

Global Gout Research: A Scientometric Assessment of Publications Output during 1998-17

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Abstract

This paper examined 12694 global research output on gout research during 1998-17, on a series of aspects, such as the 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 bibliographic characteristics of high cited papers. The gout global research output registered an average annual growth rate of 7.89% and averaged citation impact per paper of 20.87. Among 148 participating countries, the paper studied the global publication profile of top 10 countries, which had global publications share ranging from 3.51% to 28.07% during 1998-17, with highest publication share (28.07%) coming from USA, followed by U.K. (7.91%), China (5.98%), etc. The top 10 countries together contributed 71.14% share to the world publication output during 1998-17, which increased from 65.58% to 73.43% from 1998-07 to 2008-17. Medicine, among four subjects, registered the highest publications share (80.21%), followed by biochemistry, genetics and molecular biology (12.85%), pharmacology, toxicology and pharmaceuticals (12.01%) and immunology and microbiology (11.30%) during 1998-17. Among 957 organizations and 1139 authors contributing to global gout research, the 10 most productive global organizations and authors together contributed 35.93% and 49.82% respectively as their share of global publication output and 84.60% and 38.70% respectively as a share of global citation output during 1998-17. Of the 12284 journal papers (appearing in 957 journals), the top 15 most productive journals reporting global research on gout research together contributed 15.58% share of total journal publication output during 1998-17. The paper also identified 496 highly cited publications registering citations from 100 to 2492 during 1998-17 and they together received 129930 citations, averaging 161.96 citations per paper.

Keywords: *Gout Research; Metallic Disorder; Arthritis; Orthopaedics; Global Publications; Bibliometrics; Scientometrics*

Introduction

Gout is a metabolic disorder; however, because the clinical presentation closely resembles arthritis. Gout is also classified as a form of crystal-induced arthritis [1]. Gout is a form of acute arthritis that causes severe pain and swelling in the joints. It most commonly affects the big toe, but may also affect the heel, ankle, hand, wrist, or elbow. It affects the spine often enough to be a factor in lower back pain. Gout is often a recurring condition. The central pathological feature of gout is chronic deposition of monosodium urate crystals, which form in the presence of increased urate concentrations. The clinical features of gout occur as a result of the inflammatory response to monosodium urate crystals, and treatment strategies that achieve crystal dissolution are central to effective gout management [1].

Uric acid is formed in the bloodstream when the body breaks down waste products, mainly those containing purines. Purines can be produced naturally by the body, and they can be ingested from such high-purine foods as meat. Normally, the kidneys filter uric acid particles out of the blood and excrete it into the urine. If the body produces too much uric acid or the kidneys aren't able to filter enough of it out, there is a buildup of uric acid in the bloodstream. Over the course of years, or even decades, hyperuricemia may cause deposits of crystallized uric acid throughout the body. Joints, tendons, ear tips, and kidneys are favored sites. When the immune system becomes alerted to the urate crystals, it mounts an inflammatory response that includes the pain, redness, swelling, and damage to joint tissue that are the hallmarks of an acute gout attack [2]. The four phases of gout include asymptomatic hyperuricemia, acute gouty arthritis, intercritical gout and chronic tophaceous gout [2,3].

The causes of gout are unclear but appear to be multifactorial: a combination of genetic, hormonal, metabolic, and dietary factors. Family history, advancing age, male sex, or, in women, early menopause have been associated with a higher risk of gout and/or gout flares. Dietary risk factors for gout have been postulated to include alcohol consumption, as well as consumption of meat, seafood, sugar sweetened soft drinks, and foods high in fructose, whereas dairy foods and coffee have been associated with a lower risk of incident gout and in some cases a lower rate of gout flares [4].

The distribution of gout is uneven across the globe, with prevalence being highest in Pacific countries. Developed countries tend to have a higher burden of gout than developing countries, and seem to have increasing prevalence and incidence of the disease. Some ethnic groups are particularly susceptible to gout, supporting the importance of genetic predisposition. Socioeconomic and dietary factors, as well as comorbidities and medications that can influence uric acid levels and/or facilitate MSU crystal formation, are also important in determining the risk of developing clinically evident gout [5].

