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Osteoporosis Research in India: A Scientometric Assessment of Publications Output During 2007-16

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Abstract

The paper examines 1001 Indian publications on osteoporosis research, as covered in Scopus database during 2007-16, registering an annual average growth rate of 12.50%, qualitative citation impact averaged to 1097 citations per paper and international collaborative publication share of 12.59%. The top 17 most productive countries individually contributed global share from 1.80% to 26.97%, with largest global publication share coming from USA (26.97%), followed by U.K. (8.43%), China and Germany (6.72% and 6.23%), etc. Together, the 17 most productive countries accounted for 91.46% share of global publication output during 2007-16. Medicine, among subjects, accounted for the highest publications share (70.23%), followed by biochemistry, genetics & molecular biology (26.37%) and pharmacology, toxicology & pharmaceutics (23.88%) during 2007-16. The top 15 most productive organizations and authors together contributed 38.26% and 27.17% respectively as their share of global publication output and 43.01% and 51.07% respectively as their share of global citation output during 2007-16. Among the total journal output of 976 papers, the top 15 journals contributed 26.23% share to the Indian journal output during 2007-16.

Keywords: Osteoporosis research; Indian publications; scientometric; bibliometrics

Introduction

Osteopenia and osteoporosis ("porous bone") are both terms which help to define the disease characterized by low bone mass and deterioration of bone tissue. This leads to increased bone fragility and risk of fracture (broken bones), particularly of the hip, spine, wrist and shoulder. Osteoporosis is often known as "the silent thief" because bone loss occurs without symptoms [1].

Osteoporosis is defined by the World Health Organization (WHO) as a bone mineral density that is 2.5 standard deviations or more below the mean peak bone mass (average of young, healthy adults) as measured by DXA; the term "established osteoporosis" includes the presence of a fragility fracture. The disease may be classified as primary type 1, primary type 2, or secondary. The form of osteoporosis most common in women after menopause is referred to as primary type 1 or

postmenopausal osteoporosis. Primary type 2 osteoporosis or senile osteoporosis occurs after age 75 and is seen in both females and males at a ratio of 2:1. Finally, secondary osteoporosis may arise at any age and affects men and women equally. This form of osteoporosis results from chronic predisposing medical problems or disease [2].

Each year, there are an estimated 500,000 spinal fractures, 300,000 hip fractures, 200,000 broken wrists, and 300,000 fractures of other bones. About 80% of these fractures occur from relatively minor falls or accidents. Between 25% and 60% of women over 60 years of age develop spinal compression fractures. A woman's risk of developing an osteoporosis-related hip fracture is equal to her combined risk of developing breast uterine and ovarian cancer. By age 90, one third of all women and 17% of men have sustained a hip fracture [3].

Every 3 seconds, someone somewhere in the world suffers an osteoporotic fracture. According to the International Osteoporosis Foundation (IOF), this translates to 8.9 million fractures annually. In 2013, an estimated 50 million Indians had osteoporosis or low bone mass. Indians tend to develop hip fractures 10 years before people in Western nations. The risk of osteoporosis increases with age and given the steady increase in life expectancy to 77 years, an estimated 315 million Indians will be over 60 years old by the year 2050.This means that the number of people with osteoporosis and other age-related diseases will rise to unacceptably high levels in India [4].

