors, 10 authors were from the USA and two from Sweden. The study concluded that the mechanism is needed that support research in developing and marginalized economies as drug abuse is also prevalent in these countries.

Sadik Batcha [9] carried out “Research contributions on oral cancer in India during the period 2010-2017”. The data retrieved from the Web of Science database for the study. The study reported that the USA produced 31.34% of global publications on oral cancer. All India Institute of Medical Science has a TLCS of 490 and TGCS 3980. The most productive journals colloids and surface B-Bio interfaces 1180 articles and impact factor 3.887. According to statistics, the number of deaths in 2012 due to oral cancer is 36463 in males and 15361 in females. The study concluded that Indian oral cancer research is continuously increasing. This study may have found that a hospital and a university have very active research activities as compared to other specialized research Institutes.

Gupta and Ahmed [10] carried out “Pancreatitis cancer research in India during 2007-2016” to retrieve the data using the Scopus database. They examined 1168 articles obtained from the database. The international collaborative publications in pancreatic research were 26.71% during 2007-2016. The USA is the largest publications share with 65.06%, followed by Japan (16.35%). The total journal output of 1148 papers. Published in the journal of pancreas 32 during 2007-2011.

1.5 Objectives of the Study

- To assess the evolution of research productivity on Nuclear Medicine.
- Research output at national levels during the period 1991-2020.
- To evaluate the development of research productivity on Nuclear Medicine Research output at a national and international levels during the study period 1991-2020.
- To study relative growth Rate (RGR) and Doubling Time (DT) of Nuclear Medicine.
- To identify the authorship pattern to find the top-level authors along with their institutions in the field of Nuclear Medicine.
- To find out the year-wise distribution of pages and references in Nuclear Medicine.
- To spot and list out the core journals in the field of Nuclear Medicine during the period 1991-2020.

2. METHODOLOGY

The study aims to recognize the growth of scientific output in the field of Nuclear Medicine for a period of 30 years (from 1991 to 2020). The data required for the present study were retrieved from the Web of Science database. A total of 12,832 records were retrieved using the
keyword search term (TOPIC ("Nuclear Medicine"); AND Timespan: 1991-2020 from the database. The retrieved data were analyzed by using Microsoft-Excel package, HistCite software, Bib Excel, and VOS viewer Software as per the objectives of the study, and the data has been presented as tables and graphs. The study was designed to evaluate and know the growth rate of output, authorship productivity, collaborative tendency, citation metrics, top journal’s list, and geographical distribution of publications at national and international levels in Nuclear Medicine.

2.1 Data Analysis

2.1.1 Growth rate of publications

The growth rate is a measurement which necessary in any field. In meaning the growth of the number of publications in a specific discipline, this is frequently a measure of the annual increase or decrease. Table 1 shows that the growth of Nuclear Medicine totally 12,632 records the maximum number of publications in the year 2020 with 771 (6.10%) publications followed by the year 2019 with 677 (5.63%) publications and the least number of publications in the year 1992 with 170 (1.35%) publications respectively.

\[
AGR = \frac{\text{End Value} - \text{First Value}}{\text{First Value}} \times 100
\]

The annual growth rate of publications during the year 1991-2020 between -2.30 and 13.88. The highest annual growth rate was (40.00) in 1993 followed by (27.73) in 1995 and (21.29) growth in 2010. This specifies that the attentiveness and importance of nuclear medicine have been in the study period (1991-2020).

Table 1. Growth of nuclear medicine literature

| Sl. No. | Year | No. of records | % of 12632 | Cumulative growth | Cumulative % | Annual growth rate (AGR) |
|--------|------|---------------|------------|------------------|-------------|-------------------------|
| 1      | 1991 | 174           | 1.38       | 174              | 1.38        | -2.30                   |
| 2      | 1992 | 170           | 1.35       | 344              | 2.72        | 40.00                   |
| 3      | 1993 | 238           | 1.88       | 582              | 4.61        | -7.56                   |
| 4      | 1994 | 220           | 1.74       | 802              | 6.35        | 27.73                   |
| 5      | 1995 | 281           | 2.22       | 1083             | 8.57        | 21.29                   |
| 6      | 1996 | 271           | 2.15       | 1354             | 10.72       | -3.86                   |
| 7      | 1997 | 313           | 2.48       | 1667             | 13.20       | 15.50                   |
| 8      | 1998 | 300           | 2.37       | 1967             | 15.57       | -4.15                   |
| 9      | 1999 | 331           | 2.62       | 2298             | 18.19       | 10.33                   |
| 10     | 2000 | 314           | 2.49       | 2612             | 20.68       | -5.14                   |
| 11     | 2001 | 322           | 2.55       | 2934             | 23.23       | 2.55                    |
| 12     | 2002 | 312           | 2.47       | 3246             | 25.70       | -3.11                   |
| 13     | 2003 | 341           | 2.70       | 3587             | 28.40       | 9.29                    |
| 14     | 2004 | 346           | 2.74       | 3933             | 31.14       | 1.47                    |
| 15     | 2005 | 341           | 2.70       | 4274             | 33.83       | -1.45                   |
| 16     | 2006 | 364           | 2.88       | 4638             | 36.72       | 6.74                    |
| 17     | 2007 | 401           | 3.17       | 5039             | 39.89       | 10.16                   |
| 18     | 2008 | 473           | 3.74       | 5512             | 43.64       | 17.96                   |
| 19     | 2009 | 451           | 3.57       | 5963             | 47.21       | -4.65                   |
| 20     | 2010 | 547           | 4.33       | 6510             | 51.54       | 21.29                   |
| 21     | 2011 | 593           | 4.69       | 7103             | 56.23       | 8.41                    |
| 22     | 2012 | 549           | 4.35       | 7652             | 60.58       | -7.42                   |
| 23     | 2013 | 559           | 4.43       | 8211             | 65.00       | 1.82                    |
| 24     | 2014 | 575           | 4.55       | 8786             | 69.55       | 2.86                    |
| 25     | 2015 | 547           | 4.33       | 9333             | 73.88       | -4.87                   |
| 26     | 2016 | 599           | 4.74       | 9932             | 78.63       | 9.51                    |
| 27     | 2017 | 596           | 4.72       | 10528            | 83.34       | -0.50                   |
| 28     | 2018 | 656           | 5.19       | 11184            | 88.54       | 10.07                   |
| 29     | 2019 | 677           | 5.36       | 11861            | 93.90       | 3.20                    |
| 30     | 2020 | 771           | 6.10       | 12632            | 100         | 13.88                   |