Literature Review

Very few bibliometric studies are available at national and global level on gout research. Gerber, Groneberg, Klingelhöfers and Bundschuh [6] used scientometric methods to evaluate quality and quantity of scientific efforts (4424 items from 71 countries during 1990-2012) in global gout research, using PubMed and ISI-Web database. The study identified the leading countries, organizations, authors and journals, subject areas and the extent of international and national cooperation. Manimekalai and Nagarajan [7] evaluated research output on gout in different parts of the world during 1970 - 2017 through different bibliometric indicators, using Scopus database for the period 1970-17. The study examined the pattern of growth of the output, its geographical distribution. Manimekalai, Kavitha and Nagarajan [8] evaluated the Indian research output (556) on gout research during 1970-17 using different bibliometric indicators, using Scopus database. 556 papers were contributed by 3106 authors. Only 7.4% of gout research was solo research. In other words 92.6% were collaborative research. The average author per paper works out to 5.59 which indicate the collaborative research persists in gout research output and nearly 5 to 6 authors per paper. 17 countries collaborated with Indian authors at least in four papers. Similar bibliometric studies have also been carried out in the area of arthritis [9], osteoarthritis [10-12], rheumatoid arthritis [13] and osteoporosis [14].

Objectives of the Study

The present study is aimed at examining global publications on gout research as indexed and covered in Scopus database during 1998-17. The objectives are to study:

- The growth and distribution of global research literature and its growth rate;
- The publication profile of top 10 most productive countries;
- The distribution of global output by broad subject areas;
- The scientometric profile of top 50 most productive global organizations and authors, in terms of publication productivity, citation impact and international collaboration; and
- The medium of communication, particularly the most productive journals; and
- The bibliographical characteristics of its 496 highly cited papers.

Methodology

Select quantitative and qualitative indicators have been used in this study to measure the performance of global gout research. The global publication data of top 10 countries were sourced from Scopus database (<http://www.scopus.com>) using a significant keyword for the years 1998 to 2017. The “Keywords” and “Article Title” tags (as shown in the search string below) were searched for the Keyword “gout” restricting the hit to the period 1998-17. This statement became the main search string. The main search string was further restricted to individual top 10 countries one by one, in “country tag” for obtaining publication data of these countries. The main search string is further refined, as provided in Scopus database, by restricting 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. Citations to publications were also collected from the date of publication till 1 November 2018 (the date of downloading the data).

(KEY(gout) OR TITLE(gout)) AND PUBYEAR > 1997 AND PUBYEAR < 2018

Analysis

The world has published 12694 publications on gout research in 20 years during 1998-17, which increased from 269 publications in 1998 to 1052 publications in 2017, registering annual average growth rate of 7.89%. The cumulative publications in gout research increased from 3704 to 8990 from 1998 - 2007 to 2008-17, witnessing a growth rate of 142.71%. The citation impact of gout research was 20.87 during 1998-17, which decreased from 29.58 to 17.28 during 1998-07 to 2008-17 (Table 1). Of the total global publications in gout research, 61.09% (7755) appeared as articles, 20.26% (2572) as reviews, 5.42% (688) as letters, 3.74% (475) as notes, 2.57% (326) as editorials, 2.45% (311) as short surveys, 2.16% (274) as conference papers, 1.69% (215) as book chapters, and others less than 1%: erratum (45), books (23), articles in press (7), conference reviews (2) and others (1).

Period	TP	TC	CPP
1998	269	7887	29.32
1999	227	4558	20.08
2000	247	8770	35.51
2001	256	5140	20.08
2002	322	9502	29.51
2003	413	11754	28.46
2004	443	16355	36.92
2005	467	14947	32.01
2006	532	17581	33.05
2007	528	13067	24.75
2008	651	24708	37.95
2009	701	22619	32.27
2010	789	24217	30.69
2011	855	20082	23.49
2012	917	16010	17.46
2013	955	14099	14.76
2014	982	10979	11.18
2015	1044	9738	9.33
2016	1044	8535	8.18
2017	1052	4353	4.14
1998-07	3704	109561	29.58
2008-17	8990	155340	17.28
1998-17	12694	264901	20.87

Table 1: World literature on gout research: annual and cumulative growth, 1998-17.

