

## Knee Osteoarthritis: A Scientometric Assessment of Global Publications Output during 2008-17

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Received: March 05, 2018; Published: April 13, 2018

### Abstract

The present study examined 21164 global publications in knee osteoarthritis, as indexed in Scopus database during 2008-17, with a view to understand their growth rate, global share, citation impact, international collaborative papers share, distribution of publications by broad subjects, productivity and citation profile of top organizations and authors, preferred media of communication and characteristics of high cited papers. The global publications registered an annual average growth rate of 6.86% and its citation impact averaged to 13.37 citations per paper. The global share of top 10 most productive countries ranged from 3.74% to 28.16%, with largest global publication share coming from USA (28.16%), followed by UK (9.69%), China (7.54%), etc. Together, the top 10 most productive countries accounted for 82.45% global publication share during 2008-17, increasing from 80.95% to 83.45% from 2008-12 to 2013-17. Medicine, among subjects, contributed the largest publications share of 91.03%, followed by biochemistry, genetics and molecular biology (5.55%), (12.52%), engineering (10.13%), immunology and microbiology (8.14%), health profession (7.84%), pharmacology, toxicology and pharmaceuticals (2.86%) and neurosciences (1.48%) during 2008-17. Among various organizations and authors contributing to global knee osteoarthritis research, the 20 most productive global organizations and authors together contributed 24.78% and 13.16% respectively as their share of global publication output and 46.55% and 25.94% respectively as their share of global citation output during 2008-17. Amongst 6478 journal papers in global knee osteoarthritis research, the top 15 most productive journals contributed 31.0% share of total journal publication output during 2008-17. Three hundred twenty eight publications were found to be high cited, as they registered citations from 100 to 1489 during 2008-17 and they together received 58460 citations, which averaged to 178.23 citations per paper.

**Keywords:** Knee Osteoarthritis, Global publications, Scientometrics, Bibliometrics

### Introduction

Osteoarthritis (OA) is the most common form of arthritis. It is sometimes called degenerative joint disease or “wear and tear” arthritis. It most frequently occurs in the hands, hips, and knees. With OA, the cartilage and bones within a joint begin to break down. These changes usually develop slowly and get worse over time. OA can cause pain, stiffness, and swelling, and can result in disability [1].

The knee joint consists of both approximation of the proximal tibia and the distal end of the femur. The cartilage located on the ends of the femur and tibia contain an extra cellular matrix that contains type 2 proteoglycans that function by drawing fluid into the joint causing increased shock absorption and proper joint nutrition [2,3]. The knee is a synovial joint, which consists of 3 articulations. The primary joint [art. Tibio-femoral], is located between the convex femoral condyles and the concave tibial condyles. There is also the [art. Patella-femoralis] between the femur and the patella and the [art. Tibio-fibularis] located between the tibia and fibula. OA can only occur in the two primary articulations of the knee, namely the [tibio-femoral] and [patella-femoral] joint, because they have to sustain more motion than the [art. Tibio-fibularis] [3,4].

Knee osteoarthritis is typically characterized by the insidious onset of joint pain, joint stiffness, and limited range of motion. Unknowingly, knee osteoarthritis develops gradually over a period of years and goes unnoticed until it becomes symptomatic. It is common for people with knee osteoarthritis to initially complain of pain that occurs with walking, plus limitations with walking (e.g. distance), going from sit to stand, and stair-climbing. Other common complaints include a feeling that the knee is going to give out, the affected knee locks up, or a popping sensation in the joint [5].

Deterioration of articular (joint) cartilage, which is evident on plain x-rays, is an important diagnostic clue associated with knee osteoarthritis. The cartilage loss in knee osteoarthritis can be caused by: previous knee injury, repetitive strain on the knee, fracture, ligament tear, and meniscal injury, any of which can affect the alignment of the knee and leg, further promoting wear and tear, genetic predisposition to cartilage abnormalities and knee osteoarthritis, obesity and overweight which add stress and burden to the affected joint; adipose tissue increases pro-inflammatory cytokines, and leptin may play a role [5]. Knee osteoarthritis has a high burden on patients and the healthcare system – it is a major contributor to disability and lost productivity, and is the main reason for knee replacement surgery.

