Global Trends and Research Hotspots in Osteoporosis: A Multi-Dimensional Scientometric Analysis from 2016-2025 (Partial)

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Abstract

Purpose: *This report utilizes the Scopus database to conduct a scientometric analysis of osteoporosis research from 2016 to 2025. It aims to evaluate publication growth, doubling time, and the specific contributions of top authors, journals, institutions, and countries. Additionally, it defines osteoporosis as a disease caused by an imbalance in bone remodeling (where resorption exceeds deposition), leading to brittle bones and an annual increase of over 10,000 research publications in the field.*

Design/Methodology/Approach: *The study employs a scientometric approach to track the evolution and historical trends of osteoporosis research globally. It investigates how different countries have increased productivity over decades. The methodology also touches on the clinical management of the disease, which integrates bone density measurements, clinical risk evaluations, and advanced mathematical modeling for treatment planning.*

Findings: *Osteoporosis is identified via height loss, stooped posture, and bone density tests. The United States is the leading contributor, accounting for 32.57% of articles. Harvard Medical School is the most prolific institution (15.20% of papers), while specific journals and highly active authors drive most of the output. Research articles remain the primary document type, accounting for over 77% of the total output.*

Research Limitations: *The study identifies several constraints, including the technical limitations of DXA scans (which fail to measure bone quality/3D structure) and potential selection bias in observational data. There is also a noted underreporting of lifestyle risk factors and a historical research bias toward women, leaving a gap in data regarding osteoporosis in men.*

Practical Implications: *Osteoporosis carries a high risk of fragility fractures, leading to disability, loss of independence, and high healthcare costs. Effective management requires a comprehensive strategy including*

fracture risk assessment, medical treatment, and lifestyle interventions to improve the quality of life and reduce mortality rates associated with hip and spine injuries.

Originality/Value: *The value of this research lies in addressing a major global health concern. By analyzing the deterioration of bone microarchitecture in an aging population, the study highlights the significant socioeconomic burden, morbidity, and mortality caused by the disease, providing a framework for future research priorities.*

Keywords: *Scientometric, Osteoporosis, RCI, H-Index, CPP, RGR & Dt, Time Series Analysis, Highly Cited Paper.*

1. Introduction: The skeletal condition known as osteoporosis is defined by the loss of bone mass, or thinning of the bone, along with a breakdown of the internal architecture of the bone that weakens its resilience, making the bones more brittle and prone to fractures. Although any bone in the body may be impacted, the spine and hip are most afflicted. The primary risk factor for bone fragility fractures, which rises with age, is pain, functional limitation, and a significant change in people's quality of life. It is a significant public health issue with unquestionable social, health, and economic consequences. With the use of a particular radiological test known as bone mineral densitometry, the World Health Organization (WHO) defines it primarily in women as "the presence of a bone mineral density (BMD) less than or equal to 2.5 standard deviations below the average bone mass of healthy 20-year-olds." Osteoporosis is sometimes referred to be a "silent disease" that affects both sexes and worsens with age since bone loss frequently happens without any symptoms. As the architecture changes and bone tissue deteriorates, the bone becomes so weak that a very small bump or fall can cause a vertebra to break or fracture. In other words, osteoporosis's complications—spontaneous fractures or minor trauma—cause the disease's clinical symptoms. Their onset is influenced by numerous environmental factors (Elonheimo et al., 2021).

But there is a chance that people will assume that bone loss exclusively results in musculoskeletal pain. Given that a calcium and vitamin D deficiency during pregnancy and lactation causes the body to gradually deplete the calcium stores in the bone, which results in a gradual loss of bone mass, women are more likely to experience bone fractures as direct consequences of this disease. Because of this, it manifests later and more often in women who are amenorrheic or post-menopausal, who also have other hormonal abnormalities that impact bone metabolism, such as a decrease in the ovaries' synthesis of estrogens. A sedentary lifestyle or lack of physical exercise, alcohol and/or tobacco use, and calcium and vitamin D deficits brought on by malnutrition are factors that raise the chance of developing osteoporosis. There have been reports of several secondary causes, including renal tubular acidosis, diabetes mellitus, chronic renal failure, celiac disease, and monoclonal gammopathy of unknown origin. It is possible to link several epigenetic factors (Kim et al., 2020).

