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Research Productivity of India and Iran in Stomach Cancer: A Bibliometric Study

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ABSTRACT

The study aims to provide an insight into the global research productivity in stomach cancer with an in-depth analysis of the growth & development of India and Iran. The study focuses on the authorship collaborative patterns among Indian and Iranian medical scientists as well. The study was conceived with the selection of terms on "Stomach cancer". The terms- "*Stomach Cancer, Stomach Neoplasm, Gastric Cancer, and Gastric Neoplasm"* were selected from the Medical Subject Headings (MeSH) to retrieve the data from the Web of Science (WoS). The Boolean Operator "OR" was executed to retrieve the records. The data was retrieved from 1989-2017 and downloaded in the excel file after restricting the country to India and Iran. Later, *Microsoft Excel* and *STATA* software were used to analyze the data. Three important means- *annual growth rate (AGR), relative growth rate (RGR), and Doubling Time (DT)* have been used to trace the development of literature. Further, authorship patterns were analyzed using the authorship collaboration and collaborative coefficient methods. The findings of the study show that Japan has the highest contribution (16,616; 19.89%) followed by the USA (16,195; 19.38%) and China (15,683; 18.768%) respectively in the field of Stomach Cancer research. India stands at 15th position and Iran at 22thposition with 1104 (1.32%) and 718 (0.86%) publications respectively. The annual growth rate of India and Iran is slow in the onset as compared to the later years, which is a positive sign of the improvement in the research productivity. The collaborative patterns show that medical scientists prefer to work in collaboration.

KEYWORDS

Stomach Cancer, Stomach Neoplasm, Gastric Cancer, Gastric Neoplasm, Research Productivity, Scientometrics, Bibliometrics, Authorship Collaboration

INTRODUCTION

The abnormal or uncontrolled growth of cells witnessed in the stomach is referred to as Stomach Cancer (Park 2013). Stomach Cancer is the fifth most common cancer across the globe. The incidence of new cases of this cancer is four times lower in Africa as compared to Asia. A greater incidence of Stomach Cancer was reported in the Republic of Korea (Cancer Statistics, 2018).

Source: greaterhoustongasteroentology.com

REVIEW OF LITERATURE

Many studies have been carried to understand the nature and growth of literature in cancer research. Chen, Chen, Hwang, and Chou (2006) analyzed the rise of gastroenterology in China using Web of Science and MEDLINE in a bibliometric context. The results found about 2,233 records in the Web of Science from 1990 to 2004 and the highest number is observed that of articles (1,692) followed by meeting abstracts 435, and reviews 69. In Web of Science, the contribution of China in gastroenterology experienced a rise from 12 articles in 1990 to 553 in 2003 it then decreased to 125 articles by 2004. From Medline 156,760 records are retrieved with 83 gastroenterology specialty journals in a period of 14 years from 1990 to 2004. During the time frame of the study, China contributed 3,649 articles and had shown a

considerable increase from 10 in the year 1990 to 1,154 in 2004. Gupta, Gupta, and Bansal (2016) carried out a scientometric study of Stomach Cancer publications of India from 2005-2014 as registered in the Scopus database and depicted that there is an annual average growth rate of 15.47% in publication output. The topmost nations with the highest contribution were China, followed by the USA (18.06%), Japan, (16.42%), U.K. (6.91%). India stands at the 12th rank with a contribution of about 1.74%. Hu, Huang, Hong, Du, Jin, and Lin (2017) analyzed bibliometrically the 50 most-cited articles in Gastroenterology and Hepatology from mainland China and found that the topmost cited article received 279 citations and the least number of citations received by an article about 89 while as, 129 as the mean number of citations per article. Only 15 journals were used by the topmost cited articles for publishing of 50 top-cited articles among which *Hepatology* (21 articles) ranked first followed by *Journal of Gastroenterology and Hepatology*, *Journal of Hepatology*, and *World Journal of Gastroenterology* respectively. Bhat, Jeelani, and Hussain (2017) evaluated the literature on Oesophageal Cancer using PubMed from the year 1994 to 2013 and the results revealed that England is leading in terms of research output on the said disease. It was further elaborated that the disease is showing inclination but the research was showing a decline. Mushtaq and Loan (2019) studied the research productivity of Colorectal Cancer in the Web of Science in the context of India and Iran. It was revealed that there existed a positive relationship between gross domestic product of nations and research productivity and the calculated values of relative growth rate and annual growth rate were encouraging. Further, the study strongly advocated the greater tendency of the two nations towards teamwork. Mushtaq and Loan (2021a) further studied the literature growth of Lung Cancer in India and Iran in Web of Science. The results revealed that the top ten countries contribute 89.77% of the total research productivity whereas the rest of the countries contributes 10.23% only. The USA (35.75%) leads the list in the publication productivity on lung cancer followed by the Peoples Republic of China (11.51 %), Japan (9.55%), the UK (6.40%), and Germany (6.05%) respectively. India stands at 15th (1.76%) position and Iran (0.40%) at 34th position. Mushtaq and Loan (2021b) conducted a bibliometric study of Prostate Cancer research. In Prostate Cancer, the USA (105,603; 44.77%) leads the list followed by China (17,157; 7.27%) and Germany (16,200; 6.86%), United Kingdom (15,336; 6.49%) and Canada (13,556; 5.74%) respectively. India and Iran aren't among the first 15 nations and stand at 16th position (3153; 1.33%) and