There are only few bibliometric studies conducted in the past related to osteoarthritis, knee arthroplasty and surgery. Among such studies, Ajuied, Back, Smith, Davies, Wong and Earnshaw [6] studied the trends in the publication of articles regarding knee arthroplasty and soft tissue surgery with regard to geographical authorship, institutional funding and number of authors. Over 7500 articles from relevant journals with the highest impact factors according to the Thomson Reuters Journal Citation Report (2010) were evaluated from 1995 to 2010. The rate of publication increased by 16.9 per year for arthroplasty articles and by 13.9 per year for soft tissue surgery articles. The relative supremacy of the USA has declined over the 16 years, its share dropping from 72.2% to 39.2% for arthroplasty articles and from 61.7% to 36.6% for soft tissue surgery articles. The UK, Japan, South Korea and smaller countries in Asia and South America have become increasingly prolific. Eom, Bamne, Chowdhry, Chae and Kim [7] determined the temporal pattern of quantity and quality of research pertaining to total knee arthroplasty (TKA) from Asian countries with respect to the total number of publications and citations, with country-specific contribution. Using the impact factors of the journals they were published in, the distribution of research quality was determined. Kumar, Gupta and Goel [8] examined 792 Indian publications on Osteoarthritis research, as covered in Scopus database during 2007-16, with focus on growth rate, citation impact, international collaboration, broad subject-wise distribution, productivity of leading organizations, authors, journals and characteristics of High cited papers.

Since there are no earlier bibliometric studies specially devoted to knee arthritis, we decided to undertake the present study, which focuses on performance of global knee osteoarthritis research during 2008-17, based on publications covered in Scopus database. The study in particular analyses the growth rate, contribution and citation impact of world output as well as of top 10 most productive countries, distribution of global research output by broad subject areas, productivity and citation impact of 20 most productive organizations and authors, important medium of communication and the characteristics of top 328 highly cited papers.

### Methodology

The study retrieved and downloaded the publication data of the world in knee osteoarthritis research from the Scopus database (<http://www.scopus.com>) for 10 years during 2008-17. Keyword such as “knee osteoarthritis” was used in “Keyword” tag or “Article Title” and restricting it to the period 2008-17 in “date range tag” was used for searching the global publication data and this becomes the main search string. When the main search string with restricted to individual top 10 most productive country name in “country tag”, the publication data on the individual country in knee osteoarthritis was obtained. The search string is further refined and restricted to “subject area tag”, “country tag”, “source title tag”, “journal title name” and “affiliation tag”, to get information on the 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 the date of publication till 22 February 2018. The select bibliometric indicators, such as absolute indicators (number of peer reviewed papers, international collaborative papers and citations received) and relative indicators (activity index and relative citation index) have been used to measure the performance of global research in knee osteoarthritis.

(KEY(knee osteoarthritis) OR TITLE(knee osteoarthritis)) AND PUBYEAR > 2007 AND PUBYEAR < 2018

## Analysis

The world has published 21164 publications on knee osteoarthritis research in 10 years during 2008-17, which increased from 1481 publications in 2008 to 2665 publications in 2017, registering annual average growth rates of 6.86%. The cumulative growth of world publications on knee osteoarthritis increased from 8447 during 2008-12 to 12717 publications during 2013-17, witnessing a growth rate of 50.55%. The average citation per publication (CPP) registered by global publications on knee osteoarthritis research was 13.37 during 2008-17, which decreased from 23.90 during 2008-12 to 6.38 during 2013-17 (Table 1).

Publication Period	World		
	TP	TC	CPP
2008	1481	43062	29.08
2009	1534	40825	26.61
2010	1627	43732	26.88
2011	1754	38575	21.99
2012	2051	35656	17.38
2013	2278	30874	13.55
2014	2500	24644	9.86
2015	2582	16243	6.29
2016	2692	7635	2.84
2017	2665	1702	0.64
2008-12	8447	201850	23.90
2013-17	12717	81098	6.38
2008-17	21164	282948	13.37

**Table 1:** World Literature on Knee Osteoarthritis: Growth and Citation Impact, 2008-17.  
TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper

