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Prostate Cancer Research: A Bibliometric Study of India and Iran

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ABSTRACT

The study aims to provide an insight into the global research productivity in prostate 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 commenced with the selection of terms on "Prostate cancer". Three terms- *Prostate Cancer, Prostate Neoplasm, and Prostatic 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 related to prostate cancer research from 1989-2017 was retrieved and downloaded in the excel file. Later, *Microsoft Excel* software was 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 from 1989 to 2017. Further, authorship patterns were analyzed using the authorship collaboration and collaborative coefficient methods. The annual growth rate is slow in the onset as compared to the later years, which is a positive sign of the improvement in the research productivity of India and Iran while as relative growth rate shows a decrease, doubling time shows an increasing trend in both nations towards the end of 2017. Authors prefer to work in collaboration rather than individually as is evident from the values of Collaboration Coefficient and Degree of Collaboration.

Keywords: Prostate Cancer, Prostate Neoplasm, Prostatic Neoplasm, Research Productivity, Scientometrics, Bibliometrics

INTRODUCTION

Prostate Cancer is defined as the malignant Tumour that arises in the prostate gland**.** Prostate Cancer is the second most common cancer affecting males all over the globe. The highest

cases were reported in Martinique. More cases, about 68 percent were reported in developed nations (**Cancer Statistics, 2018**). Therefore, the research is conducted worldwide on prostate cancer. In Library and Information Science, Bibliometrics helps in the measurement of research output.
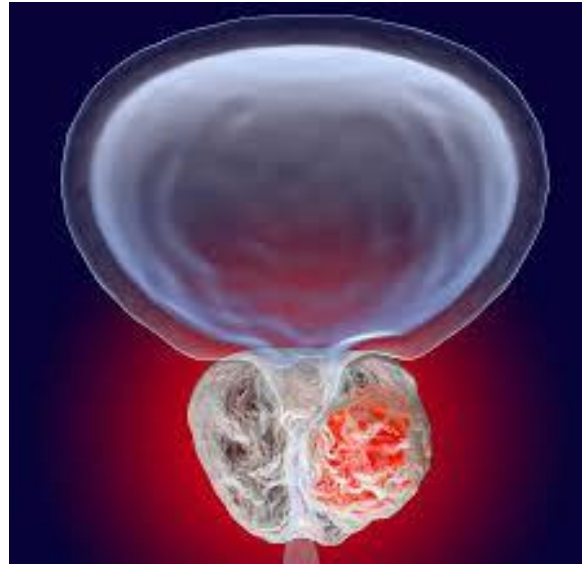
Prostate Cancer source: hopkinsmrdicine.org

REVIEW OF LITERATURE

The prostate gland a very vital component of the reproductive system is greatly under the bad effect of cancer disease. Many studies have been carried out to understand the nature of publication patterns in Oncology Mushtaq and Loan (2019) studied the research productivity of Colorectal Cancer research output 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 (2021) further studied the literature growth of lung cancer in India and Iran and concluded that there is a strong and considerable relationship between the Gross Domestic Production (GDP) of nations and publication productivity. The annual growth rate shows improvement while as relative growth rate shows a decrease, doubling time shows an increasing trend in both nations towards the end of 2017. Authors prefer to work in collaboration rather than individually. However, Gupta and Gupta (2015) examined publications on prostate cancer covered in the Scopus database during 2004-13. In global research output, many countries contributed of which the top 15 accounts for 94.80% share of the global output during 2004-13. The prominent contributing nations were the