31st position (1056; 0.44%) respectively. The present study is a step forward in the same direction and will study research productivity of Stomach Cancer in the Web of Science with special reference to India and Iran.

RESEARCH DESIGN

a) Objectives of the study

1. To identify the prominent nations globally contributing to the research productivity of stomach cancer;
2. To identify the annual growth rate, relative growth rate, and doubling time of the stomach cancer literature in India and Iran; and
3. To identify the collaborative authorship patterns of Indian and Iranian medical scientists in stomach cancer using a degree of collaboration and collaborative coefficient methods.

b) Methodology

The study was conceived with the selection of terms on "Stomach cancer". The terms- "*Stomach Cancer, Stomach Neoplasm, Gastric Cancer, and Gastric Neoplasm"* were selected from the Medical Subject Headings (MeSH) to retrieve the data from the Web of Science (WoS). The Boolean Operator "OR" was executed to retrieve the records. The data was retrieved from 1989-2017 and downloaded in the excel file after restricting the country to India and Iran. Later, *Microsoft Excel* and *STATA* software were used to analyze the data.

DATA ANALYSIS

1. Ranking of Countries in Stomach Cancer

In the field of Stomach Cancer research, Japan has the highest contribution (16,616; 19.89%) followed by the USA (16,195; 19.38%) and China (15,683; 18.768%) respectively. India stands at 15th position and Iran at 22thposition with 1104 (1.32%) and 718 (0.86%) publications respectively (Table 1). However, in Lung Cancer Research, the USA (151,903; 35.75%) leads in research productivity followed by the China (48,897; 11.51 %), and Japan (40591; 9.55%) respectively (Mushtaq & Loan, 2021a). In Prostate Cancer research, the USA leads with 105,603 (44.77%) publications followed by China (17,157; 7.27%) and Germany (16,200; 6.86%), respectively (Mushtaq and Loan, 2021b).

Table 1: Position of India and Iran Stomach Cancer Research

Rank	Nation	Publication	Percentage
1	Japan	16,616	19.89
2	USA	16,195	19.38
3	China	15,683	18.76
4	South Korea	6,585	7.88
5	Germany	4,891	5.85
6	Italy	4,244	5.08
7	UK	4,129	4.94
8	France	2,525	3.02
9	Netherlands	1,632	1.95
10	Spain	1,578	1.88
15	India	1,104	1.32
22	Iran	718	0.86

2. Annual Growth Rate of India and Iran in Stomach Cancer

Annual Growth Rate can be calculated by using the formula:

[(Last Value –Initial Value) ÷ Initial Value] 100

Table 2 provides comprehensive information about the annual growth of publications of India and Iran in the field of Stomach Cancer. About 1104 publications are credited to India from 1989-2017 and 718 to Iran from 1991-2017. The maximum publication count from India (124) is in 2016 whereas the highest count (102) is for Iran in 2017. The lowest publications (7) are credited in 1991 for India and Iran has witnessed a single publication count for the years 1991 and 2000 and no publication activity is marked by Iran in the years 1989, 1990, 1992, 1993, 1994, 1995, 1996, 1997 and 1998. There is a fluctuating trend in the annual growth rate of India and Iran between the span of 29 years with negative and positive growth rates (fig.1), however, India has witnessed an average growth rate of about 12.28 and Iran 40.50.

