



SCIENTOMETRIC STUDY OF RESEARCH PUBLICATIONS IN THE FIELD OF CERVICAL CANCER DURING 2001-2009

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ABSTRACT

In this paper, an attempt has been made to investigate the pattern of authorship, type of collaboration, Relative growth rate, doubling time and degree of collaboration in the field of Cervical Cancer. This Analysis based on 15089 papers published in the field of Cervical Cancer indexed by MEDLINE during 2001-2009. These papers were scattered in 1600 journals, which originated from 79 different countries. The highest journal published from United States followed by England. Highest output (2095 articles) was noticed in the year of 2009.

KEYWORDS : Cervical Cancer, MEDLINE, Relative Growth Rate, Doubling Time, Degree of collaboration.

INTRODUCTION

In the past few decades, science has developed into an interdisciplinary specialty with its own journals, scholarly societies, and university and departments. Thus it seems that interdisciplinary science studies are facing a dilemma. Recently PubMed comprises more than 25 million citations and abstract for biomedical literature from MEDLINE, life science journals, and online books. The old statistical data shows pubmed search engine include around 772,000 articles in 2007, around 814,000 in 2008 and nearly 830,000 articles. That growth rate shows no signs of abating. This situation demands a careful and serious investigation to find out what should be read, assimilated and used for conducting quality research in science. Since the end of World War II, medical research particularly cancer research, has expanded enormously. The importance of cancer as a major cause of death and recognition that the problems of cell growth in cancer are of basic biologic importance have stimulated research into every facets of the disease and it has become apparent that many of these facets are related.

The causes and risk factors of gynecologic cancer vary among the different types, but there are some common risks: HPV infection, DES exposure synthetic estrogens given to women before 1971 during pregnancy to prevent miscarriage, but ultimately causing health risks to the expectant mother and daughters/son they carried), smoking, HIV/AIDS infection. There are also gynecologic risk factors that we have no control over like age, race, and family history of certain diseases and conditions that elevate our risk.



To control the effect of this disease, many researches have conducted in different countries. The result of such kind of research that sheer volume of literature published on the Gynecological Cancer, concerned with certain hypothesis, significant facts, placing them in context. So that it is very essential to evaluate the output or general publication of scientist. This scientometrics study will help to the librarians of various medical college, hospitals, laboratories to take decision regarding the subscribe the core journal on concern filed in their limited budget, as well as specially for the new comers to the field, those would find almost impossible to figure out whatever their hypothesis was consist with existing publication. This study may be useful for scientists, as they would know the core journal in their subject field.

1 OBJECTIVES OF THE STUDY

- 1.To determine the year wise growth, relative growth rate and doubling time of Cervical cancer publications.
- 2.To prepare rank list of most citing journals in the field of Cervical cancer.

3. To test the appropriateness of the verbal and graphical formulation of Bradford’s law of Scattering.

2 METHODOLOGY

For the analysis, data has been collected from pubmed is provided by National Library of Medicine (NLM), Washington. Each record in MEDLINE is manually indexed with NLM’s controlled vocabulary and the Medical Subject Headings (known as MeSH.) Data downloaded through a reference manager software Endnote which is having a powerful web interface to extract data through pubmed from MEDLINE. This data can be save use the Export command to create a free-standing bibliography in RTF (Rich Text Format) under each cancer for the different time span (2001-2009). This data has been collected during the month of July, 2011. In Endnote software for downloading the data from the database, the search term applied were “Year” (i.e. 2001) AND “Cervical”; AND “Neoplasms” AND “Female” AND “Human”. Name of cancer (cervical); Neoplasm; Female and Human are the Mesh indexed terms. Total 15089 articles in cervical cancer were collected. Each record contains bibliographic details like author, year of publication, source journal, vol. no., issue no., page numbers etc. This data is converted in to excel sheet for the analysis in term of growth, authorship pattern, Journal ranking etc.

3 DATA ANALYSIS

3.1: YEARWISE PUBLICATIONS GROWTH OF CERVICAL CANCER DURING 2001-2009

In the **table no.1** details regarding the distribution of 15083 articles published during 2001-2009 are given. This table shows that maximum number of articles published in 2009, which is 2095 in number contributing 13.88% of the total contribution. This is followed by 1982 numbers in 2008, which constitute 13.14% of total contributions. However the lowest number came in 2001 is only 8.41% comprising of 1269 articles only. This is also illustrated graphically in **fig. no.1**.

| Year | No. of Articles | Percentage | Cumulative Contributions | Cumulative Percentage |
|--------------|-----------------|---------------|--------------------------|-----------------------|
| 2001 | 1269 | 8 | 1269 | 8 |
| 2002 | 1340 | 9 | 2609 | 17 |
| 2003 | 1577 | 10 | 4186 | 28 |
| 2004 | 1520 | 10 | 5706 | 38 |
| 2005 | 1632 | 11 | 7338 | 49 |
| 2006 | 1757 | 12 | 9095 | 60 |
| 2007 | 1911 | 13 | 11006 | 73 |
| 2008 | 1982 | 13 | 12988 | 86 |
| 2009 | 2095 | 14 | 15083 | 100 |
| Total | 15083 | 100.00 | | |

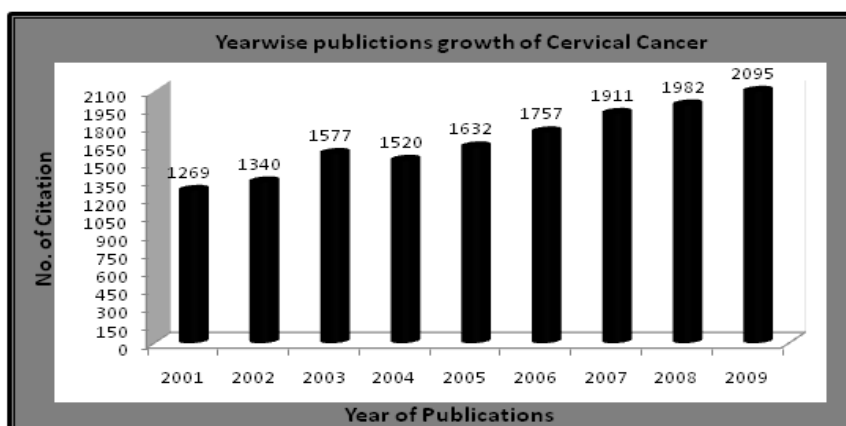


Fig.1: Year wise Publications Growth of Cervical Cancer from 2001-2009

3.2: RELATIVE GROWTH RATE AND DOUBLING TIME OF CERVICAL CANCER DURING 2000-2009

During this study the relative growth rate of Cervical Cancer publications has been calculated and presented in **table no. 2**. It can be noticed that the Relative Growth Rate of Publications decreased from 0.72 to 0.15 during 2002-2009. The mean relative growth for the first four years (i.e. 2002 to 2005) showed a growth rate of 0.43, whereas the mean relative growth rate for the last four years (i.e. 2006 to 2009) reduced to 0.18.