Total 12632 100

201
The years 1992, 1994, 1996, 1998, 2000, 2002, 2005, 2009, 2012, 2015, and 2017 have a negative growth rate. The goal for the fluctuation is that there is no continuous growth of publications every year.

Citation exploration is a top indicator in calculating individuals. Citation analysis forms link between various disciplines, study workers, periodicals, authors and countries. Citations are assumed to reflect the quality of research. Table 2 illustrated Year-wise Local Citation Score of Nuclear Medicine Literature. It was found that the highest local citation score is 1198 in the year 2008 and the lowest number of citations 158 was found in the year 2020. During the study period a total of 19323 citations were received. The overall citation per paper was 1.53 and average citation per year was 644.

The Relative Growth Rate (RGR) is increase in the number of articles or pages per unit of time. The mean RGR is over the specific period of interval can be calculated from the following formula.

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

$W_1$ is log of initial number of articles; $W_2$ is log of final number of articles after a specific period of interval $T_2 - T_1$ is unit difference between the initial time and the final time.

Table 2. Year-wise local citation score of nuclear medicine literature

| Year | No. of records | Local citation score | % of 19323 | Citation per publication |
|------|----------------|----------------------|------------|-------------------------|
| 1991 | 174            | 256                  | 1.32       | 1.47                    |
| 1992 | 170            | 325                  | 1.68       | 1.91                    |
| 1993 | 238            | 422                  | 2.18       | 1.77                    |
| 1994 | 220            | 434                  | 2.25       | 1.97                    |
| 1995 | 281            | 425                  | 2.20       | 1.51                    |
| 1996 | 271            | 694                  | 3.59       | 2.56                    |
| 1997 | 313            | 672                  | 3.48       | 2.15                    |
| 1998 | 300            | 637                  | 3.30       | 2.12                    |
| 1999 | 331            | 876                  | 4.53       | 2.65                    |
| 2000 | 314            | 656                  | 3.39       | 2.09                    |
| 2001 | 322            | 675                  | 3.49       | 2.10                    |
| 2002 | 312            | 683                  | 3.53       | 2.19                    |
| 2003 | 341            | 764                  | 3.95       | 2.25                    |
| 2004 | 346            | 769                  | 3.98       | 2.22                    |
| 2005 | 341            | 821                  | 4.25       | 2.41                    |
| 2006 | 364            | 804                  | 4.16       | 2.21                    |
| 2007 | 401            | 866                  | 4.48       | 2.16                    |
| 2008 | 473            | 1198                 | 6.20       | 2.53                    |
| 2009 | 451            | 938                  | 4.85       | 2.08                    |
| 2010 | 547            | 1026                 | 5.31       | 1.88                    |
| 2011 | 593            | 1065                 | 5.51       | 1.80                    |
| 2012 | 549            | 684                  | 3.54       | 1.25                    |
| 2013 | 559            | 787                  | 4.07       | 1.43                    |
| 2014 | 575            | 670                  | 3.47       | 1.18                    |
| 2015 | 547            | 500                  | 2.59       | 0.91                    |
| 2016 | 599            | 449                  | 2.32       | 0.75                    |
| 2017 | 596            | 476                  | 2.46       | 0.80                    |
| 2018 | 656            | 376                  | 1.95       | 0.57                    |
| 2019 | 677            | 217                  | 1.12       | 0.33                    |
| 2020 | 771            | 158                  | 0.82       | 0.22                    |
| Total | 12632          | 19323                | 100        | 1.53                    |
Table 3. Relative growth rate and doubling time