Literature Review

Only a few studies have been published in this field. Among studies carried output, Bharadwaj and Ram [5] examined 921 publications on osteoporosis during 1973-2012, as covered in Scopus database. It examined the growth of literature collaborative research pattern, identifies most productive institutions and authors and prepared a core list of journals in the field from the Indian data. Sweileh, Al-Zabi, Zyoud etc. [6] analyzed the research output (426) originating from Arab countries and 3 Middle Eastern non-Arab countries, particularly Israel, Turkey and Iran in the field of osteoporosis upto the year 2012. A total of 426 documents about "osteoporosis" were published from Arab countries which represents 0.98% of the global research output. Research about osteoporosis from Arab countries was very low until 2002 and then increased steadily. The total number of citations for osteoporosis documents from the Arab world was 5551 with an average citation of 13.03 per document and an h- index of 35. Thirty (7.04%) documents published from Arab countries about osteoporosis were published in Saudi Medical Journal. Egypt, with a total publication of 117 (27.47%) ranked first among the Arab countries in research about osteoporosis while American University in Beirut was the most productive institution with a total of 47 (11.03%) documents. Compared with other non-Arab countries in the Middle East, the research productivity from the Arab countries was lesser than that from Turkey and Israel but higher than that from Iran. Biglu, Ghavami and Biglu [7] examined 2,056 papers with "postmenopausal osteoporosis", as were indexed in SCI-E between 2001 and 2011. The annual number of publications increased during the study period. The majority of publications came from Western Europe and North America. The number of papers published by authors based in Western Europe was about 75% greater than for North America. More papers on postmenopausal osteoporosis were published in Western Europe than in North America. The networks of co-authorship pointed to the strategic positions of highly cited authors from Western Europe. The top eight authors contributing the majority of papers were from Western Europe. Consequently Western Europe had greater impact than North America.

Objectives

The main objectives of the present study are to study the performance of Indian osteoporosis research during 2007-16, using on publications data indexed in Scopus database. In particular, the study focuses on the following objectives: (i) To study the growth of Indian research output in osteoporosis research, its global share and its citation impact; (ii) To study the share of international collaboration publications in its India's output and significant contribution of foreign partner countries; (iii) To study the Indian research output by broad subject areas and the dynamics of its growth and decline; (iv) To study the publication productivity and citation impact of top 15 Indian most productive organizations and authors; and (vi) To study the modes of communication by Indian scholars.

Methodology

Thee osteoporosis research publications landscape from 2007 through 2016 were identified using the Scopus database (http://www.scopus.com). An keyword search was used to identify publications that contained the terms "osteoporosis" in the "Article title tag" or ''keyword tags" and restricting it to the period 2007-16 in "date range tag" was used for searching the global and Indian publication data and this become the main search string. The search has resulted into 47785 global and 1001 Indian publications on osteoporosis research during 2007-16.

When the main search string for India publications, using various analytical provisions in Scopus database, was restricted to "subject area tag", "country tag", "source title tag", "journal title name" and "affiliation tag", we were able to get information on distribution of publications by subject, collaborating countries, author-wise, organization-wise and journal-wise, etc. For citation data, citations to publications were also collected from date of publication till 10 July 2017.

(KEY (osteoporosis) OR TITLE (osteoporosis)) AND PUBYEAR > 2006 AND PUBYEAR < 2017
(KEY (osteoporosis) OR TITLE (osteoporosis)) AND PUBYEAR > 2006 AND PUBYEAR < 2017 AND (LIMIT-TO (AFFILCOUNTRY,"India"))

Analysis

The total research output of India in osteoporosis research consisted of cumulated to 1001 publications in 10 years during 2007-16, using a Scopus database. The annual output of India in osteoporosis research increased from 40 in the year 2007 to 89 publications in the year 2016, registering 12.50% growth per annum. The cumulative Indian output in osteoporosis research computing in 5 years increased from 395 during 2007-11 to 606 during 2012-16, registering growth rate of 53.41%. India is ranked at 17th position in global output and its global publication share in osteoporosis research was 2.09% during 2007-16, which increased from 1.61% to 2.60% from 2007-11 to 2012-16. Of the total global publications output, 64.24% (643) was published articles, 21.68% (217) as reviews, 4.70% (47) as letters, 3.50% (35) as conference papers, 2.80% (28) as editorials, 1.8% (18) as notes and the rest as articles in press (7), erratum's (3), short surveys (2) and book chapter (1). The citation impact of Indian publications on osteoporosis research averaged to 10.97 citations per publication (CPP) during 2007-16; five-yearly impact averaged to 19.61CPP for the period 2007-11 which declined to 5.33CPP in the succeeding five-year 2012-16 (Table 1).