| Year | Citation | Cumulative (CC) | W1 log C | W2 (log CC) | RGR | Dt |
|-------|----------|-----------------|----------|-------------|------|------|
| 2001 | 1269 | 1269 | 0.00 | 7.15 | | |
| 2002 | 1340 | 2609 | 7.15 | 7.87 | 0.72 | 0.96 |
| 2003 | 1577 | 4186 | 7.87 | 8.34 | 0.47 | 1.47 |
| 2004 | 1520 | 5706 | 8.34 | 8.65 | 0.31 | 2.24 |
| 2005 | 1632 | 7338 | 8.65 | 8.90 | 0.25 | 2.75 |
| 2006 | 1757 | 9095 | 8.90 | 9.12 | 0.21 | 3.23 |
| 2007 | 1911 | 11006 | 9.12 | 9.31 | 0.19 | 3.63 |
| 2008 | 1982 | 12988 | 9.31 | 9.47 | 0.17 | 4.19 |
| 2009 | 2095 | 15083 | 9.47 | 9.62 | 0.15 | 4.63 |
| Total | 15083 | | | | | |

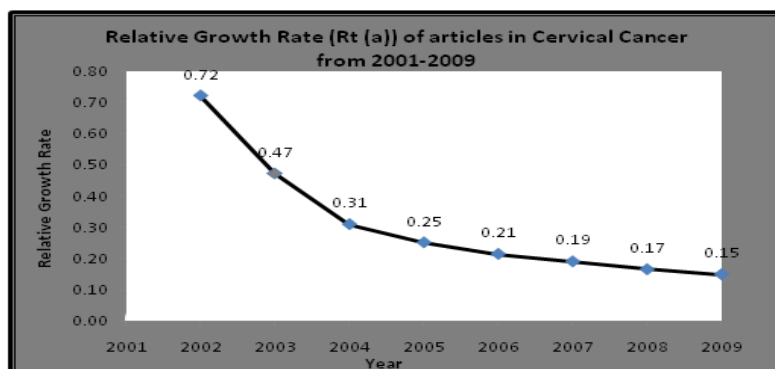


Fig 2:Relative growth rate (Rt(a)) of articles in Cervical Cancerfrom 2001-2009

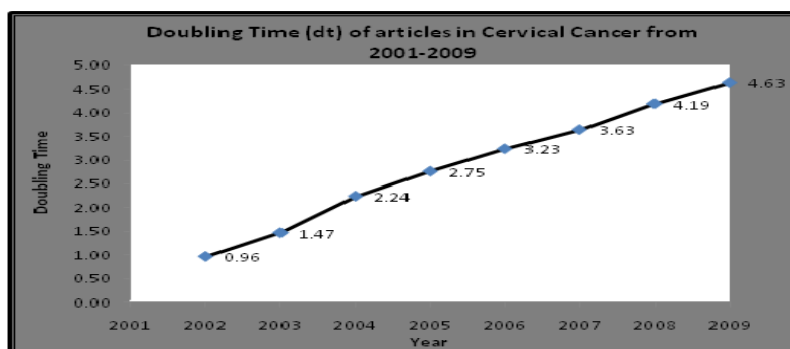


Fig 3: Doubling Time (dt) of articles in Fallopian Cancer from 2001-2009

The corresponding doubling time for different years gradually increased from 0.96 to 4.64 during 2002-2009. The mean Doubling time for the first four years (i.e. 2002 to 2005) was only 1.85 which was increased to 3.92 during the last four years (i.e. 2006 to 2009). Thus as the rate of growth of publication was decreased, the corresponding Doubling time was increased shown in **fig. no. 2 & 3**.

3.3: AUTHORSHIP PATTERN AND DEGREE OF COLLABORATION

Table no.3 indicates the Multi author’s collaborated papers occupy the first rank with 76.98% contributions. Single author’s collaborated papers (11.68) come next in order of contribution of authorship pattern during 2001-2009. Two author’s papers come under third position with 10.50 % contributions. **Fig.4** illustrates percentage of authorship pattern. **Table no. 4** show degree of collaboration of research articles in the field of cervical cancer is varies during 2001-2009 is 0.96.

Table 3: Authorship pattern of publication of Cervical Cancer during 2001-2009

| Sl. No | No. of Authors | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Total | Percentage |
|--------------|-----------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|------------|
| 1 | Single Authors | 147 | 189 | 217 | 182 | 190 | 196 | 236 | 225 | 207 | 1789 | 11.86 |
| 2 | Two Authors | 132 | 161 | 164 | 169 | 156 | 172 | 212 | 215 | 198 | 1579 | 10.47 |
| 3 | More than Two Authors | 979 | 974 | 1174 | 1163 | 1274 | 1366 | 1449 | 1529 | 1681 | 11589 | 76.83 |
| 4 | No Author | 11 | 16 | 22 | 6 | 12 | 23 | 14 | 13 | 9 | 126 | 0.84 |
| Total | | 1269 | 1340 | 1577 | 1520 | 1632 | 1757 | 1911 | 1982 | 2095 | 15083 | 100 |

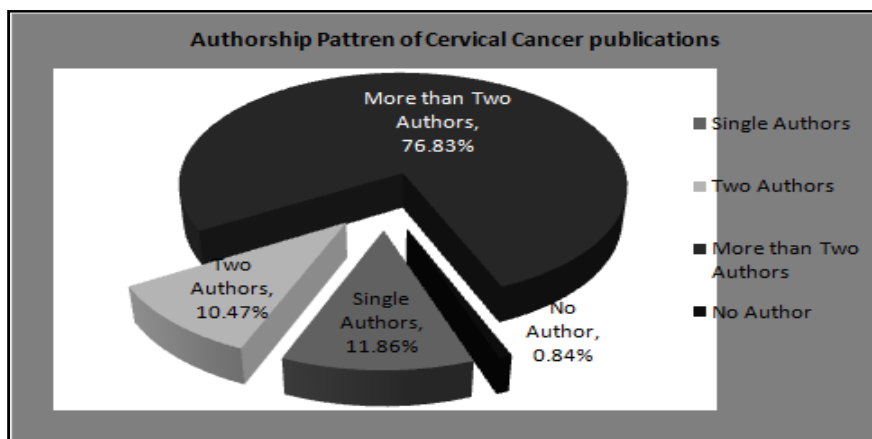


Fig. 4: Authorship pattern of publication of Cervical Cancer during 2001-2009

The formula given by K. Subramanyam is useful for determining the degree of collaboration in quantitative terms. The study followed the same formula which is mathematically put as:

$$C = \frac{NM}{NM+NS}$$

whereas, NM = Number of Multi authored paper, NS = Number of Single authored papers and C = Degree of