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper.

Global publication output and share of top 10 countries

The global gout research output originated in 148 countries during 1998-17, of which 90 countries contributed 1 - 10 papers each, 22 countries 11 - 50 papers each, 16 countries 51 - 100 papers each, 18 countries 101 - 1000 papers each, 1 country 1001 - 2000 papers each and 1 country 3568 papers during 1998-17.

Table 2 lists the output of top 10 most productive countries on global gout research during 1998-17. The cumulative publication share of 10 most productive countries in gout research was 71.14% of the world publications output and more than 100% of global citation output during 1998 - 2017. The cumulative publication share of top 10 most productive countries increased from 65.58% to 73.43% from 1998-07 to 2008-17. Individually, the global publication share of these top 10 countries varied from 3.51% to 28.07% during 1998 - 2017, with highest publication share (28.07%) coming from USA, followed by U.K (7.91%), China (5.98%), France, Germany, India and Japan (from 4.06% to 4.92%), Spain, Italy and Taiwan (from 3.51% to 3.89%) during 1998 - 2017. The global publication share increased in China, Italy, German, Taiwan, France and Japan (from 0.02% to 5.28%), as against decrease in USA, U.K. and Spain (from 0.03% to 1.16%) from 1998-07 to 2008-17. Only five countries registered relative citation index above their average value of 1.45: Italy (2.03), Germany (1.84), Spain (1.82), USA (1.71) and U.K (1.60) during 1998-17.

Subject-wise distribution of research output

As per the Scopus database classification, the global gout research output is distributed across four sub-fields during 1998-17. Among the 4 sub-fields, medicine registered the highest publications share (80.21%), followed by biochemistry, genetics and molecular biology (12.85%), pharmacology, toxicology and pharmaceuticals (12.01%) and immunology and microbiology (11.30%) during 1998-17. The publication activity, as seen through activity index from 1998-07 to 2008-17, witnessed increase in biochemistry, genetics and molecular biology (from 80.90 to 107.87), pharmacology, toxicology and pharmaceuticals (from 80.51 to 108.03) and immunology and microbiology (from 94.81 to 102.14), as against decrease in medicine (from 101.14 to 99.53) from 1998-07 to 2008-17. Biochemistry, genetics and molecular biology registered the highest citation impact per paper of 31.95, followed by immunology and microbiology (41.30), medicine (21.15) and pharmacology, toxicology and pharmaceuticals (18.69) (Table 3).

S. No	Country Name	Number of Papers			Share of Papers			TC	CPP	ICP	%ICP	RCI
		1998-07	2008-17	1998-17	1998-07	2008-17	1998-17					
1	USA	1070	2493	3563	28.89	27.73	28.07	127087	35.67	862	24.19	1.71
2	U.K.	316	688	1004	8.53	7.65	7.91	33506	33.37	358	35.66	1.60
3	China	83	676	759	2.24	7.52	5.98	8665	11.42	137	18.05	0.55
4	France	177	448	625	4.78	4.98	4.92	16790	26.86	167	26.72	1.29
5	Germany	160	455	615	4.32	5.06	4.84	23624	38.41	240	39.02	1.84
6	India	87	440	527	2.35	4.89	4.15	6455	12.25	82	15.56	0.59
7	Japan	150	366	516	4.05	4.07	4.06	15157	29.37	93	18.02	1.41
8	Spain	145	349	494	3.91	3.88	3.89	18747	37.95	162	32.79	1.82
9	Italy	120	361	481	3.24	4.02	3.79	20334	42.27	181	37.63	2.03
10	Taiwan	121	325	446	3.27	3.62	3.51	8721	19.55	84	18.83	0.94
	Total	2429	6601	9030	65.58	73.43	71.14	279086	30.91	2366	26.20	1.48
	World	3704	8990	12694				264901	20.87			

Table 2: Global publication output and share of top 10 countries in gout research during 1998-17.

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; ICP: International Collaborative Papers; RCI: Relative Citation Index.