	World	India					
	TP	TP	TC	CPP	%TP	ICP	%ICP
2007	4725	40	496	12.4	0.85	2	5
2008	4813	62	1992	32.13	1.29	10	16.13
2009	4824	76	2048	26.95	1.58	10	13.16
2010	4981	91	1510	16.59	1.83	15	16.48
2011	5168	126	1701	13.5	2.44	16	12.7
2012	5137	130	965	7.42	2.53	12	9.23
2013	5279	158	1387	8.78	2.99	21	13.29
2014	4855	111	510	4.59	2.29	14	12.61
2015	4558	118	312	2.64	2.59	16	13.56
2016	3445	89	59	0.66	2.58	10	11.24
2007-11	24511	395	7747	19.61	1.61	53	13.42
2012-16	23274	606	3233	5.33	2.6	73	12.05
2007-16	47785	1001	10980	10.97	2.09	126	12.59
TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper							

Table 1: India Research Output in Osteoporosis Research during 2007-16.

International Collaboration

India's share of internationally collaborative papers (ICP) in osteoporosis research was 12.59% during 2007-16, which decreased from 13.42% to 12.05% from 2007-11 to 2012-16. Among the leading countries contributing to internationally collaborative papers, USA topped the list with 47.62% share, followed by U.K. (19.84%), Australia and Canada (14.29% each), Switzerland (12.10%), Germany (11.11%), Japan (8.73%), etc. India's international collaborative publications share increased by 8.38% in Australia, 2.04% in Japan, 1.68% in U.K as against decrease by 12.35% in Belgium, 12.25% in USA, 11.16% in Canada, 8.58% in Lebanon, 3.95% in Netherlands, 0.88% in Switzerland and 0.36% in Germany from 2007-11 to 2012-16 (Table 2).

S.No	Collaborative Country	Number of Papers			Share of Papers		
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16
1	USA	29	31	60	54.72	42.47	47.62
2	U.K.	10	15	25	18.87	20.55	19.84
3	Australia	5	13	18	9.43	17.81	14.29
4	Canada	11	7	18	20.75	9.59	14.29
5	Switzerland	7	9	16	13.21	12.33	12.7
6	Germany	6	8	14	11.32	10.96	11.11
7	Japan	4	7	11	7.55	9.59	8.73
8	Belgium	8	2	10	15.09	2.74	7.94
9	Netherlands	5	4	9	9.43	5.48	7.14
10	Lebanon	6	2	8	11.32	2.74	6.35
	Indian Total	53	73	126	100	100	100

Table 2: Share of Leading Foreign Countries in India's Collaborative Research Output in Osteoporosis Research during 2007-16

Top 17 Most Productive Countries in Osteoporosis Research

The Indian research output in the field osteoporosis research had originated from as many as 59 countries in the world during 2007-16. Top 17 most productive countries in osteoporosis research had contributed 858 to 12890 publications each during 2007-16 (Table 3). Top 17 most productive countries in osteoporosis research accounted for 91.46% global publication share during 2007-16. Their five-yearly output accounted for 88.97% global publication share during 2007-11 which increased to94.07% during succeeding 5-year period 2012-16. Each of top 17 countries accounted for 1.80% to 26.97% global publication share during 2007-16, with USA accounting for the highest publication share (26.97%), followed by U.K (8.43%), China and Germany (6.72% and 6.23%), Italy (5.46%), etc. The global publication share in five years increased in China, South Korea, India, Italy, Japan, Brazil, Canada, Australia, Turkey, Netherlands, Spain and Switzerland , but decreased in Belgium, U.K., France, Germany and USA from 2007-11 to 2012-16.