Collaboration

In the present study the value of C is

$$C = \frac{13168}{13168+1789}$$

$$C = \frac{13168}{14957}$$

$$= 0.88$$

Table 4: Year wise Degree of collaboration of Cervical Cancer publications

| Year | Single Authors (NS) | Multiple Authors (NM) | Degree of Collaboration |
|--------------|---------------------|-----------------------|-------------------------|
| 2001 | 147 | 1111 | 0.88 |
| 2002 | 189 | 1135 | 0.86 |
| 2003 | 217 | 1338 | 0.86 |
| 2004 | 182 | 1332 | 0.88 |
| 2005 | 190 | 1430 | 0.88 |
| 2006 | 196 | 1538 | 0.89 |
| 2007 | 236 | 1661 | 0.88 |
| 2008 | 225 | 1744 | 0.89 |
| 2009 | 207 | 1879 | 0.90 |
| Total | 1789 | 13168 | 0.88 |

In the period 2009, highest degree of collaboration was found 0.90 followed by 0.89 in year 2001, 2006 and 2008. During 2004-2005 and 2007 it was found 0.88 and in the year of 2002- 2003 degree of collaboration was 0.86.

3.4AUTHOR PRODUCTIVITY IN THE FIELD OF CERVICAL CANCER

The most prolific author is P.E. Castle, who has top rank with 41 papers followed by L.C. Horn with and E. L. Franco with 25 publications on second position, L. S. Massad; P. W.Grigsby and R. Sankaranarayanan with 23 publications on third rank, M. Arbyn stand

| Sl. No. | Rank | Name of Author | Papers |
|---------|------|----------------------|--------|
| 1 | 1 | Castle, P. E. | 41 |
| 2 | 2 | Franco, E. L. | 25 |
| 3 | 2 | Horn, L. C. | 25 |
| 4 | 3 | Grigsby, P. W. | 23 |
| 5 | 3 | Massad, L. S. | 23 |
| 6 | 3 | Sankaranarayanan, R. | 23 |
| 7 | 4 | Arbyn, M. | 22 |
| 8 | 5 | Renshaw, A. A. | 21 |
| 9 | 5 | Ronco, G. | 21 |
| 10 | 6 | Bosch, F. X. | 20 |
| 11 | 6 | Monsonogo, J. | 20 |
| 12 | 7 | Ferrandina, G. | 19 |
| 13 | 8 | Branca, M. | 18 |
| 14 | 9 | Monk, B. J. | 17 |
| 15 | 10 | Herbert, A. | 16 |
| 16 | 10 | Ivanov, S. | 16 |
| 17 | 10 | Rose, P. G. | 16 |
| 18 | 10 | Wang, S. S. | 16 |
| 19 | 11 | Cox, J. T. | 15 |
| 20 | 11 | Goldie, S. J. | 15 |
| 21 | 11 | Kietpeerakool, C. | 15 |
| 22 | 11 | Wright, T. C., Jr. | 15 |
| 23 | 12 | Andersson, S. | 14 |
| 24 | 12 | Boon, M. E. | 14 |
| 25 | 12 | Santin, A. D. | 14 |
| 26 | 12 | Sawaya, G. F. | 14 |
| 27 | 12 | Suba, E. J. | 14 |
| 28 | 13 | Chan, P. K. | 13 |
| 29 | 13 | Coker, A. L. | 13 |
| 30 | 13 | DuenasGonzalez, A. | 13 |
| 31 | 13 | Franceschi, S. | 13 |
| 32 | 13 | Hockel, M. | 13 |
| 33 | 13 | Paraskevaidis, E. | 13 |
| 34 | 13 | Tanaka, T. | 13 |
| 35 | 13 | Wright, J. D. | 13 |
| 36 | 13 | Schiffman, M. | 13 |
| 37 | 14 | Ahn, W. S. | 12 |
| 38 | 14 | Barranger, E. | 12 |
| 39 | 14 | Bergeron, C. | 12 |
| 40 | 14 | Harper, D. M. | 12 |
| 41 | 14 | Kodama, J. | 12 |
| 42 | 14 | Li, H. | 12 |
| 43 | 14 | Morice, P. | 12 |

| Sl. No. | Rank | Name of Author | Total No. of Papers |
|--------------|------|----------------------------|---------------------|
| 44 | 14 | Moscicki, A. B. | 12 |
| 45 | 14 | Solomon, D. | 12 |
| 46 | 14 | Wentzensen, N. | 12 |
| 47 | 15 | Coughlin, S. S. | 11 |
| 48 | 15 | Datta, N. R. | 11 |
| 49 | 15 | Ferris, D. G. | 11 |
| 50 | 15 | Gupta, S. | 11 |
| 51 | 15 | Heatley, M. K. | 11 |
| 52 | 15 | Kahn, J. A. | 11 |
| 53 | 15 | Lehtinen, M. | 11 |
| 54 | 15 | Moodley, M. | 11 |
| 55 | 15 | Munoz, N. | 11 |
| 56 | 15 | Narayan, K. | 11 |
| 57 | 15 | Ohara, K. | 11 |
| 58 | 15 | Ramirez, P. T. | 11 |
| 59 | 15 | Sasieni, P. | 11 |
| 60 | 15 | Sherman, M. E. | 11 |
| 61 | 15 | Stoler, M. H. | 11 |
| 62 | 15 | Toita, T. | 11 |
| 63 | 15 | Ueda, M. | 11 |
| 64 | 15 | Wang, P. H. | 11 |
| 65 | 15 | Zhang, Y. | 11 |
| 66 | 16 | Behdash, N. | 10 |
| 67 | 16 | Cuzick, J. | 10 |
| 68 | 16 | Davey, D. D. | 10 |
| 69 | 16 | Einstein, M. H. | 10 |
| 70 | 16 | HaieMeder, C. | 10 |
| 71 | 16 | Harima, Y. | 10 |
| 72 | 16 | Insinga, R. P. | 10 |
| 73 | 16 | Kang, S. | 10 |
| 74 | 16 | Kim, J. J. | 10 |
| 75 | 16 | Kornovski, I. | 10 |
| 76 | 16 | Shen, M. R. | 10 |
| 77 | 16 | Wydra, D. | 10 |
| 78 | 16 | AbuRustum, N. R. | 10 |
| 79 | 17 | 25 authors with 9 papers | 225 |
| 80 | 18 | 30 authors with 8 papers | 240 |
| 81 | 19 | 38 authors with 7 papers | 266 |
| 82 | 20 | 74 authors with 6 papers | 444 |
| 83 | 21 | 122 authors with 5 papers | 610 |
| 84 | 22 | 219 authros with 4 papers | 876 |
| 85 | 23 | 418 authors with 3 papers | 1443 |
| 86 | 24 | 1317 authors with 2 papers | 2634 |
| 87 | 25 | 7131 authors with 1 papers | 7131 |
| 88 | 26 | No authors | 126 |
| Total | | | 15083 |