S. No	Subject*	Number of Papers (TP)			Activity Index		TC	CPP	%TP
		1998-07	2008-17	1998-17	1996-06	2007-17			
1	Medicine	3005	7177	10182	101.14	99.53	215372	21.15	80.21
2	Biochemistry, genetics and molecular biology	385	1246	1631	80.90	107.87	52106	31.95	12.85
3	Pharmacology, toxicology and pharmaceutics	358	1166	1524	80.51	108.03	28479	18.69	12.01
4	Immunology and microbiology	397	1038	1435	94.81	102.14	59260	41.30	11.30
	World Output	3704	8990	12694	100.00	100.00			

Table 3: Subject-wise breakup of global publications in gout research during 1998 - 2017.

Stages of the gout

On classifying papers according to various stages of gout, it was found that Chronic Tophaceous Gout contributed the largest number and share of papers (2679 papers and 21.10% share), followed by Acute Gouty Arthritis (2382 papers and 18.76% share), Asymptomatic Hyperuricemia (402 papers and 3.17% share) and Inter-critical Gout (60 papers and 0.47% share) during 1998-17. The global publication share increased in Asymptomatic Hyperuricemia (from 2.78% to 3.33%) and Chronic Tophaceous Gout (from 18.03% to 22.37%), as against decrease in Acute Gouty Arthritis (from 18.90% to 18.71%) and Inter-Critical Gout (from 0.51% to 0.46%) from 1998-07 to 2008-17 (Table 4).

S. No.	Stages of Gout	Number of Papers			Share of Papers			TC	CPP
		98-07	08-17	98-17	98-07	08-17	98-17		
1	Asymptomatic Hyperuricemia	103	299	402	2.78	3.33	3.17	7125	17.72
2	Acute Gouty Arthritis	700	1682	2382	18.90	18.71	18.76	62952	26.43
3	Inter-Critical Gout	19	41	60	0.51	0.46	0.47	1224	20.40
4	Chronic Tophaceous Gout	668	2011	2679	18.03	22.37	21.10	45228	16.88
	Total	3704	8990	12694					

Table 4: Distribution of global gout output by stages of gout during 1998-17.

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper.

Profile of top 50 most productive organizations

About 957 organizations participated in global gout research during 1998-17, of which 621 organizations contributed 1 - 10 papers each, 115 organizations 11 - 20 papers each, 25 organizations 21 - 30 papers each, 12 organizations 31 - 40 papers each, 4 organizations 41 - 50 papers each, 19 organizations 51 - 100 papers each, 6 organizations 101 - 200 papers each and 2 organization 201 - 297 papers each during 1998 - 2017.

The productivity of 50 most productive organizations in global gout research varied from 53 to 380 publications and together contributed 35.39% (4493 publications) publication share and 84.60% (224119) citation share to its cumulative publications and citations output during 1998-17. The scientometric profile of the top 15 most productive and top 15 organizations with highest citation impact is presented in table 5.

- Sixteen organizations have registered higher publications output than the group average of 89.86: V.A. Medical Centre, USA (380 papers), University of Auckland, N.Z. (249 papers), University of Otago, N.Z. (212 papers), Harvard Medical School, USA (163 papers), University of Pennsylvania, USA and Hopital Lariboisiere AP-HP, France (128 papers each), University of California, San Diego, USA(120 papers), Universite Paris 7 Denis Diderot, France (118 papers), Brigham and Women’s Hospital, USA (116 papers) and INSERM, France (115 papers), etc. and
- Twenty three organizations have registered citation impact and relative citation index higher than their average value of average citation per publication (49.88) and 2.39: Universiteit Lausanne Schweiz, Switzerland (194.72 and 9.33), National Institute of Health, Bethesda, USA (184.98 and 8.86), University of Colorado Health Science Centre, USA (120.62 and 5.78), Brigham and Women’s Hospital, USA (106.99 and 5.13), Mayo Clinic, USA (88.36 and 4.23), Massachusetts General Hospital, USA (76.09 and 3.65), Monash University, Australia (75.36 and 3.61), University of Washington, Seattle, USA (71.54 and 3.43), University of Chicago, USA (67.92 and 3.25), University of California, San Francisco, USA (66.56 and 3.19), etc.