## Global Publication Share and Citation Impact of Top 10 Most Productive Countries

The knee osteoarthritis research global output originated in more than 116 countries during 2008-17, of which 53 countries contributed 1 - 10 papers each, 24 countries 11 - 50 papers each, 10 countries 51 - 100 papers each, 15 countries 101 - 500 papers each, 7 countries 501 - 1000 papers each, 5 countries 1001-2000 papers each and 2 countries 2051 - 5959 papers each during 2008-17. Table 2 lists the output of top 10 most productive countries in knee osteoarthritis research during 2008-17. The publication share of 10 most productive countries in knee osteoarthritis was 82.45% of the world output during 2008-17, which increased from 80.95% during 2008-12 to 83.45% during 2013-17. Individually, the global publication share of these 10 countries varied from 3.74% to 28.16% during 2008-17, with highest publication share (28.16%) coming from USA, followed by U.K. (9.69%), China (7.54%), Germany, Australia and Canada (from 6.06% to 6.80%), Japan (5.69%), Netherlands and France (4.31% and 4.20%) and South Korea (3.74%) during 2008-17. The global publication share has increased by 4.90% in China, followed by 0.94% in Australia, 0.66% in South Korea, 0.35% in Japan and 0.28% in Netherlands, as against decrease by 1.56% in U.K. 1.23% in Germany, 0.79% in Canada, 0.54% in France and 0.51% in USA from 2008-12 to 2013-17. Six out of 10 countries have scored relative citation index more than 1.23: Netherlands (1.64), Canada (1.49), U.K (1.47), USA (1.37), Australia (1.35), France (1.32) and Germany (1.27) during 2008-17.

S. No	Name of Country	Number of Publications			Share of Publications			TC	CPP	ICP	%ICP	RCI
		2008-12	2013-17	2008-17	2008-12	2013-17	2008-17					
1	USA	2404	3555	5959	28.46	27.95	28.16	109418	18.36	1804	30.27	1.37
2	U.K.	898	1153	2051	10.63	9.07	9.69	40428	19.71	843	41.10	1.47
3	China	388	1207	1595	4.59	9.49	7.54	9760	6.12	328	20.56	0.46
4	Germany	637	802	1439	7.54	6.31	6.80	24359	16.93	734	51.01	1.27
5	Australia	482	845	1327	5.71	6.64	6.27	24031	18.11	663	49.96	1.35
6	Canada	552	731	1283	6.53	5.75	6.06	25530	19.90	591	46.06	1.49
7	Japan	463	742	1205	5.48	5.83	5.69	14521	12.05	174	14.44	0.90
8	Netherlands	350	562	912	4.14	4.42	4.31	20003	21.93	378	41.45	1.64
9	France	382	506	888	4.52	3.98	4.20	15655	17.63	391	44.03	1.32
10	South Korea	282	509	791	3.34	4.00	3.74	9241	11.68	135	17.07	0.87
	Total	6838	10612	17450	80.95	83.45	82.45	292946	16.79	6041	34.62	1.26
	World Total	8447	12717	21164				282948	13.37			
		2404	3555	5959	28.46	27.95	28.16	109418	18.36	1804	30.27	1.37

**Table 2:** Publication Output and Global Publication Share of Top 10 Most Productive Countries in Knee Osteoarthritis Research during 2008-17.

**Subject-Wise Distribution of Research Output**

As per the Scopus database classification, the global knee osteoarthritis research output is distributed across seven sub-fields during 2008-17. Among sub-fields, medicine registered the highest publications share (91.03%), followed by biochemistry, genetics and molecular biology (12.52%), engineering (10.13%), immunology and microbiology (8.14%), health profession (7.84%), pharmacology, toxicology and pharmaceuticals (2.86%) and neurosciences (1.48%) during 2008-17. The publication activity, as seen through activity index from 2008-12 to 2013-17, witnessed decrease in medicine (from 101.65 to 98.90), immunology and microbiology (from 116.84 to 88.82) and pharmacology, toxicology and pharmaceuticals (from 106.67 to 95.57), as against increase in biochemistry, genetics and molecular biology (from 83.33 to 111.07), engineering (from 92.32 to 105.10) and health profession (from 96.30 to 102.46) from 2008-12 to 2013-17 (Table 3).