fourth position with 22 publications, on fifth position A. A. Renshaw and G. Ronco having 21 publications. **Table no.5** provides a rank list of 9452 authors with 14957 publications. 126 papers traced with no authors during 2001-2009. Out of 9452 authors, only 367 authors have at least 5 publications. Rest of 9085 authors contribute various no of papers in the range of 5 -1 publications. Top 10 authors Figure out in **fig.5**.

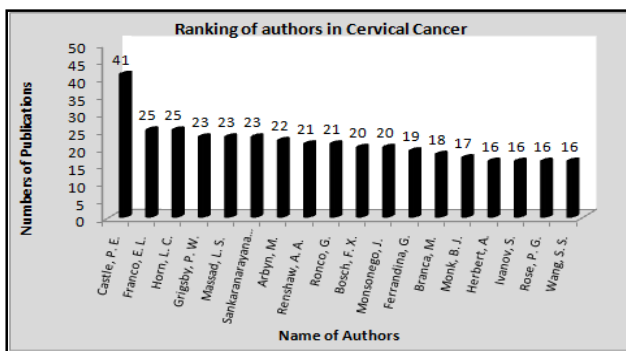


Fig 5: Ranking of authors in Cervical Cancer from 2001-2009

3.5 RANKING OF CORE JOURNALS

In total, there are 1600 journals, which published 15083 articles. Bradford’s distribution is used to identify the core journals. In the present study it has been observed that, 21 journals covered 5013 articles, next 120 journals covered 5029 articles and next 1459 journals covered 5041 articles. In other words, one third of the total citations have been covered by each group of the journals. **Table no.6** shows ranking of journal with number of published articles and their publication country. The most prolific journal is Gynecologic Oncology (Gynecol Oncol) with 1182 articles followed by International Journal of Gynecological Cancer (Int J Gynecol Cancer) with 530 articles, Cancer with 294 articles and European Journal of Gynecological Oncology with 290 articles. Around 56% journals published by United States (36.32%) and England (20.01%) followed by Netherlands (5.71%), Germany (5.33%) and Japan (2.70%).

| Sl. No. | Name of Journal | No. of citations | Cumulative citations | % of citations | % of cumulative citations | Country | Rank |
|---------|----------------------------------|------------------|----------------------|----------------|---------------------------|---------------|------|
| 1 | Gynecol Oncol | 1182 | 1182 | 7.84 | 7.84 | Switzerland | 1 |
| 2 | Int J Gynecol Cancer | 530 | 1712 | 3.51 | 11.35 | United States | 2 |
| 3 | Cancer | 294 | 2006 | 1.95 | 13.30 | United States | 3 |
| 4 | Eur J Gynaecol Oncol | 290 | 2296 | 1.92 | 15.22 | Italy | 4 |
| 5 | Int J Cancer | 276 | 2572 | 1.83 | 17.05 | United States | 5 |
| 6 | Int J Radiat Oncol Biol Phys | 266 | 2838 | 1.76 | 18.82 | United States | 6 |
| 7 | Acta Cytol | 192 | 3030 | 1.27 | 20.09 | Switzerland | 7 |
| 8 | Am J Obstet Gynecol | 187 | 3217 | 1.24 | 21.33 | United States | 8 |
| 9 | Diagn Cytopathol | 164 | 3381 | 1.09 | 22.42 | United States | 9 |
| 10 | Br J Cancer | 164 | 3545 | 1.09 | 23.50 | England | 9 |
| 11 | Cytopathology | 162 | 3707 | 1.07 | 24.58 | England | 10 |
| 12 | Obstet Gynecol | 162 | 3869 | 1.07 | 25.65 | United States | 10 |
| 13 | Int J Gynaecol | 154 | 4023 | 1.02 | 26.67 | Ireland | 11 |
| 14 | Zhonghua Bing Li Xue Za Zhi | 141 | 4164 | 0.93 | 27.61 | China | 12 |
| 15 | J Low Genit Tract Dis | 137 | 4301 | 0.91 | 28.52 | United States | 13 |
| 16 | J Natl Cancer Inst | 122 | 4423 | 0.81 | 29.32 | United States | 14 |
| 17 | Int J Gynecol Pathol | 122 | 4545 | 0.81 | 30.13 | United States | 14 |
| 18 | Anticancer Res | 118 | 4663 | 0.78 | 30.92 | Greece | 15 |
| 19 | Cancer Epidemiol Biomarkers Prev | 117 | 4780 | 0.78 | 31.69 | United States | 16 |
| 20 | Vaccine | 117 | 4897 | 0.78 | 32.47 | Netherlands | 16 |
| 21 | Ginekol Pol | 116 | 5013 | 0.77 | 33.24 | Poland | 17 |
| 22 | Cancer Res | 113 | 5126 | 0.75 | 33.99 | United States | 18 |
| 23 | Asian Pac J Cancer Prev | 111 | 5237 | 0.74 | 34.72 | Thailand | 19 |
| 24 | Eur J Obstet Gynecol Reprod Biol | 111 | 5348 | 0.74 | 35.46 | Ireland | 19 |
| 25 | Radiother Oncol | 97 | 5445 | 0.64 | 36.10 | Ireland | 20 |
| 26 | BJOG | 95 | 5540 | 0.63 | 36.73 | England | 21 |
| 27 | Acta Obstet Gynecol Scand | 87 | 5627 | 0.58 | 37.31 | England | 22 |
| 28 | Clin Cancer Res | 85 | 5712 | 0.56 | 37.87 | United States | 23 |
| 29 | Oncol Rep | 83 | 5795 | 0.55 | 38.42 | Greece | 24 |
| 30 | Arch Pathol Lab Med | 81 | 5876 | 0.54 | 38.96 | United States | 25 |
| 31 | Am J Clin Pathol | 81 | 5957 | 0.54 | 39.49 | United States | 25 |
| 32 | BMJ | 79 | 6036 | 0.52 | 40.02 | England | 26 |
| 33 | Oncogene | 75 | 6111 | 0.50 | 40.52 | England | 27 |
| 34 | J Obstet Gynaecol | 75 | 6186 | 0.50 | 41.01 | England | 27 |
| 35 | Cancer Lett | 73 | 6259 | 0.48 | 41.50 | Ireland | 28 |
| 36 | Lancet | 72 | 6331 | 0.48 | 41.97 | England | 29 |
| 37 | Gynecol Obstet | 70 | 6401 | 0.46 | 42.44 | France | 30 |
| 38 | Eur J Cancer | 67 | 6468 | 0.44 | 42.88 | England | 31 |
| 39 | Arch Gynecol Obstet | 66 | 6534 | 0.44 | 43.32 | Germany | 32 |
| 40 | J Clin Pathol | 66 | 6600 | 0.44 | 43.76 | England | 32 |
| 41 | Al Zheng | 66 | 6666 | 0.44 | 44.20 | China | 32 |
| 42 | J Clin Oncol | 65 | 6731 | 0.43 | 44.63 | United States | 33 |
| 43 | Akush Ginekol | 63 | 6794 | 0.42 | 45.04 | Bulgaria | 34 |
| 44 | Clin Oncol (R Coll Radiol) | 61 | 6855 | 0.40 | 45.45 | England | 35 |
| 45 | J Obstet Gynaecol Res | 59 | 6914 | 0.39 | 45.84 | Australia | 36 |
| 46 | JAMA | 59 | 6973 | 0.39 | 46.23 | United States | 36 |
| 47 | N Engl J Med | 56 | 7029 | 0.37 | 46.60 | United States | 37 |
| 48 | Lancet Oncol | 55 | 7084 | 0.36 | 46.97 | England | 38 |
| 49 | Prev Med | 54 | 7138 | 0.36 | 47.32 | United States | 39 |
| 50 | Nihon Rinsho | 53 | 7191 | 0.35 | 47.68 | Japan | 40 |
| 51 | BMC Cancer | 53 | 7244 | 0.35 | 48.03 | England | 40 |
| 52 | J Reprod Med | 52 | 7296 | 0.34 | 48.37 | United States | 41 |
| 53 | Aust N Z J Obstet Gynaecol | 51 | 7347 | 0.34 | 48.71 | Australia | 42 |
| 54 | J Med Virol | 50 | 7397 | 0.33 | 49.04 | United States | 43 |
| 55 | J Womens Health (Larchmt) | 49 | 7446 | 0.32 | 49.37 | United States | 44 |