United States, United Kingdom, Germany, Canada, Italy, Japan, and China. India's global publication share was 1.52% and hold 14th rank in global publication output during 2004-13. The Indian prostate cancer output came from several organizations and authors, of which the top 20 contributed 41.81% and 24.05% share, respectively. India's international collaborative share in prostate cancer was 23.39%, which decreased from 24.42% to 22.98% from 2004-08 to 2009-13. Among the Indian states and union territories contributing to prostate cancer research during 2004-13, the largest publication share (16.52%) comes from Delhi, followed by Maharashtra (15.35%), Uttar Pradesh (15.06%), Tamil Nadu (10.89%), Andhra Pradesh (7.38%), Karnataka (6.94%), Chandigarh (5.12%), West Bengal (4.61%), Punjab (2.41%), Haryana and Kerala (2.05% each), Madhya Pradesh (1.75%), Rajasthan (1.61%) and Pondicherry(0.51%) respectively. Bendels, Costrut, Schoffel, Bruggmann, and Groneberg (2018) studied the research contribution to prostate cancer based on gender and concluded that female authors lack representation to a greater extent in the prostate cancer research as the publication count to the female authors remained comparatively lower than that of male authors. In the multi-authorship pattern, male authors play the key role, however; the study further suggested the coherence or balancing of the gender disparity in the future in the said area of study. In nutshell, prostate cancer shares a greater share in the mortality rate. The research output in this area of knowledge is quite encouraging. The developed nations continue to be in the limelight in terms of productivity however, India being a developing nation has a growing publication activity in this area as well. Regarding gender, female authors are less productive in this subject.

RESEARCH DESIGN

a) Objectives

1. To identify the prominent nations contributing to prostate cancer research globally.

2. To identify the annual growth rate, relative growth rate, and doubling time of the prostate cancer literature in India and Iran; and

3. To identify the collaborative authorship patterns of Indian and Iranian authors in prostate cancer using the degree of collaboration and collaborative coefficient methods.

b) Methodology

The research started with the selection of the terms. Three terms- *Prostate Cancer, Prostate Neoplasm, and Prostatic Neoplasm* were selected from the Medical Subject Headings (MeSH) to retrieve the data from the Web of Science (WOS) maintained by Thomson Reuters. The Boolean Operator "OR" was executed to retrieve records. The data related to

prostate cancer research from 1989-2017 was retrieved and downloaded in the excel file. The records of India and Iran were retrieved by restricting the country to India and Iran respectively. Later, MS Excel software was used to analyze the data.

c) Limitations

The data has been retrieved from a single database (Web of Science) only. There may be a substantial amount of non-reported research in other databases like Scopus as well.

DATA ANALYSIS

1. Ranking of Countries in Prostate Cancer

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 (Fig.1). 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 (Table 1). The findings are in tune with the studies carried out by Coccia and Wang (2015); Aggarwal, et al. (2016); Caglar, Demir, Kucukler, and Durmus (2016); Dwivedi, Garg, and Prasad (2017); and Yeung, Goto, and Leung (2017) and who find the USA contributing the highest number of publication in their fields of studies.

Table 1: Position of India and Iran in Prostate Cancer Research

Rank	Nations	Record	Percentage
1	USA	105,603	44.77
2	China	17,157	7.27
3	Germany	16,200	6.86
4	United Kingdom	15,336	6.49
5	Canada	13,556	5.74
6	Italy	11,954	5.06
7	Japan	11,556	4.90
8	France	9,463	4.01
9	Australia	7,266	3.08
10	Netherlands	6,300	2.50
16	India	3,153	1.33
31	Iran	1056	0.44