S. No	Subject*	Number of Papers (TP)			Activity Index		%TP
		2008-12	2013-17	2008-17	2008-12	2013-17	2008-17
1	Medicine	7816	11449	19265	101.65	98.90	91.03
2	Biochemistry, Genetics and Molecular Biology	881	1768	2649	83.33	111.07	12.52
3	Engineering	790	1354	2144	92.32	105.10	10.13
4	Immunology and Microbiology	803	919	1722	116.84	88.82	8.14
5	Health Profession	638	1022	1660	96.30	102.46	7.84
6	Pharmacology, Toxicology and Pharmaceuticals	258	348	606	106.67	95.57	2.86
7	Neurosciences	145	168	313	116.07	89.33	1.48
	World Output	8447	12717	21164			

**Table 3:** Subject-Wise Breakup of Global Publications in Knee Osteoarthritis Research during 2008-17.

### Profile of Top 20 Most Productive Organizations

8409 organizations participated in global knee osteoarthritis research, of which 6052 organizations contributed 1 - 5 papers each, 1573 organizations 6 - 10 papers each, 436 organizations 11 - 20 papers each, 140 organizations 21 - 50 papers each, 147 organizations 51 - 100 papers each and 61 organizations 101 - 500 papers each. The productivity of 20 most productive organizations in knee osteoarthritis research varied from 172 to 406 publications and together contributed 24.78% (5245 publications) publication share and 46.55% (131723) citation share to its cumulative publications output during 2008-17. The scientometric profile of these 20 organizations is presented in table 4.

S. No.	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	University of California, San Francisco, USA	406	10898	26.84	52	201	49.51	2.01
2	Boston University, School of Medicine, USA	373	20011	53.65	52	277	74.26	4.01
3	University of Melbourne, Australia	340	7417	21.81	43	140	41.18	1.63
4	VA Medical Center, USA	339	6498	19.17	39	90	26.55	1.43
5	University of Sydney, Australia	322	7931	24.63	45	205	63.66	1.84
6	Harvard Medical School, USA	299	5536	18.52	41	141	47.16	1.38
7	University of Oxford, U.K	296	7475	25.25	46	158	53.38	1.89
8	Hospital for Special Surgery, New York, USA	272	4117	15.14	31	63	23.16	1.13
9	Brigham and Women's Hospital, USA	269	5972	22.20	38	116	43.12	1.66
10	Monash University, Australia	267	4807	18.00	34	94	35.21	1.35
11	Lunds Universitet, Sweden	253	7827	30.94	47	197	77.87	2.31
12	Erasmus University Medical Centre, Netherlands	231	6132	26.55	42	78	33.77	1.99
13	Duke University School of Medicine, USA	210	4490	21.38	38	54	25.71	1.60
14	INSERM, France	206	4658	22.61	39	86	41.75	1.69
15	Syddansk Universitet, Denmark	204	5245	25.71	38	148	72.55	1.92
16	Royal North Shore Hospital, Australia	202	5573	27.59	41	129	63.86	2.06
17	University of Pittsburg, USA	201	4419	21.99	37	77	38.31	1.64
18	University of Toronto, Canada	201	4822	23.99	37	72	35.82	1.79
19	Rush University Medical Centre, USA	182	4123	22.65	36	52	28.57	1.69
20	Stanford University, USA	172	3772	21.93	36	64	37.21	1.64
	Total of 20 organizations	5245	131723	25.11	40.6	2442	46.56	1.88
	Total of World	21164	282948	13.37				
	Share of top 20 organizations in World's total	24.78	46.55					

**Table 4:** Scientometric Profile of Top 20 Most Productive Global Organizations in Knee Osteoarthritis Research during 2008-17.

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; HI: h-index; ICP: International Collaborative Papers; RCI: Relative Citation Index

- Ten organizations have registered higher publications output than the group average of 262.25: University of California, San Francisco, USA (406 papers), Boston University, School of Medicine, USA (373 papers), University of Melbourne, Australia (340 papers), VA Medical Center, USA (339 papers), University of Sydney, Australia (322 papers), Harvard Medical School, USA (299 papers), University of Oxford, U.K. (296 papers), Hospital for Special Surgery, New York, USA (272 papers), Brigham and Women’s Hospital, USA (269 papers) and Monash University, Australia (267 papers) during 2008-17.
- Seven organizations have registered more than the average citation per publication (25.11) Boston University, School of Medicine, USA (53.65), Lunds Universitet, Sweden (30.94), Royal North Shore Hospital, Australia (27.59), University of California, San Francisco, USA (26.84), Erasmus University Medical Centre, Netherlands (26.55), Syddansk Universitet, Denmark (25.71) and University of Oxford, U.K (25.25) during 2008-17.
- Eight organizations have achieved more than the average share of international collaborative publications (46.56%): Lunds Universitet, Sweden (77.87%), Boston University, School of Medicine, USA (74.26%), Syddansk Universitet, Denmark (72.55%), Royal North Shore Hospital, Australia (63.86%), University of Sydney, Australia (63.66%), University of Oxford, U.K (53.38%), University of California, San Francisco, USA (49.51%) and Harvard Medical School, USA (47.16%) during 2008-17.
- Seven organizations have registered the relative citation index more than average (1.88): Boston University, School of Medicine, USA (4.01), Lunds Universitet, Sweden (2.31), Royal North Shore Hospital, Australia (2.06), University of California, San Francisco, USA (2.01), Erasmus University Medical Centre, Netherlands (1.99), Syddansk Universitet, Denmark (1.92) and University of Oxford, U.K. (1.89) during 2008-17.