| Sl. No. | Name of Journal | No. of citations | Cumulative citations | % of citations | % of cumulatv | Country | Rank |
|--------------|------------------------------------------|------------------|----------------------|----------------|---------------|----------------|------|
| 56 | Ann Oncol | 49 | 7495 | 0.32 | 49.69 | England | 44 |
| 57 | Am J Surg Pathol | 47 | 7542 | 0.31 | 50.00 | United States | 45 |
| 58 | J Med Screen | 47 | 7589 | 0.31 | 50.31 | England | 45 |
| 59 | Vopr Onkol | 46 | 7635 | 0.30 | 50.62 | Russia | 46 |
| 60 | J Clin Virol | 46 | 7681 | 0.30 | 50.92 | Netherlands | 46 |
| 61 | J Clin Microbiol | 45 | 7726 | 0.30 | 51.22 | United States | 47 |
| 62 | Int J Oncol | 45 | 7771 | 0.30 | 51.52 | Greece | 47 |
| 63 | Zhonghua Zhong Liu Za Zhi | 45 | 7816 | 0.30 | 51.82 | China | 47 |
| 64 | Oncology | 44 | 7860 | 0.29 | 52.11 | Switzerland | 48 |
| 65 | Strahlenther Onkol | 44 | 7904 | 0.29 | 52.40 | Germany | 48 |
| 66 | Gan To Kagaku Ryoho | 42 | 7946 | 0.28 | 52.68 | Japan | 49 |
| 67 | Hum Pathol | 41 | 7987 | 0.27 | 52.95 | United States | 50 |
| 68 | Salud Publica Mex | 39 | 8026 | 0.26 | 53.21 | Mexico | 51 |
| 69 | J Infect Dis | 39 | 8065 | 0.26 | 53.47 | United States | 51 |
| 70 | J Med Assoc Thai | 39 | 8104 | 0.26 | 53.73 | Thailand | 51 |
| 71 | Tumori | 39 | 8143 | 0.26 | 53.99 | Italy | 51 |
| 72 | Zentralbl Gynakol | 39 | 8182 | 0.26 | 54.25 | Germany | 51 |
| 73 | J Gynecol Obstet Biol Reprod (Paris) | 39 | 8221 | 0.26 | 54.51 | France | 51 |
| 74 | Cancer Causes Control | 37 | 8258 | 0.25 | 54.75 | Netherlands | 52 |
| 75 | Zhonghua Yi Xue Za Zhi | 37 | 8295 | 0.25 | 55.00 | China | 52 |
| 76 | Gynecol Obstet Invest | 36 | 8331 | 0.24 | 55.23 | Switzerland | 53 |
| 77 | Ginecol Obstet Mex | 36 | 8367 | 0.24 | 55.47 | Mexico | 53 |
| 78 | Jpn J Clin Oncol | 36 | 8403 | 0.24 | 55.71 | England | 53 |
| 79 | J Pathol | 36 | 8439 | 0.24 | 55.95 | England | 53 |
| 80 | Am J Clin Oncol | 35 | 8474 | 0.23 | 56.18 | United States | 54 |
| 81 | Bull Cancer | 35 | 8509 | 0.23 | 56.41 | France | 54 |
| 82 | Curr Opin Obstet | 35 | 8544 | 0.23 | 56.65 | England | 54 |
| 83 | Ceska Gynekol | 34 | 8578 | 0.23 | 56.87 | Czech Republic | 55 |
| 84 | Mod Pathol | 34 | 8612 | 0.23 | 57.10 | United States | 55 |
| 85 | Int J Clin Oncol | 34 | 8646 | 0.23 | 57.32 | Japan | 55 |
| 86 | J Cancer Res Clin Oncol | 34 | 8680 | 0.23 | 57.55 | Germany | 55 |
| 87 | Ned Tijdschr Geneesk | 32 | 8712 | 0.21 | 57.76 | Netherlands | 56 |
| 88 | Best Pract Res Clin Obstet Gynaecol | 32 | 8744 | 0.21 | 57.97 | Netherlands | 56 |
| 89 | Int J STD AIDS | 32 | 8776 | 0.21 | 58.18 | England | 56 |
| 90 | Ugeskr Laeger | 31 | 8807 | 0.21 | 58.39 | Denmark | 57 |
| 91 | J Virol | 31 | 8838 | 0.21 | 58.60 | England | 57 |
| 92 | Eur J Cancer Prev | 31 | 8869 | 0.21 | 58.80 | England | 57 |
| 93 | CMAJ | 30 | 8899 | 0.20 | 59.00 | Canada | 58 |
| 94 | Coll Antropol | 30 | 8929 | 0.20 | 59.20 | Croatia | 58 |
| 95 | Virology | 30 | 8959 | 0.20 | 59.40 | United States | 58 |
| 96 | Obstet Gynecol Clin North Am | 30 | 8989 | 0.20 | 59.60 | United States | 58 |
| 97 | J Biomed Opt | 30 | 9019 | 0.20 | 59.80 | United States | 58 |
| 98 | Indian J Pathol Microbiol | 30 | 9049 | 0.20 | 59.99 | India | 58 |
| 99 | Cancer Radiother | 30 | 9079 | 0.20 | 60.19 | France | 58 |
| 100 | Cancer Detect Prev | 30 | 9109 | 0.20 | 60.39 | England | 58 |
| 101 | Sichuan Da Xue Xue Bao Yi Xue Ban | 29 | 9138 | 0.19 | 60.58 | China | 59 |
| 102 | Lakartidningen | 28 | 9166 | 0.19 | 60.77 | Sweden | 60 |
| 103 | Biochem Biophys Res Commun | 28 | 9194 | 0.19 | 60.96 | United States | 60 |
| 104 | N Z Med J | 27 | 9221 | 0.18 | 61.14 | New Zealand | 61 |
| 105 | Tidsskr Nor Laegeforen | 27 | 9248 | 0.18 | 61.31 | Norway | 61 |
| 106 | Brachytherapy | 27 | 9275 | 0.18 | 61.49 | United States | 61 |
| 107 | Minerva Ginecol | 26 | 9301 | 0.17 | 61.67 | Italy | 62 |
| 108 | Int J Hyperthermia | 26 | 9327 | 0.17 | 61.84 | England | 62 |
| 109 | Histopathology | 26 | 9353 | 0.17 | 62.01 | England | 62 |
| 110 | Clin Exp Obstet Gynecol | 25 | 9378 | 0.17 | 62.18 | Italy | 63 |
| 111 | 74 Journals with range of 24-15 articles | 1392 | 10770 | 9.23 | 71.40 | | |
| 112 | 74 Journals with range of 14-5 articles | 2367 | 13137 | 15.69 | 87.10 | | |
| 113 | 74 Journals with less than 5 Articles | 1946 | 15083 | 12.90 | 100.00 | | |
| Total | | 15083 | | | | | |