Fig. 1. Spiral of Countries in Prostate Cancer Research

USA 105603

Netherlands 6,300

China 17157

Australia 7266

Germany 16200

France 9463

United Kingdom 15,336

Japan 11556

Canada 13556

Italy 11954
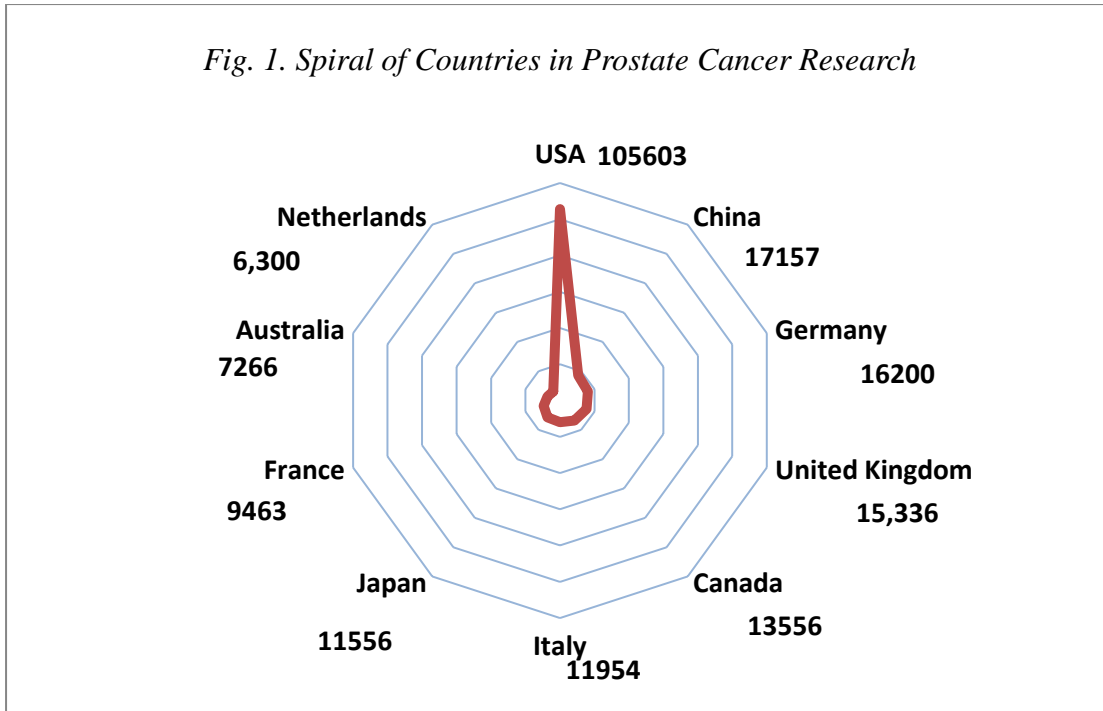
2. Annual Growth Rate of India and Iran in Prostate Cancer

Fig. 2: Annual Growth Rate in Prostate Cancer Research
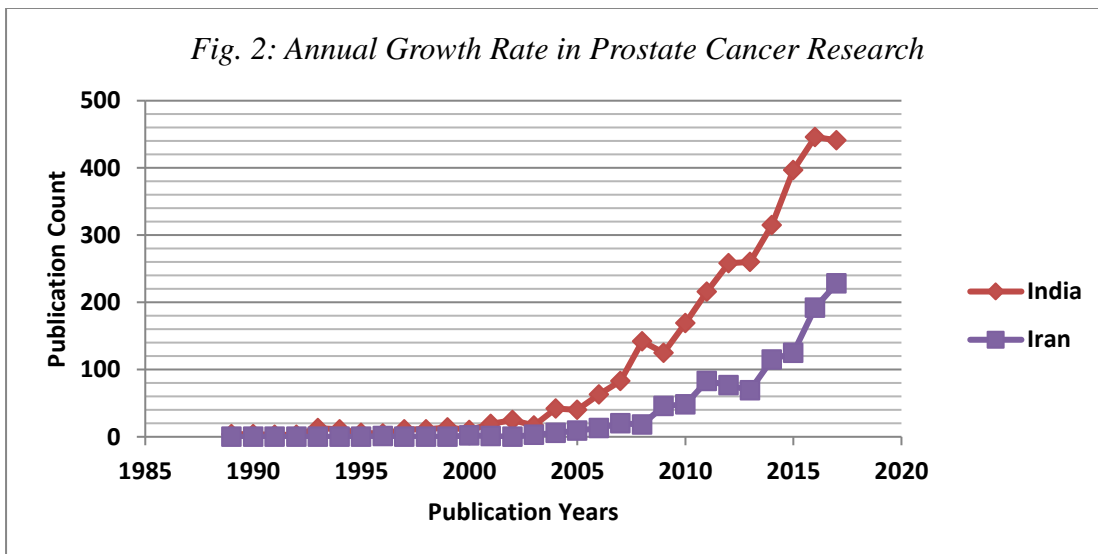
The research output concerning Prostate Cancer is considerable in the two countries. It is quite clear that about 3153 publications are published from India and 1056 from Iran. The last year (2017) marks the greatest number of publications for both the nations *i.e.* 441 for India and 228 for Iran. India has published since 1989 whereas there is no publication activity from Iran during the first seven (7) years (1989 - 1995). In India, negative annual growth is observed in 1991,1994,1995,1996, 2000,2003,2005, 2009, and 2017, whereas in the case of Iran 2001, 2002,2008, 2012, and 2013 witnessed a negative annual growth rate. However, both nations have a positive annual growth rate during the rest of the years. The average

growth rate of India is 31.12 whereas the average growth rate of Iran is 28.31 (Table 2). The positive growth rate is evident for a good number of years which is an encouraging notion depicting the improvement of research (Fig.2).