S. No	Name of the Organization	TP	TC	CPP	HI	RCI
1	V.A. Medical Centre, USA	380	16656	43.83	62	2.10
2	University of Auckland, N.Z.	249	6370	25.58	40	1.23
3	University of Otago, N.Z.	212	5626	26.54	37	1.27
4	Harvard Medical School, USA	163	8867	54.40	44	2.61
5	University of Pennsylvania, USA	128	7670	59.92	39	2.87
6	Hopital Lariboisiere AP-HP, France	128	5164	40.34	32	1.93
7	University of California, San Diego, USA	120	5683	47.36	37	2.27
8	Universite Paris 7 Denis Diderot, France	118	4717	39.97	30	1.92
9	Brigham and Women’s Hospital, USA	116	12411	106.99	44	5.13
10	INSERM, France	115	4614	40.12	28	1.92
11	Chang Gung Memorial Hospital, Taiwan	100	2738	27.38	27	1.31
12	AP-HP Assistance Publique-Hopitaux de Paris, France	95	2414	25.41	25	1.22
13	Redboud University Nijmegen Medical Centre, Netherlands	94	6209	66.05	30	3.16
14	University of Alabama at Birmingham, USA	94	3164	33.66	25	1.61
15	Massachusetts General Hospital, USA	94	7152	76.09	29	3.65
16	Redboud University Nijmegen Medical Centre, Netherlands	94	6209	66.05	30	3.16
17	University of British Columbia. Canada	84	5109	60.82	33	2.91
18	Mayo Clinic, USA	80	7069	88.36	24	4.23
19	Centre Hospitalier Universitaire Vandois, Switzerland	74	4414	59.65	21	2.86
20	University of Washington, Seattle , USA	67	4793	71.54	25	3.43
21	University of Chicago, USA	65	4415	67.92	21	3.25
22	University of Colorado Health Science Centre, USA	63	7599	120.62	29	5.78
23	Hospital de Cruces, Spain	61	3805	62.38	27	2.99
24	Universiteit Lausanne Schweiz, Switzerland	58	11294	194.72	29	9.33
25	Monash University, Australia	58	4371	75.36	21	3.61
26	University of California, San Francisco, USA	55	3661	66.56	26	3.19
27	National Institute of Health, Bethesda, USA	53	9804	184.98	30	8.86

Table 5: Scientometric profile of top 15 most productive global organizations and top 15 organizations leading in citation impact per paper and relative citation index in gout research during 1998-17.

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; ICP: International Collaborative Papers; RCI: Relative Citation Index.

Profile of top 50 most productive authors

1139 authors participated in global gout research during 1998-17, of which 960 authors contributed 1 - 10 papers each, 98 authors 11 - 20 papers each, 67 authors 21 - 50 papers each, 13 authors 51 - 100 papers each, and 1 author 240 papers during 1998-17.

The productivity of 50 most productive authors in global gout research varied from 28 to 240 publications and together contributed 49.82% (2491 publications) publication share and 38.70% (102516) citation share to its cumulative publications and citations output during 1996-17. The scientometric profile of these 15 most productive authors and 15 authors leading in Citation per Paper and Relative Citation Index are presented in table 6.

- Fifteen authors registered higher publications output than the group average of 49.82: N. Dalbeth (240 papers), H.K. Choi (95 papers), L.K. Stamp (93 papers), F. Perez-Ruiz (92 papers), J.A. Singh (83 papers), N. Schlesinger (80 papers), T. Bardin (70 papers), M. Doherty and H.R. Schumacher (66 papers), W.J. Taylor (64 papers), E. Roddy (56 papers), R. Terkeltaub (54 papers), F. Liote (53 papers), E. Pascual (51 papers), P. Richette (51 papers); and
- Twenty two authors registered more than the average citation per publication (41.153) and relative citation index of 1.97: R.J. Johnson (106.17 and 5.09), H.R. Schumacher (87.68 and 4.20), R. Terkeltaub (83.17 and 3.98), H.K. Choi (77.91 and 3.73), M.A. Becker (75.75 and 3.63), F. Liote 3.18), M. Doherty (64.02 and 3.07), J.S. Sundry (62.25 and 2.98), F. Perez-Ruiz (62.02 and 2.97), T. Neogi (61.90 and 2.97), L. Punzi (60.87 and 2.92), E. Pascual (59.10 and 2.83), H.R. Schumacher (53.03 and 2.54), N.L. Edwards (52.62 and 2.52), T. Bardin (52.54 and 2.52), etc.