3.5.1 APPLICATION OF BRADFORD LAW OF CERVICAL CANCER DURING 2000-2009.

Table no.7 depict Bradford’s zones, which identifies form an approximately geometric series in the form 1:n:n². Here, multiplier is 8.93, so the ratio of zone is:

$$21:(21 \times 8.93):(21 \times 8.93^2)$$

$$21:(187.53):(1674.64)$$

$$= 1883.17$$

$$\text{Percentage of error} = \frac{1883.17 - 1600}{1600} \times 100$$

$$= 17.698$$

Here the percentage error is not negligible and it was found that the relationship of each zone in the present study is 21:120:1459. This does not fit into the Bradford’s distribution(21:188:1675). Following method based on the Leimkuhler model was employed for the verification of Bradford’s Law of Scattering.

| Table 7: Bradford Zones of Scattering for Cervical Cancer | | | | | | | |
|-----------------------------------------------------------|---------------------------------|---------------|---------------------------|---------------|--------------------------|-------------------------------------------|---------------|
| Zone | No of Contribution in each zone | % | No of Journals (Observed) | % | Bradford Multiplier (bm) | No of Journals (Expected) | % |
| Zone I | 5013 | 33.24 | 21 | 1.31 | | 21 | 1.11 |
| zone II | 5029 | 33.34 | 120 | 7.50 | 120/21= 5.71 | 21* 8.93= 187.53≈ 188 | 9.92 |
| zone III | 5041 | 33.42 | 1459 | 91.19 | 1459/120= 12.15 | 21*(8.93) ² = 1674.64≈ 1675 | 88.90 |
| Total | 15083 | 100.00 | 1600 | 100.00 | | 1883.17≈ 1885 | 100.00 |
| Geometric mean of bm = 8.93 | | | | | | | |

Application of Leimkuhler Model:

In the present study of Journal Citation were divided in three zones (p=3 where p denote the Number of Zones) for application of Bradford’s using the mathematical formula,

$$R(r) = a \log(1+br) \dots \dots \dots (1)$$

Where R(r) is the cumulative number items produced by the source of rank 1,2,3.....r, a and b are constant

$$a = \frac{y_0}{\log k} \dots \dots \dots (2)$$

$$b = \frac{k-1}{r_0} \dots \dots \dots (3)$$

where r_0 is the number of source in the frist Bradford’s group, y_0 is the number of items in every Bradford group and k is Bradford multiplier.

The value of Bradford’s multiplier k is calculated as follows:

$$k = (e^y y_m)^{1/p} \text{ where } e^y = (1.781)$$

In the present case y_m = number of items in the most productive source = 1182 and hence

$$k = (1.781 \times 1182)^{1/3} = 12.816$$

$$y_0 = A/P$$

where, A denotes the total number of articles = 15082

and, p denotes the number of zones = 3

$$y_0 = 15082/3 = 5027.666$$

and r_0 = number of journals in the nucleus of Bradford is calculated as

$$r_0 = \frac{T(k-1)}{(k^p - 1)} \text{ where T = Total number of Journals}$$

$$r_0 = \frac{1600(12.816-1)}{(12.816^3 - 1)}$$

$$r_0 = \frac{18905.6}{2104.026-1}$$

$$r_0 = 8.985$$

$$a = \frac{y_0}{\log k} = \frac{5027.666}{\log(12.816)}$$

$$a = \frac{5027.666}{1.107}$$

$$a = 4541.698$$

$$b = \frac{k-1}{r_o} = \frac{12.816-1}{8.985}$$

b= 1.315

Table no.8 shows that the number of journals in the nucleus is 8.985 and the mean value of the Bradford multiplier is 12.819.