Fig. 1: Annual Growth Rate in Stomach Cancer Research

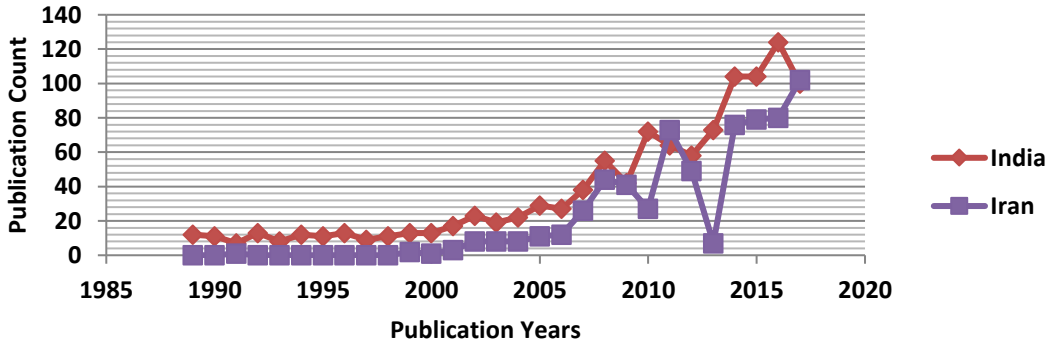

Table 2: Annual Growth Rate of India and Iran in Stomach Cancer

Period	**India**			**Iran**		
Year	**Publications**	**Cumulative**	**Annual Growth Rate (AGR)**	**Publications**	**Cumulative**	**Annual Growth Rate (AGR)**
1989	12	12	-	0	0	-
1990	11	23	-8	0	0	
1991	7	30	-36	1	1	
1992	13	43	86	0	1	
1993	8	51	-38	0	1	
1994	12	63	50	0	1	
1995	11	74	-8	0	1	
1996	13	87	18	0	1	
1997	9	96	-31	0	1	
1998	11	107	22	0	1	
1999	13	120	18	2	3	
2000	13	133	0	1	4	-50
2001	17	150	31	3	7	200
2002	23	173	35	8	15	167
2003	19	192	-17	8	23	0
2004	22	214	16	8	31	0
2005	29	243	32	11	42	38
2006	27	270	-7	12	54	9
2007	38	308	41	26	80	117
2008	55	363	45	44	124	69
2009	42	405	-24	41	165	-7
2010	72	477	71	27	192	-34
2011	64	541	-11	73	265	170
2012	58	599	-9	49	314	-33
2013	73	672	26	67	381	37
2014	104	776	42	76	457	13
2015	104	880	0	79	536	4
2016	124	1004	19	80	616	1
2017	100	1104	-19	102	718	28
1989-2017	**38.06**	**Average**	**12.28**	**24.75**	**Average**	**40.50**

3. Relative Growth Rate & Doubling Time of India and Iran in Stomach Cancer

Relative Growth Rate (RGR) can simply be defined as the increase in the number of articles or pages per unit of time. The mean relative growth rate over a specific time interval can be calculated as follows:

Relative Growth Rate (RGR)

$$1 - 2R = Log\ W2 - Log\ W1 / T2 - T1$$

Whereas

1-2 R- mean relative growth rate over the specific period

LogeW1 - log of the initial number of articles

Loge W2- log of the final number of articles after a specific period

T2-T1- the unit difference between the initial time and the final time

Here a year is taken as the unit of time.

Doubling time is calculated by 0.693/R.

Introspection into the calculated values of the relative growth rate of the literature of Stomach Cancer indicates that India has shown the highest value of relative growth rate of about 0.65 in the year 1990 and at the end of the year 2017 has shown the least value of about 0.09. Iran has marked the highest relative growth rate of about 1.09 in 1999 and 2016 witnesses the lowest relative growth rate. During the rest of the years, the respective values are not constant. Doubling time is dependent on the relative growth rate, it is quite clear that for India the year 1990 witnesses the least value of doubling time of about 1.06 and the highest of 7.7 in 2017 while for Iran the highest value of about 4.95 is in 2016, and the lowest in the year 1999 about 0.63. The mean RGR for India is 0.16 and mean DT 5.07 whereas for Iran mean RGR is 0.34 and the mean DT is 2.67 (Table 3). Mushtaq and Loan (2021a) observed that in Lung cancer research, the RGR and Doubling Time (Dt) of Iran and India showed a fluctuating trend over the years as well. In Prostate Cancer Research, the results are also in tune with the present study (Mushtaq and Loan, 2021b).

Table 3: Relative Growth Rate and Doubling Time of India and Iran in Stomach Cancer