S.No	Name of the Country	Number of Papers			Share of Papers		
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16
1	USA	7053	5837	12890	28.77	25.08	26.97
2	U.K.	2122	1907	4029	8.66	8.19	8.43
3	China	1061	2151	3212	4.33	9.24	6.72
4	Germany	1608	1371	2979	6.56	5.89	6.23
5	Italy	1238	1369	2607	5.05	5.88	5.46
6	Canada	1142	1148	2290	4.66	4.93	4.79
7	Japan	1052	1128	2180	4.29	4.85	4.56
8	France	1098	904	2002	4.48	3.88	4.19
9	Australia	919	931	1850	3.75	4	3.87
10	Spain	929	896	1825	3.79	3.85	3.82
11	Switzerland	661	633	1294	2.7	2.72	2.71
12	Netherlands	634	629	1263	2.59	2.7	2.64
13	Turkey	599	624	1223	2.44	2.68	2.56
14	South Korea	361	830	1191	1.47	3.57	2.49
15	Belgium	559	450	1009	2.28	1.93	2.11
16	India	395	606	1001	1.61	2.6	2.09
17	Brazil	377	481	858	1.54	2.07	1.8
	Total	21808	21895	43703	88.97	94.07	91.46
	World	24511	23274	47785	100	100	100
	Share of 17 Countries in World Total	88.97	94.07	91.46			

Table 3: Global Publication Share of Top 17 Most Productive Countries in Osteoporosis Research during 2007-16

Subject-Wise Distribution of Research Output

The Indian osteoporosis research output published during 2007-16 is distributed across three sub-fields (as identified in Scopus database classification), with medicine accounting for the highest publications share (70.23%), followed by biochemistry, genetics & molecular biology (26.37%) and pharmacology, toxicology &pharmaceutics (23.88%) during 2007-16. The activity index, which computes change in research activity in a discipline over time 2007-11 to 2012-16 (world average activity index of a given subject is taken as 100), witnessed increase in biochemistry, genetics & molecular biology (from 80.63 to 112.62) and pharmacology, toxicology & pharmaceutics (from 92.25 to 105.05), as against decline of research activity in medicine (from 103.46 to 97.75 from 2007-11 to 2012-16. Medicine, among three subjects registered the highest citation impact per paper (11.74), followed by biochemistry, genetics & molecular biology (11.47) and pharmacology, toxicology & pharmaceutics (8.13) during 2007-16, (Table 4).

S.No	Subject*	Number of Papers (TP)			Activity Index		TC	CPP	%TP
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16	2007-16	2007-16
1	Medicine	287	416	703	103.46	97.75	8252	11.74	70.23
2	Biochemistry, Genetics & Molecular Biology	84	180	264	80.63	112.62	3029	11.47	26.37
3	Pharmacology, Toxicology & Pharmaceutics	87	152	239	92.25	105.05	1943	8.13	23.88
	Total Indian Output	395	606	1001	100	100			
There is overlapping of literature covered under various subjects									
TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper									

Table 4: Subject-Wise Breakup of Global Publications in Osteoporosis Research in India during 2007-16.

Profile of Top 15 Most Productive Indian Organizations

In Indian osteoporosis research, the productivity of 15 most productive organizations varied from 14 to 63 publications and together they contributed 38.26% (383) publication share and 43.01% (4722) citation share to its cumulative publications output during 2007-16. The scientometric profile of these 15 organizations is presented in Table 4. Four of these organizations registered publications output greater than the group average of 25.53: Central Drug Research Institute, Lucknow (63 papers), All India Institute of Medical Sciences, New Delhi (61 papers), Postgraduate Institute of Medical Education & Research, Chandigarh (36 papers) and Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow (29 papers) during 2007-16. Five organizations registered impact above the group average of 12.33 citations per publication during 2007-16:Indraprastha Apollo Hospital, Delhi (47.30), Central Drug Research Institute, Lucknow (17.81), Christian Medical College, Vellore (17.79), Indian Institute of Science, Bangalore(17.65) and Kind Edward Memorial Hospital, Mumbai (17.33) during 2007-16. Six organizations registered h-index above the group average of 7.47: Central Drug Research Institute, Lucknow (20), All India Institute of Medical Sciences, New Delhi (12), Indraprastha Apollo Hospital, Delhi (8), Indian Institute of Science, Bangalore, Kind Edward Memorial Hospital, Mumbai and Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow (8 each) during 2007-16. Seven organizations contributed international collaborative publications share above the group average of 12.53%: Maulana Azad Medical College, Delhi (40.0%), Manipal University (22.22%), Indraprastha Apollo Hospital, Delhi (21.74%), Kasturba Medical College, Manipal (21.43%), CSM Medical University, Lucknow (21.43%), Institute of Medical Sciences, BHU, Varanasi (14.29%) and All India Institute of Medical Sciences, New Delhi (13.11%) during 2007-16. Five organizations registered the relative citation index above the group average (1.12) of all organizations: Indraprastha Apollo Hospital, Delhi (4.31), Central Drug Research Institute, Lucknow (1.62), Christian Medical College, Vellore (1.62), and Indian Institute of Science, Bangalore (1.61) and Kind Edward Memorial Hospital, Mumbai (1.58) during 2007-16.