**Profile of Top 20 Most Productive Authors**

11321 authors participated in global knee osteoarthritis research, of which 8112 authors contributed 1 - 5 papers each, 2173 authors 6 - 10 papers each, 572 authors 11 - 20 papers each, 286 authors 21 - 30 papers, 109 authors 31 - 50 papers each, 52 authors 51 - 100 papers each and 17 authors 101 - 300 papers each. The productivity of 20 most productive authors in knee osteoarthritis research varied from 96 to 254 publications and together contributed 13.16% (2785 publications) publication share and 25.94% (73393) citation share to its cumulative publications output during 2008-17. The scientometric profile of these 20 authors is presented in table 5.

S. No.	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI	ICP	%ICP	RCI
1	A. Guermazi	Boston University, School of Medicine, USA	254	7657	30.15	48	212	83.46	2.25
2	M.C. Nevitt	University of California, San Francisco, USA	223	6624	29.70	44	131	58.74	2.22
3	F.M. Ciucuttini	Monash University, Australia	204	4247	20.82	33	73	35.78	1.56
4	D.T. Felson	Boston University, School of Medicine, USA	189	6989	36.98	47	140	74.07	2.77
5	F.W. Roemer	Boston University, School of Medicine, USA	187	5091	27.22	41	166	88.77	2.04
6	D.J. Hunter	University of Sydney, Australia	177	3972	22.44	31	136	76.84	1.68
7	K.L. Bennell	University of Melbourne, Australia	141	3170	22.48	31	65	46.10	1.68
8	S.M.A. Bierma Zeinstra	Erasmus University Medical Centre, Netherlands	138	4113	29.80	29	38	27.54	2.23
9	J. Niu	Boston University, School of Medicine, USA	128	3999	31.24	36	73	57.03	2.34
10	R.S. Hinman	University of Melbourne, Australia	121	2963	24.49	31	45	37.19	1.83
11	J.P. Pelletier	University of Montreal Hospital Research Centre, Canada	112	2922	26.09	34	65	58.04	1.95
12	J. Martel-Pelletier	University of Montreal Hospital Research Centre, Canada	109	2802	25.71	32	61	55.96	1.92
13	T.M. Link	University of California, San Francisco, USA	105	2636	25.10	30	54	51.43	1.88
14	A.E. Wluka	Monash University, Australia	103	2088	20.27	26	23	22.33	1.52
15	J.N. Katz	Brigham & Women’s Hospital, USA	101	2320	22.97	23	40	39.60	1.72
16	E.M. Roos	University of Southern Denmark	101	3329	32.96	28	69	68.32	2.47
17	J. Dekker	V.U. University Medical Centre, Amsterdam, Netherlands	100	1607	16.07	23	34	34.00	1.20
18	G. Jones	University of Tasmania, Australia	98	2230	22.76	25	46	46.94	1.70
19	V.B. Kraus	Duke University Medical Centre, USA	98	2820	28.78	31	45	45.92	2.15
20	W. Wirth	Chondrometrics GmbH, Airing, Germany	96	1814	18.90	26	88	91.67	1.41
		Total of 20 authors	2785	73393	26.35	32.45	1604	57.59	1.97
		Total of the World	21164	282948	13.37				
		Share of 20 authors in World output	13.16	25.94					

**Table 5:** Top 20 Most Productive Authors in Knee Osteoarthritis Research, 2008-17.

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; HI: h-index; ICP: International Collaborative Papers; RCI: Relative Citation Index