| Sl. No. | Year | No. of records | Cumulative growth | W1   | W2   | Relative growth rate (RGR) | Doubling time (DT) |
|---------|------|----------------|-------------------|------|------|---------------------------|--------------------|
| 1       | 1991 | 174            | 174               | 5.16 | 5.16 | 0.68                      | 1.02               |
| 2       | 1992 | 170            | 344               | 5.16 | 5.84 | 0.68                      | 1.02               |
| 3       | 1993 | 238            | 582               | 5.84 | 6.37 | 0.53                      | 1.32               |
| 4       | 1994 | 220            | 802               | 6.37 | 6.69 | 0.32                      | 2.16               |
| 5       | 1995 | 281            | 1083              | 6.69 | 6.99 | 0.30                      | 2.31               |
| 6       | 1996 | 271            | 1354              | 6.99 | 7.21 | 0.22                      | 3.10               |
| 7       | 1997 | 313            | 1667              | 7.21 | 7.42 | 0.21                      | 3.33               |
| 8       | 1998 | 300            | 1967              | 7.42 | 7.58 | 0.17                      | 4.19               |
| 9       | 1999 | 331            | 2298              | 7.58 | 7.74 | 0.16                      | 4.46               |
| 10      | 2000 | 346            | 2612              | 7.74 | 7.87 | 0.13                      | 5.41               |
| 11      | 2001 | 312            | 2934              | 7.87 | 7.98 | 0.12                      | 5.96               |
| 12      | 2002 | 312            | 3246              | 7.98 | 8.09 | 0.10                      | 6.86               |
| 13      | 2003 | 341            | 3587              | 8.09 | 8.19 | 0.10                      | 6.94               |
| 14      | 2004 | 346            | 3933              | 8.19 | 8.28 | 0.09                      | 7.53               |
| 15      | 2005 | 341            | 4274              | 8.28 | 8.36 | 0.08                      | 8.33               |
| 16      | 2006 | 364            | 4638              | 8.36 | 8.44 | 0.08                      | 8.48               |
| 17      | 2007 | 401            | 5039              | 8.44 | 8.52 | 0.08                      | 8.36               |
| 18      | 2008 | 473            | 5512              | 8.52 | 8.61 | 0.09                      | 7.72               |
| 19      | 2009 | 451            | 5963              | 8.61 | 8.69 | 0.08                      | 8.81               |
| 20      | 2010 | 547            | 6510              | 8.69 | 8.78 | 0.09                      | 7.90               |
| 21      | 2011 | 593            | 7103              | 8.78 | 8.87 | 0.09                      | 7.95               |
| 22      | 2012 | 549            | 7652              | 8.87 | 8.94 | 0.07                      | 9.31               |
| 23      | 2013 | 559            | 8211              | 8.94 | 9.01 | 0.07                      | 9.83               |
| 24      | 2014 | 575            | 8786              | 9.01 | 9.08 | 0.07                      | 10.24              |
| 25      | 2015 | 547            | 9333              | 9.08 | 9.14 | 0.06                      | 11.47              |
| 26      | 2016 | 599            | 9932              | 9.14 | 9.20 | 0.06                      | 11.14              |
| 27      | 2017 | 596            | 10528             | 9.20 | 9.26 | 0.06                      | 11.89              |
| 28      | 2018 | 656            | 11184             | 9.26 | 9.32 | 0.06                      | 11.46              |
| 29      | 2019 | 677            | 11861             | 9.32 | 9.38 | 0.06                      | 11.79              |
| 30      | 2020 | 771            | 12632             | 9.38 | 9.44 | 0.06                      | 11.00              |
| Total   |      | 12632          |                   |      |      |                           |                    |

Table 3 denoted the Relative Growth Rate (RGR) of Nuclear medicine for the study period. The maximum RGR value was 0.68 in the year 1992 and followed by the year 1993 with the value of 0.53. Similarly, the lowest value showed in the years 2015, 2016, 2017, 2018, 2019, and 2020 with the same value of 0.06. The Doubling time is the time required of publications to double size. As observed by Bradford “Between Relative growth rate and doubling time there is a direct equivalence”. For the study doubling time of publications was calculated by the formula is given.

\[
DT = \frac{0.693}{RGR}
\]

Table 3 disturbed with the Doubling Time (DT). It was recognized that the maximum DT in the year 2017 with the value of 11.89 and followed by the year 11.79. Similarly, the lowest DT was reported in the year 1992 with a value of 1.02. On the whole, it was known to there was also variation in both Relative Growth Rate and Doubling Time during the study period.

Times Series Analysis deals with the Future Growth of publications. Each Year the publication production is rising massively and the growth of publication are analyzed with the getting worse analysis. Hence, the technique is used to calculate the number of publications for the near future. In this study 2025, 2030, 2040, and 2050 are studied. Since the calculations, it is found that the valued future growth in Nuclear Medicine literature increased from 2020 with 771 publications to 2025 with 777 publications to 2030 with 867 publications to 2040 with 1045 publications and 2050 with 1223 publications. Hence, it was assumed that the growth of
Table 4. Time series analysis of nuclear medicine literature

| Sl. No. | Year | Publications (Y) | X  | X²  | XY    |
|--------|------|------------------|----|-----|-------|
| 1      | 1991 | 174              | -14.5 | 210.25 | -2523 |
| 2      | 1992 | 170              | -13.5 | 182.25 | -2295 |
| 3      | 1993 | 238              | -12.5 | 156.25 | -2975 |
| 4      | 1994 | 220              | -11.5 | 132.25 | -2530 |
| 5      | 1995 | 281              | -10.5 | 110.25 | -2950.5 |
| 6      | 1996 | 271              | -9.5  | 90.25  | -2574.5 |
| 7      | 1997 | 313              | -8.5  | 72.25  | -2660.5 |
| 8      | 1998 | 300              | -7.5  | 56.25  | -2250 |
| 9      | 1999 | 331              | -6.5  | 42.25  | -2151.5 |
| 10     | 2000 | 314              | -5.5  | 30.25  | -1727 |
| 11     | 2001 | 322              | -4.5  | 20.25  | -1449 |
| 12     | 2002 | 312              | -3.5  | 12.25  | -1092 |
| 13     | 2003 | 341              | -2.5  | 6.25   | -852.5 |
| 14     | 2004 | 346              | -1.5  | 2.25   | -519 |
| 15     | 2005 | 341              | 0.0   | 0.25   | 170.5 |
| 16     | 2006 | 364              | 0.5   | 0.25   | 182 |
| 17     | 2007 | 401              | 1.5   | 2.25   | 601.5 |
| 18     | 2008 | 473              | 2.5   | 6.25   | 1182.5 |
| 19     | 2009 | 451              | 3.5   | 12.25  | 1578.5 |
| 20     | 2010 | 547              | 4.5   | 20.25  | 2461.5 |
| 21     | 2011 | 593              | 5.5   | 30.25  | 3261.5 |
| 22     | 2012 | 549              | 6.5   | 42.25  | 3568.5 |
| 23     | 2013 | 599              | 7.5   | 56.25  | 4192.5 |
| 24     | 2014 | 575              | 8.5   | 72.25  | 4887.5 |
| 25     | 2015 | 547              | 9.5   | 90.25  | 5196.5 |
| 26     | 2016 | 599              | 10.5  | 110.25 | 6289.5 |
| 27     | 2017 | 596              | 11.5  | 132.25 | 6854 |
| 28     | 2018 | 656              | 12.5  | 156.25 | 8200 |
| 29     | 2019 | 677              | 13.5  | 182.25 | 9139.5 |
| 30     | 2020 | 771              | 14.5  | 210.25 | 11799.5 |
| Total  |      | 12632            | 0    | 2247.5 | 40055 |