S.No	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	Central Drug Research Institute, Lucknow	63	1122	17.81	20	4	6.35	1.62
2	All India Institute of Medical Sciences, New Delhi	61	480	7.87	12	8	13.11	0.72

3	Postgraduate Institute of Medical Education & Research, Chandigarh	36	165	4.58	7	1	2.78	0.42
4	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	29	151	5.21	8	3	10.34	0.47
5	Christian Medical College, Vellore	24	427	17.79	6	2	8.33	1.62
6	SRM University, Chennai	23	42	1.83	3	2	8.7	0.17
7	Indraprastha Apollo Hospital, Delhi	23	1088	47.3	8	5	21.74	4.31
8	Manipal University	18	109	6.06	6	4	22.22	0.55
9	Banaras Hindu University, Varanasi	17	107	6.29	7	2	11.76	0.57
10	Indian Institute of Science, Bangalore	17	300	17.65	8	2	11.76	1.61
11	Kind Edward Memorial Hospital, Mumbai	15	260	17.33	8	1	6.67	1.58
12	Maulana Azad Medical College, Delhi	15	177	11.8	5	6	40	1.08
13	Kasturba Medical College, Manipal	14	114	8.14	6	3	21.43	0.74
14	CSM Medical University, Lucknow	14	104	7.43	4	3	21.43	0.68
15	Institute of Medical Sciences, BHU, Varanasi	14	76	5.43	4	2	14.29	0.49
	Total of 15 organizations	383	4722	12.33	7.47	48	12.53	1.12
	Total of India	1001	10980	10.97				
	Share of top 15 organizations in India total output	38.26	43.01					
TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index								

Table 4: Scientometric Profile of Top 15 Most Productive Organization in Osteoporosis Research in India during 2007-16.

Profile of Top 15 Most Productive Authors

In Indian osteoporosis research, the productivity of 15 most productive top 15 most productive authors varied from 12 to 33 publications. Together they contributed 27.17% (272) global publication share and 51.07% (5607) citation share during 2007-16. The scientometric profile of these 15 authors is presented in Table 5. Six authors registered publications output above the group average of 6.13: N. Chattopadhyay (33 papers), R. Trivedi (31 papers), A. Mithal (25 papers), R. Maurya and D. Singh (23 papers each) and M. Anburajan (19 papers) during 2007-16. Five authors registered impact above the group average of 20.61citations per publication: A. Mithal (55.56), G. Swarnkar (30.31), K. Sharan (25.69), A. Kumar (21.92) and N. Chattopadhyay (21.58) during 2007-16. Three authors contributed international collaborative publications share above the group average of 10.29% of all authors: A. Mithal (64.0%), G. Swarnkar (15.38%) and M. Anburajan (10.53%) during 2007-16. Five authors registered the relative citation index above the group average (1.88) of all authors: A. Mithal (5.06), G. Swarnkar (2.76), K. Sharan (2.34), A. Kumar (2.0) and N. Chattopadhyay (1.97) during 2007-16.