S. No	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI
1	N. Dalbeth	University of Auckland, N.Z.	240	6139	25.58	39
2	H.K. Choi	Harvard Medical School, USA	95	7401	77.91	40
3	L.K. Stamp	University of Otago, N.Z.	93	1692	18.19	21
4	F. Perez-Ruiz	Hucesospital de Cruces, Spain	92	5706	62.02	35
5	J.A. Singh	VA Medical Centre, USA	83	2659	32.04	23
6	N. Schlesinger	Rutgers Robert Wood Johnson Medical School at Brunswick, USA	80	2464	30.80	27
7	T. Bardin	Hopital-Larboisiere. AP-HP, France	70	3678	52.54	26
8	M. Doherty	University of Nottingham, U.K.	66	4225	64.02	28
9	H.R. Schumacher	University of Pennsylvania, USA	66	3500	53.03	26
10	W.J. Taylor	University of Otago, N.Z.	64	1324	20.69	20
11	E. Roddy	Keele University, U.K.	56	2533	45.23	18
12	R. Terkeltaub	University of California, San Diego, USA	54	4491	83.17	32
13	F. Liote	INSERUM, France	53	3517	66.36	20
14	E. Pascual	Hospital General Universitario de Alicante	51	3014	59.10	23
15	P. Richette	Hopital-Larboisiere. AP-HP, France	51	1437	28.18	18
16	M.A. Becker	University of Chicago, USA	48	3636	75.75	29
17	N.L. Edwards	University of Florida, USA	45	2368	52.62	21
18	R.J. Johnson	University of Colorado Health Science Centre, USA	41	4353	106.17	23
19	L. Punzi	University of Padova, Italy	38	2313	60.87	18
20	T. Neogi	Boston University School of Medicine, USA	31	1919	61.90	17
21	J.S. Sundry	Duke University Medical Centre, NC, USA	28	1743	62.25	20

Table 6: Top 15 most productive authors and 15 authors leading in citations per paper and relative citation index in global gout research, 1998-17.

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; ICP: International Collaborative Papers; RCI: Relative Citation Index.

Medium of communication

Of the total 12694 papers, 96.77% (12284) appeared in journals, 1.82% (231) in books, 0.78% (99) in book series, 0.35% (44) as trade publications, 0.28% (35) in conference proceedings and 0.01% (1) as undefined during 1998-17.

About 957 journals participated in global gout research in journals during 1996-17, of which 536 journals published 1 - 10 papers each, 115 journals 11 - 20 papers each, 25 journals 21 - 30 papers each, 12 journals 31 - 40 papers each, 4 journals 41 - 50 papers each, 19 journals 51 - 100 papers each, 6 journals 101 - 200 papers each and 2 journals 201 - 297 papers each during 1998-17.

The 15 most productive journals in global gout research contributed from 81 to 297 papers and together contributed 15.58% share (1914 papers) to the total journal publication output during 1998-17. The publication share of these top 15 most productive journals increased from 14.03% to 16.23% from 1998-07 to 2008-17. The most productive journal (with 373 papers) was *Journal of Rheumatology* followed by *Annals of Rheumatic Diseases* (215 papers), *Journal of Clinical Rheumatology* (172 papers), *Clinical Rheumatology* (145 papers), *Arthritis and Rheumatism* (129 papers), *Arthritis Research and Therapy* (115 papers), etc. during 1998-17 (Table 7).