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

Period	India			Iran		
Year	Publications	Cumulative	Annual Growth Rate (AGR)	Publications	Cumulative	Annual Growth Rate (AGR)
1989	4	4		0	0	-
1990	4	8	0	0	0	-
1991	3	11	-25	0	0	-
1992	3	14	0	0	0	-
1993	13	27	333.33	0	0	-
1994	11	38	-15.38	0	0	-
1995	6	44	-45.45	0	0	-
1996	5	49	-16.66	1	1	-
1997	11	60	120	0	1	-
1998	11	71	0	0	1	-
1999	14	85	27.27	0	1	-
2000	10	95	-28.57	2	3	-
2001	19	114	90	1	4	-50
2002	25	139	31.57	0	4	-100
2003	17	156	-32	3	7	-
2004	42	198	147.05	6	13	100
2005	40	238	-4.76	9	22	50
2006	63	301	57.5	13	35	44
2007	83	384	31.74	20	55	54
2008	142	526	71.08	18	73	-10
2009	125	651	-11.97	46	119	156
2010	169	820	35.2	48	167	4
2011	216	1036	27.81	83	250	73
2012	258	1294	19.44	77	327	-7
2013	260	1554	0.77	69	396	-10
2014	315	1869	21.15	115	511	67
2015	397	2266	26.03	125	636	9
2016	446	2712	12.34	192	828	54
2017	441	3153	-1.12	228	1,056	19
1989-2017	**108.72**	**Mean**	**31.12**	**48.00**	**Mean**	**28.31**

3. Relative Growth Rate (RGR) and Doubling Time (DT) in Prostate Cancer

In order, to understand the growth and development of literature on prostate cancer annual growth rate, relative growth rate, and doubling time values are calculated.

Annual Growth Rate can be calculated by using the formula:

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

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.

A brief idea of the Relative Growth Rate (RGR) and doubling time (DT) for Prostate Cancer research in India and Iran are provided in table (5.34). Prostate Cancer research output for India has shown the highest value of RGR (0.69) in the year 1989 since then it has decreased with fluctuations as the years 1996, 2000 and 2003 show the least value of 0.11 and the recent year (2017) expresses the relative growth rate of about 0.15. While for Iran, the highest value of relative growth rate is 1.09 in 2000 and the least value is evident in 2013 at 0.20, and in between variation in the values is quite evident. Doubling time of the literature from India is about 1 in the year 1990 and the years 1996, 2000, 2003 show the highest value of doubling time 6.3. In the case of Iran, the least value of DT is 0.63 in 2000 and the highest of 3.46 in 2013, and the year 2017 experiences a doubling time of 2.77. Doubling time shows a clear variation from the year of inception of publication to 2017. The mean RGR and DT for India are 0.238 and 3.49 respectively and the mean RGR and DT for Iran are 0.386 and 2.04 respectively (Table 3)**.**