S.No	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI	ICP	%ICP	RCI
1	N. Chattopadhyay	Central Drug Research Institute, Lucknow	33	712	21.58	18	3	9.09	1.97
2	R. Trivedi	Central Drug Research Institute, Lucknow	31	551	17.77	14	1	3.23	1.62
3	A. Mithal	Indraprashta Apollo Hospital, Delhi	25	1389	55.56	13	16	64	5.06
4	R. Maurya	Central Drug Research Institute, Lucknow	23	437	19	14	2	8.7	1.73
5	D. Singh	Central Drug Research Institute, Lucknow	23	398	17.3	12	0	0	1.58
6	M. Anburajan	SRM University, Chennai	19	39	2.05	3	2	10.53	0.19
7	D.K. Khajuria	AL-Ameen College of Pharmacy , Bangalore	15	131	8.73	8	0	0	0.8
8	P. Kushwaha	Central Drug Research Institute, Lucknow	14	199	14.21	9	0	0	1.3
9	J. Gautam	Central Drug Research Institute, Lucknow	13	198	15.23	9	0	0	1.39
10	V. Khedgikar	Central Drug Research Institute, Lucknow	13	210	16.15	10	0	0	1.47

11	G.K. Nagar	Central Drug Research Institute, Lucknow	13	223	17.15	10	0	0	1.56
12	K. Sharan	Central Drug Research Institute, Lucknow	13	334	25.69	11	1	7.69	2.34
13	G. Swarnkar	Central Drug Research Institute, Lucknow	13	394	30.31	12	2	15.38	2.76
14	A. Kumar	Central Drug Research Institute, Lucknow	12	263	21.92	10	1	8.33	2
15	R. Razdan	AL-Ameen College of Pharmacy , Bangalore	12	129	10.75	8	0	0	0.98
Total of 15 authors			272	5607	20.61	10.73	28	10.29	1.88
Total of India			1001	10980	10.97				
Share of top 15 authors in Indian total output			27.17	51.07					
TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index									

Table 5: Scientometric Profile of Top 15 Most Productive Authors in Osteoporosis Research in India during 2007-16.

Medium of Communication

Of the total Indian publications output in osteoporosis research, 97.50% (976) appeared in journals. The top 15 most productive journals accounted for 10 to 41 papers each in osteoporosis research and together accounted for 26.23% share (255 papers) of total journal publication output during 2007-16. The publication share of these top 15 most productive journals increased from22.28% to 28.64% between 2007-11 and 2012-16. The top most productive journal (with 26 papers) was Journal of Clinical & Diagnostic Research, followed by Osteoporosis International (26 papers), International Journal of Pharma& Bio Sciences (24 papers), Indian Journal of Medical Science and Indian Journal of Rheumatology (19 papers each), etc. during 2007-16.

S.No	Name of the Journal	Number of Papers		
		2007-11	2012-16	2007-16
1	Journal of Clinical & Diagnostic Research	6	35	41
2	Osteoporosis International	12	14	26
3	International Journal of Pharma& Bio Sciences	6	18	24
4	Indian Journal of Medical Science	9	10	19
5	Indian Journal of Rheumatology	13	6	19
6	Archives of Osteoporosis	4	12	16
7	BMJ Case Reports	0	16	16
8	Indian Journal of Pharma Sciences Research and Review	7	8	15
9	Research Journal of Pharmaceutical Biological & Chemical Sciences	2	12	14
10	Indian Journal of Pharmacy & Pharmaceutical Science	1	11	12
11	Journal of International Medical Science Academy	7	5	12
12	JK Science	7	4	11
13	Asian Journal of Pharmaceutical & Clinical Research	6	4	10
14	Indian Journal of Clinical Biochemistry	6	4	10
15	Journal of Endocrinology & Metabolism	0	10	10
	Total of 15 journals	86	169	255
	Total India journal output	386	590	976
	Share of top 15 journals in Indian journal output	22.28	28.64	26.13

Table 6: Top 15 Most Productive Journals in Osteoporosis Research in India during 2007-16.