S. No	Name of the Journal	Number of Papers		
		1998-07	2008-17	1998-17
1	<i>Journal of Rheumatology</i>	117	180	297
2	<i>Annals of Rheumatic Diseases</i>	52	163	215
3	<i>Journal of Clinical Rheumatology</i>	46	126	172
4	<i>Clinical Rheumatology</i>	35	110	145
5	<i>Arthritis and Rheumatism</i>	60	69	129
6	<i>Arthritis Research and Therapy</i>	9	106	115
7	<i>Rheumatology</i>	55	51	106
8	<i>Rheumatology International</i>	21	81	102
9	<i>Joint Bone Spine</i>	16	84	100
10	<i>Arthritis Care and Research</i>	19	80	99
11	<i>Current Opinion in Rheumatology</i>	33	59	92
12	<i>Rheumatology, U.K.</i>	0	88	88
13	<i>PLOS One</i>	0	87	87
14	<i>Clinical and Experimental Rheumatology</i>	36	50	86
15	<i>Journal of Ethnopharmacology</i>	12	69	81
	Total of 15 Journals	511	1403	1914
	Total of World	3641	8643	12284
	Share of 15 journals in World journal output	14.03	16.23	15.58

Table 7: List of top 15 most productive journals in global gout research during 1998-2017.

Highly cited papers

There were 496 highly cited papers, which have received citations 100 to 2492 citations during 1998-17. These 496 highly cited papers together received 129930 citations, leading to average citation per paper of 161.96. Of the total highly cited papers, 311 were in citation range 101 - 200, 121 in 201 - 400 citations range, 18 in 401 - 500 citation range, 29 in 501 - 1000 citation range, 11 in 1001 - 2000 citation range and 6 in 2001 - 2492 citation range.

1. Among highly cited papers, the largest participation, was with from USA (265 papers), followed by U.K. (73 papers), Germany (50 papers), Switzerland (48 papers), Netherland (43 papers), Spain (42 papers), Canada (40 papers), Italy (38 papers), France (31 papers), Australia (30 papers), Japan (29 papers), etc.
2. Among 4963 highly cited papers, 305 appeared as articles, 177 as reviews, 8 as conference papers, 5 as editorials, 4 as short surveys and 1 as letter.
3. The leading organizations participating in highly cited papers were: VA Medical Centre, USA (43 papers), Brigham and Women’s Hospital, USA (26 papers), Harvard Medical School. USA (23 papers), University of Pennsylvania, USA and Universiteit Lausanne Schweiz, Switzerland (20 papers each), University of British Columbia, Canada and University of California, San Diego (16 papers each), Redboud University Nijemegen Medical Centre, Netherland (15 papers), Massachusetts General Hospital, USA, Centre Hospitalier Universitaire Vandois, Switzerland University of Colorado Health Centre, USA (14 papers each), University of Florida, USA (13 papers), Boston University School of Medicine, USA, Duke University School of Medicine, University of Toronto, Canada, University of Chicago, USA and University of California, Los Angles (12 papers each), etc.

4. The leading authors participating in high cited papers were: H.K. Choi (20 papers), F. Perez-Ruiz (15 papers), M. Doherty and R.J. Johnson (12 papers each), H.R. Schumacher, N. Dalbeth and M.A. Beker (10 papers each), R. Terkeltaub (9 papers), T. Bardin and F. Liote and J.S. Sundy (7 papers each), J.A. Singh, E. Pascual and A. So (6 papers each), etc.
5. The leading journals participating in highly cited papers were: *Arthritis and Rheumatism* (32 papers), *Annals of Rheumatic Diseases* (30 papers), *Journal of Rheumatology* (19 papers), *The Lancet* (14 papers), *New England Journal of Medicine* (13 papers), *Arthritis Care and Research and Arthritis Research and Therapy* (12 papers each), *Rheumatology* (9 papers), *Journal of Ethnopharmacology* (8 papers), etc.

Summary and Conclusions

Summary of findings

12694 global publications on gout research, as covered in Scopus database, were published during 1998-17 and they increased from 269 to 1052 in the year 1998 to the year 2017, averaging 7.89% annual growth rate. About 148 countries participated in global gout research, of which the global publication share of the top 10 most productive countries varied from 3.51% to 28.07% during 1998-17, with highest publication share (28.07%) coming from USA, followed by U.K. (7.91%), China (5.98%) etc. Together these top 10 countries contributed 71.14% share of the world publications output during 1998-17, which increased from 65.58% to 73.43% from 1998-07 to 2008-17.