- Seven authors have registered higher publications output than the group average of 139.25: A Guermazi (USA) (254 papers), MC Nevitt (USA) (223 papers), FM Ciucuttini (Australia) (204 papers), DT Felson (USA) (189 papers), FW Roemer (USA) (187 papers), DJ Hunter (Australia) (177 papers) and KL Bennell (Australia) (141 papers) during 2008-17.
- Eight authors have registered more than the average citation per publication (26.35) of all authors: DT Felson (USA) (36.98), EM Roos (Denmark) (32.96), J Niu (USA) (31.24), A Guermazi (USA) (30.15), SMA Bierma-Zeinstra (Netherlands) (29.80), MC Nevitt (USA) (29.70), VB Kraus (USA) (28.78) and FW Roemer (USA) (27.22) during 2008-17.
- Eight authors have achieved more than the average share of international collaborative publications (57.59%) of all authors: W Wirth (Germany) (91.67%), FW Roemer (USA) (88.77%), A Guermazi (USA) (83.46%), DJ Hunter (Australia) (76.84%), DT Felson (USA) (74.07%), EM Roos (Denmark) (68.32%), MC Nevitt (USA) (58.74%) and JP Pelletier (Canada) (58.04) during 2008-17.
- Eight authors registered the relative citation index more than average (1.97) of all authors: DT Felson (USA) (2.77), EM Roos (Denmark) (2.47), J Niu (USA) (2.34), A Guermazi (USA) (2.25), SMA Bierma-Zeinstra (Netherlands) (2.23), MC Nevitt (USA) (2.22), VBKraus (USA) (2.15) and FW Roemer (USA) (2.04) during 2008-17.

**Medium of Communication**

2152 journals participated in 6478 journal papers in knee osteoarthritis, of which 1570 journals contributed 1 - 5 papers each, 430 journals 6 - 10 papers each, 52 journals 11 - 20 papers each, 41 journals 31 - 50 papers each, 27 journals 51 - 100 papers each, 29 journals 101 - 500 papers each and 4 journals more than 572 - 1258 papers each. The 15 most productive journals in knee osteoarthritis contributed from 202 to 1258 papers and together contributed 31.00% share (6478 papers) to the total journal publication output during 2008-17. The publication share of these top 15 most productive journals decreased from 31.73% to 30.52% from 2008-12 to 2013-17. The most productive journal (with 1258 papers) was *Osteoarthritis and Cartilage*, followed by *Journal of Arthroplasty* (821 papers), *Knee Surgery, Sports, Traumatology Arthroscopy* (633 papers), *Knee* (572 papers), *BMC Musculoskeletal Disorders* (423 papers), etc. during 2008-17 (Table 6).

S. No.	Name of the Journal	Number of Papers		
		2008-12	2013-17	2008-17
1	<i>Osteoarthritis and Cartilage</i>	546	712	1258
2	<i>Journal of Arthroplasty</i>	292	529	821
3	<i>Knee Surgery, Sports, Traumatology Arthroscopy</i>	187	446	633
4	<i>Knee</i>	205	367	572
5	<i>BMC Musculoskeletal Disorders</i>	143	280	423
6	<i>Arthritis Care and Research</i>	168	211	379
7	<i>Clinical Orthopaedics and Related Research</i>	174	184	358
8	<i>Annals of Rheumatic Diseases</i>	162	166	328
9	<i>International Orthopaedics</i>	125	186	311
10	<i>Journal of Orthopaedic Research</i>	107	170	277
11	<i>Arthritis and Rheumatism</i>	222	38	260
12	<i>Arthritis Research and Therapy</i>	120	122	242
13	<i>PLOS One</i>	21	190	211
14	<i>American Journal of Sports Medicine</i>	74	129	203
15	<i>Orthopedics</i>	103	99	202
	Total of 15 Journals	2649	3829	6478
	Total of World	8349	12547	20896
	Share of 15 journals in World journal output	31.73	30.52	31.00