Table 3: Relative Growth Rate (RGR) and Doubling Time (DT) in Prostate Cancer

Year	India						Iran					
	Productivity	Cumulative	W_1	W_2	RGR	DT	Productivity	Cumulative	W_1	W_2	RGR	DT
1989	4	4	-	1.38	-	-	0	0	-	-	-	-
1990	4	8	1.38	2.07	0.69	1	0	0	-	-	-	-
1991	3	11	2.07	2.39	0.32	2.16	0	0	-	-	-	-
1992	3	14	2.39	2.63	0.24	2.88	0	0	-	-	-	-
1993	13	27	2.63	3.29	0.66	1.05	0	0	-	-	-	-
1994	11	38	3.29	3.63	0.34	2.03	0	0	-	-	-	-
1995	6	44	3.63	3.78	0.15	4.62	0	0	-	0	-	-
1996	5	49	3.78	3.89	0.11	6.3	1	1	0	0	-	-
1997	11	60	3.89	4.09	0.2	3.46	0	1	0	0	-	-
1998	11	71	4.09	4.26	0.17	4.07	0	1	0	0	-	-
1999	14	85	4.26	4.44	0.18	3.85	0	1	0	0	-	-
2000	10	95	4.44	4.55	0.11	6.3	2	3	0	1.09	1.09	0.63
2001	19	114	4.55	4.73	0.18	3.85	1	4	1.09	1.38	0.29	2.38
2002	25	139	4.73	4.93	0.2	3.46	0	4	1.38	1.38	0	-
2003	17	156	4.93	5.04	0.11	6.3	3	7	1.38	1.94	0.56	1.23
2004	42	198	5.04	5.28	0.24	2.88	6	13	1.94	2.56	0.62	1.11
2005	40	238	5.28	5.47	0.19	3.64	9	22	2.56	3.09	0.53	1.30
2006	63	301	5.47	5.70	0.23	3.01	13	35	3.09	3.55	0.46	1.50
2007	83	384	5.70	5.95	0.25	2.77	20	55	3.55	4.00	0.45	1.54
2008	142	526	5.95	6.26	0.31	2.23	18	73	4.00	4.29	0.29	2.38
2009	125	651	6.26	6.47	0.21	3.3	46	119	4.29	4.77	0.48	1.44
2010	169	820	6.47	6.70	0.23	3.01	48	167	4.77	5.11	0.34	2.03
2011	216	1036	6.70	6.94	0.24	2.88	83	250	5.11	5.52	0.41	1.69
2012	258	1294	6.94	7.16	0.22	3.15	77	327	5.52	5.78	0.26	2.66
2013	260	1554	7.16	7.34	0.18	3.85	69	396	5.78	5.98	0.20	3.46
2014	315	1869	7.34	7.53	0.19	3.64	115	511	5.98	6.23	0.25	2.77
2015	397	2266	7.53	7.72	0.19	3.64	125	636	6.23	6.45	0.22	3.15
2016	446	2712	7.72	7.90	0.18	3.85	192	828	6.45	6.71	0.26	2.66
2017	441	3153	7.90	8.05	0.15	4.62	228	1056	6.71	6.96	0.25	2.77
1989-2017	Average (India)				0.238	3.49	Average (Iran)				0.386	2.04

4. Authorship patterns in Prostate cancer research in India and Iran

a) Degree of Collaboration

To understand the nature of authorship degree of collaboration and collaborative coefficient are calculated.

Degree of collaboration

C = Degree of collaboration

NM = Number of multi-authored papers

NS = Number of single-authored papers

DC=NM / (NM+NS)

Degree of Collaboration is a measure that reflects the extent of collaboration in research using the formula as suggested by Subramanyam (1983). It is clear from the data (table 4) that single authorship is the least choice of medical scientists in both nations in 28 years as less than 3% of the publications are single-authored in both countries. The degree of collaboration of both countries is very high, *i.e.* (0.97 for Iran and 0.97 for India). Karisiddappa, Maheswarappa & Shirol (1990), Bandyopadhyay (2001), and Biradar & Tadasad (2015) found similar results in Psychology, Mathematics, and Economics respectively.

(b) Collaborative Coefficient

To understand the nature of authorship in the two nations collaborative coefficient (CC) has been calculated as recommended by **Ajiferuke, Burell, & Tague (1988)** for both nations as:

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

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 0.60, *i.e.* (0.65 for India and 0.64 for Iran). This also confirms that both nations prefer multiple authorship patterns**.** Therefore, it can be inferred that teamwork is prominent in both nations which is an encouraging sign.

Table 4: Degree of Collaboration in India and Iran

Country	Single-authored Publications	Multi-authored Publications	Total Publications	Collaborative Coefficient	Degree of Collaboration
India	87	3,066	3,153	0.65	0.97
Iran	29	1,028	1,057	0.64	0.97

CONCLUSION

The findings of the study show that there is a strong and considerable relationship between the Gross Domestic Production (GDP) of nations and publication productivity. The annual growth rate is slow in the onset as compared to the later years which is a positive sign of the improvement in the research of the two nations while as relative growth rate shows a decrease, doubling time shows an increasing trend in both nations towards the end of 2017. Authors like to work in collaboration rather than single authorship. This strongly advocates that there is a multi-disciplinary flavour in research in the field of prostate cancer in India and Iran.

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