publications in the Nuclear Medicine literature may be definitely improved as per the projected future years.

Straight Line equation $Y_c = a + bX$
Since $\Sigma X = 0$
a = $\Sigma Y/N = 12632/30 = 421.07$
b = $\Sigma XY/\Sigma X^2 = 40055/2247.5 = 17.82$
Estimated literature in 2025 = $421.07 + (17.82\times(2025-2005)) = 777.47$
Estimated literature in 2030 = $421.07 + (17.82\times(2030-2005)) = 866.57$
Estimated literature in 2040 = $421.07 + (17.82\times(2040-2005)) = 1044.77$
Estimated literature in 2050 = $421.07 + (17.82\times(2050-2005)) = 1222.97$

Table 5 represented the number of pages in Nuclear Medicine Literature during the period 1991-2020 of the study. It was found that 99952 pages are found to contain 12632 publications during the period. The highest number of pages of 6982 (6.99%) is found to be 771 publications in 2020, followed by 6089 (6.09%) of the pages found out to be in 677 publications in 2019. It concludes that the overall pages of the publications between 1103(1.10%) appearing in 174 publications in 1991 and 3021(3.02%) of papers appearing in 364 publications in 2006. It is found that in general, when there is an increase in the publication the growth is also found to be increased. It is noted that the same did not appear in the fluctuating trend during the study.

The above Table 6 shows the year wise distribution of references in Nuclear Medicine during 1991-2020. It is observed from the data that there is a decreasing and increasing trend in the quantum references from 1991-2020. It was obvious from the table that a maximum number of references (7.32%) were published in the year 2015.
Table 5. Year-wise Distribution of Pages Output

| Sl. No. | Year | No. of publications | No. of pages | % of 99952 | Average no. of pages per publications |
|--------|------|---------------------|--------------|------------|--------------------------------------|
| 1      | 1991 | 174                 | 1103         | 1.10       | 6.34                                 |
| 2      | 1992 | 170                 | 1092         | 1.09       | 6.42                                 |
| 3      | 1993 | 238                 | 1669         | 1.67       | 7.01                                 |
| 4      | 1994 | 220                 | 1763         | 1.76       | 8.01                                 |
| 5      | 1995 | 281                 | 2360         | 2.36       | 8.40                                 |
| 6      | 1996 | 271                 | 2228         | 2.23       | 8.22                                 |
| 7      | 1997 | 313                 | 2437         | 2.44       | 7.79                                 |
| 8      | 1998 | 300                 | 2651         | 2.65       | 8.64                                 |
| 9      | 1999 | 331                 | 2691         | 2.69       | 8.13                                 |
| 10     | 2000 | 314                 | 2847         | 2.85       | 9.07                                 |
| 11     | 2001 | 322                 | 2257         | 2.26       | 7.01                                 |
| 12     | 2002 | 312                 | 2325         | 2.33       | 7.45                                 |
| 13     | 2003 | 341                 | 2423         | 2.42       | 7.11                                 |
| 14     | 2004 | 346                 | 2742         | 2.74       | 7.92                                 |
| 15     | 2005 | 341                 | 2454         | 2.46       | 7.20                                 |
| 16     | 2006 | 364                 | 3021         | 3.02       | 8.30                                 |
| 17     | 2007 | 401                 | 3038         | 3.04       | 7.58                                 |
| 18     | 2008 | 473                 | 3500         | 3.50       | 7.40                                 |
| 19     | 2009 | 451                 | 3285         | 3.29       | 7.28                                 |
| 20     | 2010 | 547                 | 4004         | 4.01       | 7.32                                 |
| 21     | 2011 | 593                 | 4356         | 4.36       | 7.35                                 |
| 22     | 2012 | 549                 | 4175         | 4.18       | 7.60                                 |
| 23     | 2013 | 559                 | 4247         | 4.25       | 7.60                                 |
| 24     | 2014 | 575                 | 4629         | 4.63       | 8.05                                 |
| 25     | 2015 | 547                 | 4319         | 4.32       | 7.90                                 |
| 26     | 2016 | 599                 | 4593         | 4.60       | 7.67                                 |
| 27     | 2017 | 596                 | 5092         | 5.09       | 8.54                                 |
| 28     | 2018 | 656                 | 5580         | 5.58       | 8.51                                 |
| 29     | 2019 | 677                 | 6089         | 6.09       | 8.99                                 |
| 30     | 2020 | 771                 | 6982         | 6.99       | 9.06                                 |
| Total  |      | 12632               | 99952        | 100        | 7.91                                 |

2020 and minimum number of references (0.73%) of 2817 was published in the year 1992 respectively.