**Table 6:** List of Top 15 Most Productive Journals in Global Knee Osteoarthritis during 2008-17.

### Highly Cited Papers

There were 328 highly cited papers, which have received citations from 100 to 1489 during 2008-17. These 328 highly cited papers together received 58460 citations, leading to average citation per paper of 178.23. Of the 64 highly cited papers, 19 involve the participation of single organization (non-collaborative) and 45 involved the participation of two or more organizations (of which 28 national collaborative and 17 international collaborative). Among international collaborative papers, the largest participation was from USA (167 papers), followed by U.K. (58 papers), Germany and Canada (34 papers each), Australia (33 papers), Sweden (25 papers), Netherlands (24 papers), Italy and Belgium (18 papers each), France (17 papers), Denmark (16 papers), Switzerland (15 papers), Spain (14 papers), Norway (13 papers), Japan (12 papers), South Korea, Austria and Finland (5 papers each), China (4 papers), India, New Zealand and Portugal (3 papers each), Brazil (2 papers), etc. Among 328 highly cited papers, 242 appeared as articles, 76 as reviews and 10 as conference papers. The 328 highly cited papers involved the participation of 2057 authors and 1291 organizations. Among high cited papers, the most productive organizations were: Boston University School of Medicine, USA (21 papers), University of Sydney, Australia and Lunds University, Sweden (15 papers each), Brigham and Women's Hospital, USA (14 papers), University of Oxford, U.K. (12 papers), Erasmus University Medical Centre, Netherlands and Royal North Shore Hospital, Australia (11 papers), University of Iowa, USA (10 papers), Hospital for Special Surgery-New York, USA and McMaster's University, Canada (8 papers each), Syddansk Universitet, Denmark and University of North Carolina at Chapel Hill, USA (7 papers each), VA Medical Centre, USA, Monash University, Australia, INSERM, France and University of Pittsburg, USA (6 papers each), etc. Among high cited papers, the most productive authors were: A Guermazi (USA) and DT Felson (USA) (15 papers each), MC Nevitt (USA) (11 papers), FW Roemer (USA) (10 papers), N Niu (USA) (9 papers), DJ Hunter (Australia), KL Bennell (Australia) and RS Hinman (Australia) (7 papers each), etc.

These 328 highly cited papers were published in 124 journals, of which 34 papers were published in *Osteoarthritis and Cartilage*, followed by *Arthritis and Rheumatism* (23 papers), *Annals of Rheumatic Diseases* (21 papers), *American Journal of Sports Medicine* (19 papers), *Arthritis Care and Research* (15 papers), *Clinical Orthopaedics and Related Research* (12 papers), *Journal of Bone and Joint Surgery. Series A* (10 papers), *BMJ Online* (8 papers), *Arthroscopy Journal of Arthroscopic and Related Surgery and Knee Surgery Sports Traumatology and Arthroscopy* (7 papers each), *Journal of Bone and Joint Surgery, Series B* (6 papers), *Acta Orthopaedica*, *BMC Musculoskeletal Disorders*, *Arthritis Research and Therapy*, *Journal of Biomechanics*, *Rheumatic Disease Clinic of North America*, *Pain* and *New England Journal of Medicine* (5 papers), *Seminar in Arthritis and Rheumatology*, *Nature Reviews in Rheumatology* and *Annals of Internal Medicine* (4 papers each), *Journal of Rheumatology*, *Clinical Biomechanics*, *Journal of Orthopaedic Research*, *Best Practice and Research Clinical Rheumatology and Nature Medicine* (3 papers each), *Knee*, *International Orthopaedics*, *British Journal of Sports Medicine*, *Current Opinion in Rheumatology*, *Cochrane Database of Systematic Reviews*, and *Physical Therapy* (2 papers) and 1 paper each in 92 other journals.

### Discussion and Conclusion

21164 global publications on knee osteoarthritis, as indexed in Scopus database, were published during 2008-17 and they increased from 1481 to 2665 in the year 2008 to the year 2017, registering 6.86% growth per annum. Their cumulative global publication output on hip replacement surgery increased from 8447 to 12717, witnessing 50.55% growth from 2008-12 to 2013-17. The citation impact per paper of global publications knee osteoarthritis research was averaged to 13.37 during 2008-17, however, decreasing from 23.90 during 2008-12 to 6.38 during 2013-17.