| Table 8: Leimkuhler Model of Bradford Law for Cervical Cancer | | | | | | |
|---------------------------------------------------------------|---------------------------|-------|-------------------------------------------------------|------------------------------------------------------------|-------|-----------------------------------------------------------------------------|
| Zone | No of Journals (Observed) | % | No of Cumulative Contribution in each zone (Observed) | No of Journals (Expected) (formula $r_o, r_o k, r_o k^2$) | % | No of Cumulative Contribution in each zone (Expected) [R (r) =a log (1+br)] |
| Zone I | 21 | 1.31 | 5013 | 8.985×9 | 0.56 | 5037.391 |
| zone II | 120 | 7.5 | 10042 | 8.985×12.816=115.151≈115 | 7.18 | 10065.378 |
| zone III | 1459 | 91.19 | 15083 | 8.985×(12.816) ² =1475.784≈1476 | 92.25 | 15100.728 |
| Total | 1600 | 100 | | 1599.920≈1600 | 100 | |

Therefore, the Bradford’s distribution is written as:

$$8.985: 8.985 \times 12.816: 8.985 \times (12.816)^2$$

$$8.985: 115.151: 1475.784 = 1599.926$$

$$\begin{aligned} \text{Percentage error of Journals} &= \frac{1599.926-1600}{1600} \times 100 \\ &= -4.625 \end{aligned}$$

$$\begin{aligned} \text{Percentage error of Citations} &= \frac{15100.728-15089}{15089} \times 100 \\ &= 0.077 \end{aligned}$$

Here the percentage error is negligible so the Bradford’s law fits very well in this data set. It is observed that, the number of journals contributing references to each zone increases by multiplier of 12.816. The data of the zonal analysis shows that the first zone containing 9 journals contributed 5037 citations, 115 journals of second zone produced 5028 and the 1476 journals of third zone produced 5036 citations. **Fig 6** shows a graphical presentation with the data. **Table no. 9** presented against logarithm of the cumulative number of journals and expected and observed Cumulative number of citation. On the basis of data a graph plotted with cumulative number of citations against logarithm of the cumulative number of journals.

| Sl. No. | Rank No | No of Journals | Cum of Jl. (r) | Log (n) of (r) | No of citation | Total no of citation | Cum. No of citations observed (O) | Cum. No of citations expected (E) [R (r) = a log (1+b r)] |
|---------|---------|----------------|----------------|----------------|----------------|----------------------|-----------------------------------|-----------------------------------------------------------|
| 1 | 1 | 1 | 1 | 0 | 1182 | 1182 | 1182 | 1655.681 |
| 2 | 2 | 1 | 2 | 0.30 | 530 | 530 | 1712 | 2542.927 |
| 3 | 3 | 1 | 3 | 0.48 | 294 | 294 | 2006 | 3152.694 |
| 4 | 4 | 1 | 4 | 0.60 | 290 | 290 | 2296 | 3617.800 |
| 5 | 5 | 1 | 5 | 0.70 | 276 | 276 | 2572 | 3993.890 |
| 6 | 6 | 1 | 6 | 0.78 | 266 | 266 | 2838 | 4309.625 |
| 7 | 7 | 1 | 7 | 0.85 | 192 | 192 | 3030 | 4581.724 |
| 8 | 8 | 1 | 8 | 0.90 | 187 | 187 | 3217 | 4820.797 |
| 9 | 9 | 2 | 10 | 1.00 | 164 | 328 | 3545 | 5226.388 |
| 10 | 10 | 2 | 12 | 1.08 | 162 | 324 | 3869 | 5562.635 |
| 11 | 11 | 1 | 13 | 1.11 | 154 | 154 | 4023 | 5711.451 |
| 12 | 12 | 1 | 14 | 1.15 | 141 | 141 | 4164 | 5849.823 |
| 13 | 13 | 1 | 15 | 1.18 | 137 | 137 | 4301 | 5979.121 |
| 14 | 14 | 2 | 17 | 1.23 | 122 | 244 | 4545 | 6214.768 |
| 15 | 15 | 1 | 18 | 1.26 | 118 | 118 | 4663 | 6322.812 |
| 16 | 16 | 2 | 20 | 1.30 | 117 | 234 | 4897 | 6522.617 |
| 17 | 17 | 1 | 21 | 1.32 | 116 | 116 | 5013 | 6615.409 |
| 18 | 18 | 1 | 22 | 1.34 | 113 | 113 | 5126 | 6704.031 |
| 19 | 19 | 2 | 24 | 1.38 | 111 | 222 | 5348 | 6870.156 |
| 20 | 20 | 1 | 25 | 1.40 | 97 | 97 | 5445 | 6948.250 |
| 21 | 21 | 1 | 26 | 1.41 | 95 | 95 | 5540 | 7023.369 |
| 22 | 22 | 1 | 27 | 1.43 | 87 | 87 | 5627 | 7095.733 |
| 23 | 23 | 1 | 28 | 1.45 | 85 | 85 | 5712 | 7165.535 |
| 24 | 24 | 1 | 29 | 1.46 | 83 | 83 | 5795 | 7232.951 |
| 25 | 25 | 2 | 31 | 1.49 | 81 | 162 | 5957 | 7361.241 |
| 26 | 26 | 1 | 32 | 1.51 | 79 | 79 | 6036 | 7422.387 |
| 27 | 27 | 2 | 34 | 1.53 | 75 | 150 | 6186 | 7539.270 |
| 28 | 28 | 1 | 35 | 1.54 | 73 | 73 | 6259 | 7595.212 |
| 29 | 29 | 1 | 36 | 1.56 | 72 | 72 | 6331 | 7649.612 |
| 30 | 30 | 1 | 37 | 1.57 | 70 | 70 | 6401 | 7702.552 |
| 31 | 31 | 1 | 38 | 1.58 | 67 | 67 | 6468 | 7754.107 |
| 32 | 32 | 3 | 41 | 1.61 | 66 | 198 | 6666 | 7901.151 |
| 33 | 33 | 1 | 42 | 1.62 | 65 | 65 | 6731 | 7947.827 |
| 34 | 34 | 1 | 43 | 1.63 | 63 | 63 | 6794 | 7993.423 |
| 35 | 35 | 1 | 44 | 1.64 | 61 | 61 | 6855 | 8037.989 |
| 36 | 36 | 2 | 46 | 1.66 | 59 | 118 | 6973 | 8124.210 |
| 37 | 37 | 1 | 47 | 1.67 | 56 | 56 | 7029 | 8165.947 |
| 38 | 38 | 1 | 48 | 1.68 | 55 | 55 | 7084 | 8206.819 |
| 39 | 39 | 1 | 49 | 1.69 | 54 | 54 | 7138 | 8246.861 |
| 40 | 40 | 2 | 51 | 1.71 | 53 | 106 | 7244 | 8324.587 |
| 41 | 41 | 1 | 52 | 1.72 | 52 | 52 | 7296 | 8362.330 |
| 42 | 42 | 1 | 53 | 1.72 | 51 | 51 | 7347 | 8399.365 |