The intellectual communication is well executed by referring to publications to earlier research in the more number of references, the additional quality of the reference paper. Table 7 shows that there are 387952 references covered range from 0 references to 580 references. None of the references covered 17.29% of total publications in the study. The research publication with 11-20 range reference is the highest number in the study. When the number of references increases above 40 the number of publications decreases. Therefore, it is assumed that the optimum number of references in research publications in the nuclear medicine research.

2.2 Author Productivity

Table 8 concerned with Authorship Pattern Vs Number of Publications revealed that the Authorship Pattern in Nuclear Medicine literature fluctuates from single-authored publications to 78 authored publications during the study period 1991-2020. As per the analysis of the table, the highest number of research output by single-authored was 14.06% with 1776 contributions followed by double authored contributions was 13.07% (1651) and three authored contributions were 12.59% (1590). At this point, the largest collection had been designed by publications with single-authored to six authored. It was also concluded that only on publication contributed by 78 authors. It displays that collaborative research ruled than specific research in the field of study. There were some anonymous contributions found with 314 publications (2.46%) in the authorship pattern of Nuclear Medicine literature.

Table 9 show that the contributions made as single vs. multiple authors’ publications fluctuated in the study period. The highest percentage of single-authored contributions was identified in the year 1995 with 87 publications and the highest percentage of multi-authored contributions identified in the year 2020 with 706 publications. It was visibly specified that the multi-authorship pattern with 10542 (83.45%)
publications was biggest than the single authorship pattern with 1776 (14.06%) publications. It was known that collaborative authorship was the major kind of authorship pattern in the field of Nuclear medicine literature.

Table 10 illustrate the Degree of Collaboration, Collaboration Index, and Collaboration Co-efficient. Using Subramanyam’s formula using the Degree of Collaboration in Nuclear Medicine Literature.

\[
DC = \frac{Nm}{Nm + Ns}
\]

Nm=Number of Multi authors during a period in a field
Ns=Number of Single authors during a period in a field

The Degree of Collaboration ranged from 0.60 to 0.92 during the period (1991 to 2020). The Degree of Collaboration was on the increasing trend throughout the study period. The minimum value (0.60) in the year 1991 and 0.92 in the year 2013, 2015, and 2020 which was the maximum. When two or more two authors contribute their knowledge to publish a paper with joint or collaborative work is called collaboration. The CI can obtain by the total number of authors divided by the number of published articles. The following results were observed CI values between 4.04 and 6.76. The CI was valued for the year 1991 to 2020 such that; the minimum number of values 3.97 in the year 1993 followed by 3.98 in the year 1992. The maximum number of values 6.86 in the year 2019.

Collaborative Coefficient that reflects both the mean number of authors per paper as well as the proportion of multi-authored papers. The value of the Collaborative Coefficient range between 0 and 1. The following results were observed that the CC value is between 0.41 and 0.71. The CC was valued for the year 1991 to 2020. The
maximum number of values 0.71 in the year 2020 followed by 0.70 in the year 2015, 2017, and 2018.

From Table 11 document type-wise distribution of publications of Nuclear Medicine literature was detected. As per the analysis, there were 18 types of document categorized. The document type “Article” was the highly preferred document type by the researchers which received 7544 (59.72%) publications with 138460 citations among all types of documents. The document type “Review” received 1642 (13.00%) publications with 47016 citations and the document type “Meeting Abstract” received 1065 (8.43%) publications with 103 citations. Then again, the document type “Review” had received the highest CPP value of 28.63, followed by document type “Article” with the value of 18.35 and “Proceedings Paper” with the value 18.04 respectively. Then again the document type “Article” had received the highest h-index value of 134, followed by document type “Review” with an h-index value is 100 respectively.

Table 12 showed the Language-wise distribution of Nuclear Medicine Research. It was recognized that contributions were made in 19 languages at the global level. It was noted that the English language was the leading language of interaction which received 11651 (92.23%) publications with 204449 citations. After that the German language received 448 (3.55%) publications with 1486 citations and the French language received 303 (2.40%) publications with 382 citations. Also, the language English had received with highest CPP value of 17.55, Followed by Polish with the value 3.89 and Korean with the value of 3.50 respectively. The English language has the highest h-index value 156 followed by German with a value of 16.

**Table 7. Reference pattern vs publications in nuclear medicine literature**

| Reference pattern | No. of records | % of 12632 | No. of references | % of 387952 |
|-------------------|----------------|------------|-------------------|-------------|
| 0                 | 2184           | 17.29      | 0                 | 0           |
| 1-10              | 1551           | 12.28      | 9602              | 2.48        |
| 11-20             | 2369           | 18.75      | 37046             | 9.55        |
| 21-30             | 2264           | 17.92      | 57284             | 14.77       |
| 31-40             | 1447           | 11.46      | 50903             | 13.12       |
| 41-50             | 773            | 6.12       | 35016             | 9.03        |
| 51-60             | 437            | 3.46       | 24134             | 6.22        |
| 61-70             | 329            | 2.60       | 21487             | 5.54        |
| 71-80             | 279            | 2.21       | 21079             | 5.43        |
| 81-90             | 179            | 1.42       | 15294             | 3.94        |
| 91-100            | 185            | 1.46       | 17706             | 4.56        |
| 101-110           | 123            | 0.97       | 12953             | 3.34        |
| 111-120           | 105            | 0.83       | 12154             | 3.13        |
| 121-130           | 62             | 0.49       | 7750              | 2.00        |
| 131-140           | 60             | 0.47       | 8137              | 2.10        |
| 141-150           | 41             | 0.32       | 5975              | 1.54        |
| 151-160           | 50             | 0.40       | 7781              | 2.01        |
| 161-170           | 32             | 0.25       | 5275              | 1.36        |
| 171-180           | 22             | 0.17       | 3849              | 0.99        |
| 181-190           | 18             | 0.14       | 3342              | 0.86        |
| 191-200           | 17             | 0.13       | 3296              | 0.85        |
| 201-210           | 16             | 0.13       | 3303              | 0.85        |
| 211-220           | 10             | 0.08       | 2160              | 0.56        |
| 221-230           | 16             | 0.13       | 3611              | 0.93        |
| 231-240           | 10             | 0.08       | 2360              | 0.61        |
| 241-250           | 12             | 0.09       | 2935              | 0.76        |
| 251-300           | 17             | 0.13       | 4610              | 1.19        |
| 301-400           | 17             | 0.13       | 5555              | 1.43        |
| 401-500           | 5              | 0.04       | 2207              | 0.57        |
| 501-580           | 2              | 0.02       | 1148              | 0.30        |