Summary & Conclusion

Summary

India had produced 1001 publications on osteoporosis research as indexed in Scopus database in 10 years during 2007-16. These publications increased from 40 to 89 from the year 2007 to year 2016, registering 12.50% annual growth. India's global publications share on osteoporosis research was 2.09% during 2007-16, which increased from 1.61% to 2.60% from 2007-11 to 2012-16. India's citation impact on osteoporosis research averaged to 10.97 citations per publication during 2007-16, which dropped from 19.61 to 5.33 from 2007-11 to 2012-16. The share of international collaborative papers of India in its research output on osteoporosis research was 12.59% during 2007-16, which decreased from 13.42% to 12.05% from 2007-11 to 2012-16. Medicine, among subjects, accounted for the highest publications share (70.23%), followed by biochemistry, genetics & molecular biology (26.37%) and pharmacology, toxicology & pharmaceutics (23.88%) during 2007-16.

The top 15 most productive organizations and authors together contributed 38.26% and 27.17% respectively as their share of global publication output and 43.01% and 51.07% respectively as their share of global citation output during 2007-16. The leading most productive Indian organizations contributing to osteoporosis research were Central Drug Research Institute, Lucknow (with 63 papers), followed All India Institute of Medical Sciences, New Delhi(61 papers), Postgraduate Institute of Medical Education & Research, Chandigarh (36 papers) and Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow (29 papers) during 2007-16. The leading Indian organizations with comparatively higher citation impact per paper were Indraprastha Apollo Hospital, Delhi (47.30), Central Drug Research Institute, Lucknow (17.81), Christian Medical College, Vellore (17.79), Indian Institute of Science, Bangalore(17.65) and Kind Edward Memorial Hospital, Mumbai (17.33) during 2007-16.

The leading most productive authors contributing to Indian osteoporosis research were N. Chattopadhyay (with 33 papers), followed by R. Trivedi (31 papers), A. Mithal (25 papers), R. Maurya and D. Singh (23 papers each) and M. Anburajan (19 papers) during 2007-16. The leading Indian authors with comparatively higher citation impact per paper were A. Mithal (55.56), G. Swarnkar(30.31), K. Sharan (25.69), A. Kumar(21.92) and N. Chattopadhyay (21.58) during 2007-16.

Of the 976 journal publications from India on osteoporosis, the top 15 most productive journals accounted for 26.23% share of total Indian journal publication output during 2007-16, which increased from 22.28% to 28.64% between 2007-11 and 2012-16. The top most productive journal was Journal of Clinical & Diagnostic Research (26 papers), followed by Osteoporosis International (26 papers), International Journal of Pharma& Bio Sciences (24 papers), Indian Journal of Medical Science and Indian Journal of Rheumatology (19 papers each), etc. during 2007-16.

Conclusions

Conclude that the risk of osteoporosis increases with age and given the steady increase in life expectancy to 77 years, an estimated 315 million Indians will be over 60 years old by the year 2050. This means that the number of people with osteoporosis and other age-related diseases will rise to unacceptably high levels in India. It is therefore is the right time to carefully consider and create the framework for managing this situation now and at the same time we need to take the necessary steps to create awareness and provide preventive support among public and healthcare professionals as well. According to one survey of Indian orthopaedic surgeons, most believe that fewer than 20% of patients with osteoporosis in India are actually diagnosed and treated for the condition; as a result there is a need to cover at least 75% of the total cases. At the undergraduate level, most aspiring medical students in our country receive inadequate osteoporosis-related education. Most of the screening and diagnostic centres at present are in urban areas and largely inaccessible to 70% of the population that lives in rural areas. Comprehensive management requires a full team of experts comprising a doctor, nurse, dietician, occupational therapist and physiotherapist. Most clinics in India however are not equipped with multi-specialty capabilities. Additionally, many patients drop-out from treatment owing to the high long-term cost and lack of medical insurance. Biological and cultural factors also impact osteoporosis management in India. For instance, calcium and vitamin D are important for strong, healthy bones but over 80% of Indians have low vitamin D levels. In the last two decades, awareness about osteoporosis in India has increased. Professionals, healthcare providers and industry have established associations to improve awareness and research. Better awareness is also linked to better compliance. If the younger family members are more aware about osteoporosis management, it can encourage compliance and follow-up among older patients in the family.

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