	India						Iran					
Year	**Output**	**Cumulative**	**W_1**	**W_2**	**RGR**	**DT**	**Output**	**Cumulative**	**W_1**	**W_2**	**RGR**	**DT**
1989	12	12	-	2.48	-	-	0	0	-	-	-	-
1990	11	23	2.48	3.13	0.65	1.06	0	0	-	-	-	-
1991	7	30	3.13	3.40	0.27	2.56	1	1	-	0	-	-
1992	13	43	3.40	3.76	0.36	1.92	0	1	0	0	-	-
1993	8	51	3.76	3.93	0.17	4.07	0	1	0	0	-	-
1994	12	63	3.93	4.14	0.21	3.3	0	1	0	0	-	-
1995	11	74	4.14	4.30	0.16	4.33	0	1	0	0	-	-
1996	13	87	4.30	4.46	0.16	4.33	0	1	0	0	-	-
1997	9	96	4.46	4.56	0.10	6.93	0	1	0	0	-	-
1998	11	107	4.56	4.67	0.11	6.3	0	1	0	0	-	-
1999	13	120	4.67	4.78	0.11	6.3	2	3	0	1.09	1.09	0.63
2000	13	133	4.78	4.89	0.11	6.3	1	4	1.09	1.38	0.29	2.38
2001	17	150	4.89	5.01	0.12	5.32	3	7	1.38	1.94	0.56	1.23
2002	23	173	5.01	5.15	0.14	4.95	8	15	1.94	2.70	0.76	0.91
2003	19	192	5.15	5.25	0.10	6.93	8	23	2.70	3.13	0.43	1.61
2004	22	214	5.25	5.36	0.11	6.3	8	31	3.13	3.43	0.3	2.31
2005	29	243	5.36	5.49	0.13	5.33	11	42	3.43	3.73	0.3	2.31
2006	27	270	5.49	5.59	0.10	6.93	12	54	3.73	3.98	0.25	2.77
2007	38	308	5.59	5.73	0.14	4.95	26	80	3.98	4.38	0.4	1.73
2008	55	363	5.73	5.89	0.16	4.33	44	124	4.38	4.82	0.44	1.57
2009	42	405	5.89	6.00	0.11	6.3	41	165	4.82	5.10	0.28	2.47
2010	72	477	6.00	6.16	0.16	4.33	27	192	5.10	5.25	0.15	4.62
2011	64	541	6.16	6.29	0.13	5.33	73	265	5.25	5.57	0.32	2.16
2012	58	599	6.29	6.39	0.13	5.33	49	314	5.57	5.74	0.17	4.07
2013	73	672	6.39	6.51	0.12	5.32	67	381	5.74	5.94	0.2	2.31
2014	104	776	6.51	6.65	0.14	4.95	76	457	5.94	6.12	0.18	3.85
2015	104	880	6.65	6.77	0.12	5.32	79	536	6.12	6.28	0.16	4.3
2016	124	1004	6.77	6.91	0.14	4.95	80	616	6.28	6.42	0.14	4.95
2017	100	1104	6.91	7.00	0.09	7.7	102	718	6.42	6.57	0.15	4.62
1989-2017	**India (Mean)**				**0.16**	**5.07**	**Iran (Mean)**				**0.34**	**2.67**

4. Authorship Collaboration

a) Degree of Collaboration

To understand the nature (extent and pattern) of authorship degree of collaboration and collaborative coefficient are calculated.

Degree of collaboration

C= NM /(NM+NS), where

C = Degree of collaboration

NM = Number of multi-authored papers

NS = Number of single-authored papers

Degree of Collaboration is a measure that reflects the extent of collaboration in research using formula as suggested by Subramanyam (1983). It is very much obvious that single authorship is the least of authors in both nations. The degree of collaboration of both countries is very high, i.e. (0.96 for India and 0.97 for Iran) (Table 4). Karisiddappa, Maheswarappa & Shirol (1990), Bandyopadhyay (2001), and Biradar & Tadasad (2015) found similar results in Psychology, Mathematics, and Economics as well.

(b) Collaborative Coefficient

To understand the nature of authorship in the two nations collaborative coefficient (CC) has been calculated as recommended by Ajiferuke for both nations

$$CC = 1 - \frac{\sum_{j=1}^{k}\left(\frac{1}{j}\right)f_j}{N}$$

Fj = the number of authored papers

N = total number of research published; and

k = the number of authors per paper

Fj = the number of authored papers

The value of the collaboration coefficient (CC) is above 0.50, i.e. (0.65 for India and 0.65 for Iran). This value also strongly advocates that the subject experts in both nations like to work collaboratively. Therefore, it is quite clear that Stomach Cancer Research in both nations is diverse as there are ideas and thoughts from scientists from different but allied branches.

Table 4: Degree of Collaboration in India and Iran

Country	Single author	Multi-author	Degree of Collaboration	Collaborative Coefficient
India	44	1060	96	0.65
Iran	21	697	97	0.65

Conclusion

Japan has the highest contribution (16,616; 19.89%) in Stomach Cancer Research and has dethroned the USA from the number one spot. However, the USA still occupied the second rank with 16,195 (19.38%) publications followed by China (15,683; 18.768%) China is gaining momentum in various areas of research for the last two decades and improves its ranking as well. India stands at 15th position and Iran at 22thposition with 1104 (1.32%) and 718 (0.86%) publications respectively. The annual growth rate of India and Iran is slow in the onset as compared to the later years, which is a positive sign of the improvement in the research productivity. The collaborative patterns of medical scientists of India and Iran show that they prefer to work in collaboration.

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