Medicine, among four subjects, registered the highest publications share (80.21%), followed by biochemistry, genetics and molecular biology (12.85%), pharmacology, toxicology and pharmaceuticals (12.01%) and immunology and microbiology (11.30%) during 1998-17.

Among 957 organizations and 1139 authors contributing to global gout research, the 10 most productive global organizations and authors together contributed 35.93% and 49.82% respectively as their share of global publication output and 84.60% and 38.70% respectively as a share of global citation output during 1998-17. The leading organizations in research productivity were: V.A. Medical

Among 957 organizations and 1139 authors contributing to global gout research, the 10 most productive global organizations and authors together contributed 35.93% and 49.82% respectively as their share of global publication output and 84.60% and 38.70% respectively as a share of global citation output during 1998-17. The leading organizations in research productivity were: V.A. Medical Centre, USA (380 papers), University of Auckland, N.Z. (249 papers), University of Otago, N.Z. (212 papers), Harvard Medical School, USA (163 papers), University of Pennsylvania, USA and Hopital Lariboisiere AP-HP, France (128 papers each), University of California, San Diego, USA (120 papers), Universite Paris 7 Denis Diderot, France (118 papers), Brigham and Women's Hospital, USA (116 papers) and INSERM, France (115 papers), etc.; and The leading organizations in terms of citation impact per paper and relative citation index were: Universit-eit Lausanne Schweiz, Switzerland (194.72 and 9.33), National Institute of Health, Bethesda, USA (184.98 and 8.86), University of Colorado Health Science Centre, USA (120.62 and 5.78), Brigham and Women's Hospital, USA (106.99 and 5.13), Mayo Clinic, USA (88.36 and 4.23), Massachusetts General Hospital, USA (76.09 and 3.65), Monash University, Australia (75.36 and 3.61), University of Washington, Seattle, USA (71.54 and 3.43), University of Chicago, USA (67.92 and 3.25), University of California, San Francisco, USA (66.56 and 3.19), etc.

Journal of Rheumatology was the most productive journal (with 373 papers) in global gout research followed by *Annals of Rheumatic Diseases* (215 papers), *Journal of Clinical Rheumatology* (172 papers), *Clinical Rheumatology* (145 papers), *Arthritis and Rheumatism* (129 papers), *Arthritis Research and Therapy* (115 papers), etc. during 1998-17. Among the 12284 journal papers (in 957 journals) in global gout research, the top 15 most productive journals contributed 15.58% share of total journal publication output during 1998-07, which increased from 14.03% to 16.23% from 1998-07 to 2008-17.

There were 496 highly cited papers, which have received citations from 100 to 2492 during 1998-17 and together have 129930 citations, leading to average citation per paper of 161.96. Among highly cited papers, USA had the largest participation with 265 papers, followed by U.K. (73 papers), Germany (50 papers), Switzerland (48 papers), Netherlands (43 papers), Spain (42 papers), Canada (40 papers), Italy (38 papers), France (31 papers), Australia (30 papers), Japan (29 papers), etc.

Conclusion

Management of gout includes both pharmacologic and nonpharmacologic approaches. Pharmacologic interventions included anti-inflammatory drugs (NSAIDs and corticosteroids), colchicine, urate-lowering therapies (xanthine oxidase inhibitors and uricosuric agents), and combination drug therapies. Nonpharmacologic interventions included dietary interventions (low-purine diet, fructose restriction, other carbohydrate restriction, ethanol restriction, sour cherry juice, dairy products and vegetables, Mediterranean diet, and DASH [Di-

etary Approaches to Stop Hypertension] diet), other lifestyle measures (smoking cessation, exercise, and hydration), and dietary supplements and alternative treatments (vitamin C supplementation and traditional Chinese medicine). Co-interventions included combination drug and dietary or alternative treatments.

The increasing prevalence and impact of gout mean that greater focus is required to ensure best outcomes for patients. Newer therapeutic agents are on the horizon, but gout can still be well treated with our current agents, especially in light of recent insights into treatment strategies, such as commencing allopurinol during acute attacks and starting at a low dose and titrating up. Generally speaking, the most important strategy is to treat to a serum urate target (< 0.36 mmol/L in most people) as this is critical to preventing gout flares and resolving tophi.

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