The global publication share of the top 10 most productive countries in knee osteoarthritis research varied from 3.74% to 28.16%, with highest publication share (28.16%) coming from USA, followed by U.K. (9.69%), China (7.54%), Germany, Australia and Canada (from 6.06% to 6.80%), Japan (5.69%), Netherlands and France (4.31% and 4.20%) and South Korea (3.74%) during 2008-17. Together these top 10 countries contributed 82.45% global share during 2008-17, increasing from 80.95% during 2008-12 to 83.45% during 2013-17. The global publication share has increased in China, Australia, South Korea, Japan and Netherlands, as against decrease in U.K., Germany, Canada, France and USA from 2008-12 to 2013-17. Six out of 10 countries have scored relative citation index more than 1.23: Netherlands (1.64), Canada (1.49), U.K. (1.47), USA (1.37), Australia (1.35), France (1.32) and Germany (1.27) during 2008-17. Six countries (out of 10) have scored relative citation index more than 1.23: Netherlands (1.64), Canada (1.49), U.K. (1.47), USA (1.37), Australia (1.35), France (1.32) and Germany (1.27) during 2008-17.



Among seven broad subjects, medicine contributed the largest publications share of 91.03% in knee osteoarthritis research, followed by biochemistry, genetics and molecular biology (12.52%), engineering (10.13%), immunology and microbiology (8.14%), health profession (7.84%), pharmacology, toxicology and pharmaceuticals (2.86%) and neurosciences (1.48%) during 2008-17. As per the Scopus database classification, the global knee osteoarthritis research output is distributed across seven sub-fields during 2008-17.

Among leading organizations and authors participating in global knee osteoarthritis research, the 20 most productive global organizations and authors together contributed 24.78% and 13.16% respectively as their share of global publication output and 46.55% and 25.94% respectively as their share of global citation output during 2008-17. The leading organizations in research productivity were: University of California, San Francisco, USA (406 papers), Boston University, School of Medicine, USA (373 papers), University of Melbourne, Australia (340 papers), VA Medical Center, USA (339 papers), University of Sydney, Australia (322 papers), Harvard Medical School, USA (299 papers), University of Oxford, U.K. (296 papers), Hospital for Special Surgery, New York, USA (272 papers), Brigham and Women's Hospital, USA (269 papers) and Monash University, Australia (267 papers) during 2008-17. The leading organizations in terms of relative citation index were: Boston University, School of Medicine, USA (4.01), Lunds Universitet, Sweden (2.31), Royal North Shore Hospital, Australia (2.06), University of California, San Francisco, USA (2.01), Erasmus University Medical Centre, Netherlands (1.99), Syddansk Universitet, Denmark (1.92) and University of Oxford, U.K. (1.89) during 2008-17.

Among the total global journal output of 6478 papers in knee osteoarthritis research, the top 15 most productive journals contributed 31.0% share of total journal publication output during 2008-17, which decreased from 31.73% to 30.52% from 2008-12 to 2013-17. *Osteoarthritis and Cartilage* was the most productive journals with 1258 papers each, followed by *Journal of Arthroplasty* (821 papers), *Knee Surgery, Sports, Traumatology Arthroscopy* (633 papers), *Knee* (572 papers), *BMC Musculoskeletal Disorders* (423 papers), etc. during 2008-17.

The top 328 highly cited publications registered citations in the range from 100 to 81489 citations per paper and together these top 328 papers cumulated 58460 citations, with an average of 178.235 citations per paper. These 328 highly cited papers resulted from participation of 2057 authors and 1291 organizations, and were published in 124 journals, of which 34 papers were published in *Osteoarthritis and Cartilage*, followed by *Arthritis and Rheumatism* (23 papers), *Annals of Rheumatic Diseases* (21 papers), *American Journal of Sports Medicine* (19 papers), *Arthritis Care and Research* (15 papers), *Clinical Orthopaedics and Related Research* (12 papers), *Journal of Bone and Joint Surgery. Series A* (10 papers), etc.

Conclude that there is need for evolving guidelines at national level for reducing the risk of osteoarthritis, early diagnosis of osteoarthritis, treatment and management in early stage of osteoarthritis, treatment and management during acute episodes of osteoarthritis, long term management of osteoarthritis, and treatment and management in advanced stages of osteoarthritis. There is an need for increasing awareness on the importance in identifying early phases of the degenerative processes in knee osteoarthritis (OA), the crucial period of the disease when there might still be the possibility to initiate treatments preventing its progression. The national policy should be directed to increasing education of the public and the medical community about the high prevalence of these conditions, especially in affected subgroups particularly the aged people, to decrease their impact and ultimately prevent them. Additional research is needed to determine the evaluative techniques for OA of the knee that provide the most useful information for management decisions, the management techniques that maximize patient outcomes, and the criteria that should be used to select patients who would benefit most from referral for possible total knee replacement.

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**Volume 9 Issue 5 May 2018**

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