| Total             | 12632          | 100        | 387952            | 100         |
Table 8. Authorship pattern of nuclear medicine literature

| Authorship pattern | No. of contribution | % of 12632 | No. of authors | % of 61819 |
|--------------------|---------------------|------------|----------------|------------|
| 1                  | 1776                | 14.06      | 1776           | 2.87       |
| 2                  | 1651                | 13.07      | 3302           | 5.34       |
| 3                  | 1590                | 12.59      | 4770           | 7.72       |
| 4                  | 1515                | 11.99      | 6060           | 9.80       |
| 5                  | 1317                | 10.43      | 6585           | 10.65      |
| 6                  | 1183                | 9.37       | 7098           | 11.48      |
| 7                  | 874                 | 6.92       | 6118           | 9.90       |
| 8                  | 713                 | 5.64       | 5704           | 9.23       |
| 9                  | 461                 | 3.65       | 4149           | 6.71       |
| 10                 | 381                 | 3.02       | 3810           | 6.16       |
| 11                 | 245                 | 1.94       | 2695           | 4.36       |
| 12                 | 153                 | 1.21       | 1836           | 2.97       |
| 13                 | 112                 | 0.89       | 1456           | 2.36       |
| 14                 | 75                  | 0.59       | 1050           | 1.70       |
| 15                 | 65                  | 0.51       | 975            | 1.58       |
| 16                 | 44                  | 0.35       | 704            | 1.14       |
| 17                 | 30                  | 0.24       | 510            | 0.82       |
| 18                 | 19                  | 0.15       | 342            | 0.55       |
| 19                 | 23                  | 0.18       | 437            | 0.71       |
| 20                 | 16                  | 0.13       | 320            | 0.52       |
| 21                 | 17                  | 0.13       | 357            | 0.58       |
| 22                 | 8                   | 0.06       | 176            | 0.28       |
| 23                 | 4                   | 0.03       | 92             | 0.15       |
| 24                 | 5                   | 0.04       | 120            | 0.19       |
| 25                 | 5                   | 0.04       | 125            | 0.20       |
| 26                 | 8                   | 0.06       | 208            | 0.34       |
| 27                 | 4                   | 0.03       | 108            | 0.17       |
| 28                 | 3                   | 0.02       | 84             | 0.14       |
| 29                 | 2                   | 0.02       | 58             | 0.09       |
| 30                 | 2                   | 0.02       | 60             | 0.10       |
| 31                 | 4                   | 0.03       | 124            | 0.20       |
| 32                 | 2                   | 0.02       | 64             | 0.10       |
| 33                 | 3                   | 0.02       | 99             | 0.16       |
| 36                 | 1                   | 0.01       | 36             | 0.06       |
| 43                 | 1                   | 0.01       | 43             | 0.07       |
| 46                 | 1                   | 0.01       | 46             | 0.07       |
| 53                 | 1                   | 0.01       | 53             | 0.09       |
| 58                 | 1                   | 0.01       | 58             | 0.09       |
| 64                 | 1                   | 0.01       | 64             | 0.10       |
| 69                 | 1                   | 0.01       | 69             | 0.11       |
| 78                 | 1                   | 0.01       | 78             | 0.13       |
| Anonymous          | 314                 | 2.49       | -              | -          |
| Total              | 12632               | 100        | 61819          | 100        |

Table 9. Single author vs multiple authors of nuclear medicine literature

| Sl. No. | Year | Single author | Multiple authors | Anonymous | Total |
|---------|------|---------------|------------------|-----------|-------|
| 1       | 1991 | 68            | 101              | 5         | 174   |
| 2       | 1992 | 45            | 124              | 1         | 170   |
| 3       | 1993 | 82            | 146              | 10        | 238   |
| 4       | 1994 | 55            | 148              | 17        | 220   |
| 5       | 1995 | 87            | 175              | 19        | 281   |
| 6       | 1996 | 75            | 178              | 18        | 271   |
| 7       | 1997 | 74            | 224              | 35        | 313   |
| 8       | 1998 | 84            | 195              | 21        | 300   |
| 9       | 1999 | 63            | 256              | 12        | 331   |
| 10      | 2000 | 60            | 233              | 21        | 314   |
| 11      | 2001 | 52            | 251              | 19        | 322   |
| 12      | 2002 | 59            | 241              | 12        | 312   |
| 13      | 2003 | 58            | 267              | 16        | 341   |
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| Sl. No. | Year | Single author | Multiple authors | Anonymous | Total |
|---------|------|---------------|------------------|-----------|-------|
| 14      | 2004 | 58            | 281              | 7         | 346   |
| 15      | 2005 | 42            | 286              | 13        | 341   |
| 16      | 2006 | 48            | 302              | 14        | 364   |
| 17      | 2007 | 45            | 348              | 8         | 401   |
| 18      | 2008 | 56            | 407              | 10        | 473   |
| 19      | 2009 | 67            | 379              | 5         | 451   |
| 20      | 2010 | 72            | 467              | 8         | 547   |
| 21      | 2011 | 57            | 533              | 3         | 593   |
| 22      | 2012 | 61            | 483              | 5         | 549   |
| 23      | 2013 | 42            | 510              | 7         | 559   |
| 24      | 2014 | 55            | 512              | 8         | 575   |
| 25      | 2015 | 43            | 500              | 4         | 547   |
| 26      | 2016 | 55            | 537              | 7         | 599   |
| 27      | 2017 | 44            | 545              | 7         | 596   |
| 28      | 2018 | 48            | 600              | 8         | 656   |
| 29      | 2019 | 62            | 607              | 8         | 677   |
| 30      | 2020 | 59            | 706              | 6         | 771   |
| Total   |      | 1776          | 10542            | 314       | 12632 |
| %       |      | 14.06         | 83.45            | 2.49      |       |