Table 9: Application of Bradford's Law of Cervical Cancer (Graphical Presentation)

| Sl. No. | Rank No | No of Journals | Cum of Jl. (r) | Log (n) of (r) | No of citation | Total no of citation | Cum. No of citations observed (O) | Cum. No of citations expected (E) [R (r) =a log (1+b r)] |
|--------------|---------|----------------|----------------|----------------|----------------|----------------------|-----------------------------------|----------------------------------------------------------|
| 43 | 43 | 1 | 54 | 1.73 | 50 | 50 | 7397 | 8435.717 |
| 44 | 44 | 2 | 56 | 1.75 | 49 | 98 | 7495 | 8506.472 |
| 45 | 45 | 2 | 58 | 1.76 | 47 | 94 | 7589 | 8574.775 |
| 46 | 46 | 2 | 60 | 1.78 | 46 | 92 | 7681 | 8640.793 |
| 47 | 47 | 3 | 63 | 1.80 | 45 | 135 | 7816 | 8735.852 |
| 48 | 48 | 2 | 65 | 1.81 | 44 | 88 | 7904 | 8796.772 |
| 49 | 49 | 1 | 66 | 1.82 | 42 | 42 | 7946 | 8826.540 |
| 50 | 50 | 1 | 67 | 1.83 | 41 | 41 | 7987 | 8855.866 |
| 51 | 51 | 6 | 73 | 1.86 | 39 | 234 | 8221 | 9023.216 |
| 52 | 52 | 2 | 75 | 1.88 | 37 | 74 | 8295 | 9075.985 |
| 53 | 53 | 4 | 79 | 1.90 | 36 | 144 | 8439 | 9177.470 |
| 54 | 54 | 3 | 82 | 1.91 | 35 | 105 | 8544 | 9250.297 |
| 55 | 55 | 4 | 86 | 1.93 | 34 | 136 | 8680 | 9343.397 |
| 56 | 56 | 3 | 89 | 1.95 | 32 | 96 | 8776 | 9410.447 |
| 57 | 57 | 3 | 92 | 1.96 | 31 | 93 | 8869 | 9475.293 |
| 58 | 58 | 8 | 100 | 2.00 | 30 | 240 | 9109 | 9638.464 |
| 59 | 59 | 1 | 101 | 2.00 | 29 | 29 | 9138 | 9657.943 |
| 60 | 60 | 2 | 103 | 2.01 | 28 | 56 | 9194 | 9696.333 |
| 61 | 61 | 3 | 106 | 2.03 | 27 | 81 | 9275 | 9752.552 |
| 62 | 62 | 3 | 109 | 2.04 | 26 | 78 | 9353 | 9807.214 |
| 63 | 63 | 1 | 110 | 2.04 | 25 | 25 | 9378 | 9825.103 |
| 64 | 64 | 4 | 114 | 2.06 | 24 | 96 | 9474 | 9895.079 |
| 65 | 65 | 3 | 117 | 2.07 | 23 | 69 | 9543 | 9945.979 |
| 66 | 66 | 7 | 124 | 2.09 | 22 | 154 | 9697 | 10059.873 |
| 67 | 67 | 7 | 131 | 2.12 | 21 | 147 | 9844 | 10167.549 |
| 68 | 68 | 8 | 139 | 2.14 | 20 | 160 | 10004 | 10283.812 |
| 69 | 69 | 9 | 148 | 2.17 | 19 | 171 | 10175 | 10406.907 |
| 70 | 70 | 10 | 158 | 2.20 | 18 | 180 | 10355 | 10535.232 |
| 71 | 71 | 9 | 167 | 2.22 | 17 | 153 | 10508 | 10643.993 |
| 72 | 72 | 7 | 174 | 2.24 | 16 | 112 | 10620 | 10724.625 |
| 73 | 73 | 10 | 184 | 2.26 | 15 | 150 | 10770 | 10834.379 |
| 74 | 74 | 15 | 199 | 2.30 | 14 | 210 | 10980 | 10988.344 |
| 75 | 75 | 15 | 214 | 2.33 | 13 | 195 | 11175 | 11131.157 |
| 76 | 76 | 15 | 229 | 2.36 | 12 | 180 | 11355 | 11264.324 |
| 77 | 77 | 13 | 242 | 2.38 | 11 | 143 | 11498 | 11372.883 |
| 78 | 78 | 18 | 260 | 2.41 | 10 | 180 | 11678 | 11513.965 |
| 79 | 79 | 29 | 289 | 2.46 | 9 | 261 | 11939 | 11721.963 |
| 80 | 80 | 36 | 325 | 2.51 | 8 | 288 | 12227 | 11952.950 |
| 81 | 81 | 42 | 367 | 2.56 | 7 | 294 | 12521 | 12192.146 |
| 82 | 82 | 46 | 413 | 2.62 | 6 | 276 | 12797 | 12424.608 |
| 83 | 83 | 68 | 481 | 2.68 | 5 | 340 | 13137 | 12724.734 |
| 84 | 84 | 89 | 570 | 2.76 | 4 | 356 | 13493 | 13059.106 |
| 85 | 85 | 142 | 712 | 2.85 | 3 | 426 | 13919 | 13497.333 |
| 86 | 86 | 276 | 988 | 2.99 | 2 | 552 | 14471 | 14142.924 |
| 87 | 87 | 612 | 1600 | 3.20 | 1 | 612 | 15083 | 15093.207 |
| Total | | 1600 | | | | 15083 | | |

4.CONCLUSION

This scientometric study is effort to draw a literature map of articles published in the field of Cervical Cancer during 2001-2009 indexed by MEDLINE. MEDLINE is world largest medical database in the field of medical science. This study shows that Cervical Cancer research increasing year by year, with a marginal decrease in the year 2004. The distribution of articles from 2001-2009 is not consistent as it ranges from 1269-2095 and maximum number of articles were published during 2009 (13.89%).The majority of scientists like to contribute jointly, so trend towards collaborative research increasing day by day. In this study Bradford distribution does not fit in this study. Therefore, the mathematical method based on Leimkuhler model is employed for the verification of Bradford’s Law of Scattering. In the method of Leimkuhler model, the percentage error is found to be the most (-4.265) negligible, so that the law find valid for the data set.

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