Table 10. Degree of collaboration, collaboration index and collaboration co-efficient of nuclear medicine literature

| Sl. No. | Year | Degree of collaboration (DC) | Collaboration index (CI) | Collaboration co-efficient (CC) |
|---------|------|-----------------------------|--------------------------|-------------------------------|
| 1       | 1991 | 0.60                        | 4.04                     | 0.41                          |
| 2       | 1992 | 0.73                        | 3.98                     | 0.49                          |
| 3       | 1993 | 0.64                        | 3.97                     | 0.43                          |
| 4       | 1994 | 0.73                        | 4.18                     | 0.51                          |
| 5       | 1995 | 0.67                        | 4.35                     | 0.47                          |
| 6       | 1996 | 0.70                        | 4.55                     | 0.50                          |
| 7       | 1997 | 0.75                        | 4.54                     | 0.53                          |
| 8       | 1998 | 0.70                        | 4.87                     | 0.50                          |
| 9       | 1999 | 0.80                        | 5.13                     | 0.58                          |
| 10      | 2000 | 0.80                        | 5.25                     | 0.58                          |
| 11      | 2001 | 0.83                        | 5.19                     | 0.60                          |
| 12      | 2002 | 0.80                        | 5.05                     | 0.58                          |
| 13      | 2003 | 0.82                        | 5.49                     | 0.60                          |
| 14      | 2004 | 0.83                        | 5.88                     | 0.61                          |
| 15      | 2005 | 0.87                        | 5.27                     | 0.64                          |
| 16      | 2006 | 0.86                        | 5.57                     | 0.63                          |
| 17      | 2007 | 0.89                        | 5.34                     | 0.64                          |
| 18      | 2008 | 0.88                        | 5.58                     | 0.66                          |
| 19      | 2009 | 0.85                        | 5.79                     | 0.64                          |
| 20      | 2010 | 0.87                        | 5.39                     | 0.65                          |
| 21      | 2011 | 0.90                        | 5.65                     | 0.67                          |
| 22      | 2012 | 0.89                        | 5.56                     | 0.66                          |
| 23      | 2013 | 0.92                        | 5.76                     | 0.69                          |
| 24      | 2014 | 0.90                        | 5.91                     | 0.67                          |
| 25      | 2015 | 0.92                        | 6.01                     | 0.70                          |
| 26      | 2016 | 0.91                        | 6.00                     | 0.68                          |
| 27      | 2017 | 0.93                        | 6.33                     | 0.70                          |
| 28      | 2018 | 0.93                        | 6.53                     | 0.70                          |
| 29      | 2019 | 0.91                        | 6.86                     | 0.69                          |
| 30      | 2020 | 0.92                        | 6.76                     | 0.71                          |
Table 11. Document type wise distribution

| Sl. No. | Document type         | No. of contributions | % of 12632 | Total citations | % of 206951 | CPP h-index |
|---------|-----------------------|----------------------|------------|----------------|-------------|-------------|
| 1       | Article               | 7544                 | 59.72      | 138460         | 66.90       | 18.35       | 134         |
| 2       | Review                | 1642                 | 13.00      | 47016          | 22.72       | 28.63       | 100         |
| 3       | Meeting Abstract      | 1065                 | 8.43       | 103            | 0.05        | 0.10        | 4           |
| 4       | Editorial Material    | 1011                 | 8.00       | 3855           | 1.86        | 3.81        | 26          |
| 5       | Proceedings Paper     | 907                  | 7.18       | 16361          | 7.91        | 18.04       | 58          |
| 6       | News Item             | 192                  | 1.52       | 137            | 0.07        | 0.71        | 6           |
| 7       | Letter                | 159                  | 1.26       | 667            | 0.32        | 4.19        | 10          |
| 8       | Correction            | 33                   | 0.26       | 18             | 0.01        | 0.55        | 3           |
| 9       | Note                  | 31                   | 0.25       | 267            | 0.13        | 8.61        | 9           |
| 10      | Biographical-Item     | 15                   | 0.12       | 5              | 0.00        | 0.33        | 1           |
| 11      | Reprint               | 10                   | 0.08       | 22             | 0.01        | 2.20        | 2           |
| 12      | Book Review           | 8                    | 0.06       | 0              | 0.00        | 0.00        | 0           |
| 13      | Bibliography          | 6                    | 0.05       | 0              | 0.00        | 0.00        | 0           |
| 14      | Item About an Individual | 3                   | 0.02       | 0              | 0.00        | 0.00        | 0           |
| 15      | Book Chapter          | 2                    | 0.02       | 40             | 0.02        | 20.00       | 1           |
| 16      | Poetry                | 2                    | 0.02       | 0              | 0.00        | 0.00        | 0           |
| 17      | Discussion            | 1                    | 0.01       | 0              | 0.00        | 0.00        | 0           |
| 18      | Software Review       | 1                    | 0.01       | 0              | 0.00        | 0.00        | 0           |
| **Total**|                      | **12632**             | **100**    | **206951**     | **100**     | **16.38**   |             |

Table 12. Language wise distributions

| Sl. No. | Language | No. of contributions | % of 12632 | Total citations | % of 206951 | CPP h-index |
|---------|----------|----------------------|------------|----------------|-------------|-------------|
| 1       | English  | 11651                | 92.23      | 204449         | 98.79       | 17.55       | 156         |
| 2       | German   | 448                  | 3.55       | 1486           | 0.72        | 3.32        | 16          |
| 3       | French   | 303                  | 2.40       | 382            | 0.18        | 1.26        | 8           |
| 4       | Spanish  | 149                  | 1.18       | 493            | 0.24        | 3.31        | 11          |
| 5       | Portuguese | 10                  | 0.08       | 29             | 0.01        | 2.90        | 4           |
| 6       | Greek    | 10                   | 0.08       | 20             | 0.01        | 2.00        | 3           |
| 7       | Polish   | 9                    | 0.07       | 35             | 0.02        | 3.89        | 3           |
| 8       | Russian  | 8                    | 0.06       | 13             | 0.01        | 1.63        | 2           |
| 9       | Japanese | 7                    | 0.06       | 11             | 0.01        | 1.57        | 2           |
| 10      | Italian  | 7                    | 0.06       | 2              | 0.00        | 0.29        | 1           |
| 11      | Czech    | 6                    | 0.05       | 15             | 0.01        | 2.50        | 2           |
| 12      | Hungarian | 6                   | 0.05       | 2              | 0.00        | 0.33        | 1           |
| 13      | Serbian  | 5                    | 0.04       | 2              | 0.00        | 0.40        | 1           |
| 14      | Chinese  | 5                    | 0.04       | 1              | 0.00        | 0.20        | 1           |
| 15      | Korean   | 2                    | 0.02       | 7              | 0.00        | 3.50        | 1           |
| 16      | Croatian | 2                    | 0.02       | 2              | 0.00        | 1.00        | 1           |
| 17      | Turkish  | 2                    | 0.02       | 0              | 0.00        | 0.00        | 0           |
| 18      | Slovene  | 1                    | 0.01       | 1              | 0.00        | 1.00        | 1           |
| 19      | Unspecified | 1                   | 0.01       | 1              | 0.00        | 1.00        | 1           |
| **Total**|          | **12632**             | **100**    | **206951**     | **100**     | **16.38**   |             |

3. RECOMMENDATIONS

Based on the findings of the research study two sets of recommendations have been made one for research organisations and another for researchers.

- Sign more MOUs with leading research institutions and universities to encourage collaborative research.
- Motivate the researchers to publish more by providing incentives and awards.
- Train the young researchers in Research methodology and preparation of papers for publications in journals.
- Researchers have to do more collaborative work.
- Researchers have to publish more in journals which have high Impact factor.
- Researchers can perform similar research in a new context, location and culture.
4. CONCLUSIONS
Scientometric assessment becomes a key element of research in the Library and Information. Productivity indicators can be measured through several publications by scientists, Science institutions, and countries. Such kinds of studies provide an insight into the dynamics of research activities and facilitate the researchers/scientists, policymakers to provide adequate facilities and proper guidance. Hence, it is the indispensable technique used to the quality and quantity of literature published from various disciplines within a particular geographical area. This research is the pioneering scientometric study on nuclear medicine research. The study has evaluated a total of 12,632 documents published during a period of 30 years i.e. from 1991 to 2020, using specific scientific indicators. All the seven objectives of the research study have been fully accomplished.

CONSENT
It’s not applicable.

ETHICAL APPROVAL
It’s not applicable.

COMPETING INTERESTS
Authors have declared that no competing interests exist.

REFERENCES
1. Egghe L, Rousseau K, Introduction to informetrics. Amsterdam, Elsevier; 1990.
2. Tague-Sutcliffe JM. An introduction to infometrics. Information Processing and Management. 1992;28:1-3.
3. Van Raan AFJ. Scientometrics: State of the art. Scientometrics. 1997;38(1):205-218.
4. Ravichandra Rao IK. Library to informatics: Development in India. In Information System, Networks and services in India Ed by A Neelmehan and K.N. Prasad, Bangalore, Ranganathan Centre for Information Studies. 1998;2:187-208.
5. Vijayakumar P, Sivasubramaniyan G, Rao MS. Bibliometrics analysis of Indian journal of nuclear medicine. Indian Journal of Information Sources and Services. 2019;9(1):122-127.
6. McKellar C, Currie G. Publication productivity in nuclear medicine. Journal of Nuclear Medicine Technology. 2015;43(2):122-128.
7. Rathika N, Thanuskodi S. Research output on encephalitis literature: A scientometric analysis from 2008 to 2017. In Challenges and Opportunities of Open Educational Resources Management, IGI Global. 2020;143-161.
8. Garg KC, Kumar S. Bibliometrics of the global drug abuse research output as reflected by coverage in web of science core collection during 2011-2018. Journal of Scientometric Research. 2020;9(2):174-184.
9. Sadik Batcha M. Research contributions on oral cancer in India: A scientometric analysis. Research Journal of Library and Information Science. 2018;2(1):1-8.
10. Gupta BM, Ahmed KM. Pancreatitis research in India: A scientometric assessment of publications during 2007-16. EC Gastroenterology and Digestive System. 2018;5:37-47.

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