Prevention is the best way to cure osteoporosis. Throughout life, bone, or bone tissue, is a highly active living tissue that is continuously created (ossification), grows, and remodels (bone turnover). Hormonal activities, certain nutrients (calcium, phosphorus, magnesium, vitamin D, and vitamin K), and physical activity all contribute to these processes (formation,

development, and remodeling), which are crucial for the integrity or strength of the bone. As a result, they are acknowledged as elements that are crucial to osteoporosis prevention and therapy. Maintaining a healthy BMD throughout your life is essential. To prevent bone mass loss in adulthood and old life, it is essential to attain optimal bone development in the youngest. A diet that offers the vital nutrients for bone development, growth, and maintenance must be followed to accomplish these objectives. It is crucial to ensure that the daily needs or minimum requirements of calcium (1300 mg/day), phosphorus (1250 mg/day), magnesium (420 mg/day), and vitamin D (20 mcg/day, or 800 IU/day) are met through regular nutrition (daily consumption of foods containing these nutrients) or supplementation. Engage in regular outdoor activities that provide adequate sun exposure for the skin's synthesis of vitamin D, while avoiding excessive exposure due to the negative effects on skin health (Burden et al., 2020; Kanis et al., 2020; Chiodini et al., 2020).

2. Scientometrics Study: Scientometrics is a truly multidisciplinary research field that encompasses practically all scientific disciplines. Furthermore, many significant bibliometric analyses of important scientific topics have arisen in the recent two decades. Bibliometrics is now defined as the study of measuring documents. The term "measurement" refers to the use of mathematical and statistical approaches to determine the growth of documents, scattering of literature in various forms of documents, publication of documents by an author, influence of documents, and so on. Alan Prichard (1969) invented the term "bibliometric" to define the use of statistical and mathematical approaches to texts and other news, the process of writing. Van Raan (1997) Quantitative studies of science and technology, according to scientometric research. "Scientometrics is defined as the quantitative evaluation and inter-comparison of scientific activity, productivity, and progress," writes Beck (1978). Bookstein (1995) described scientometrics as "the science of measuring science." Scientometrics is also regarded as a bibliometric assessment for assessing scientific development, societal significance, and the influence of science and technology applications.

Ingwerson and Christensen (1997) defined the phrase as "a recent extension of traditional. Ranganathan (1948) developed the word librametry to describe the measurement of various library operations and services using mathematical and statistical methodologies. expression, and the character and course of a discipline. Cole and Eales (1917) used statistical analysis to analyze the literature in their publication on the history of comparative anatomy. Hulme (1923) made the most significant contribution when he released the book Statistical Bibliography. The most significant contribution was provided by Hulme, who published the book statistical bibliography; this term was used for statistical measurements until the end of the 1960s. bibliometric analysis, also to cover non-scholarly communities in which information is produced, communicated, and used."

3. Review of Literature: P. Rajendran, J. Manickaraj, and B. Elango (2013) look through the SCOPUS database for wireless communication research contributions made by Indian scientists between 2001 and 2012. After being obtained, 1,128 records are exported to Microsoft Excel. 808 (71.63%) of the

several communication channels used by Indian scientists have been published as conference papers. While DT rises from 1.24 to 2.67, RGR falls from 0.56 in 2002 to 0.26 in 2012. Over the course of the study, the median level of collaboration was 0.95, with a range of 0.83 to 1. In the journal Communications in Computer and Information Science Germany, Anna University has 32 research publications out of 51 (4.52%) research papers. Analysis of transmit-receive diversity in Rayleigh fading by Dighe P.A., Mallik R.K., and Jamuar S.S. (2003) is a highly cited work. The article about India is found in IEEE Transactions on Communications, 51 (4), pp. 694-703. 254.

M. Manikandan, & N. Amsaveni. (2015) conducted an analysis of cloud computing scientometric metrics, focusing on author productivity. The computer science department is growing and rising because of the global interest in connecting networking and information from various parts of the world. To determine study trends in terms of H-Index, collaborative patterns, and citations, we tried to quantify the research output in this work utilizing a scientometric study on cloud computing. Buyya R. has published 40 research papers, holds an H-index of 12, has a total of 294 citations, and has received 912 citations worldwide. The degree of collaboration is 0.86, and the contributions of several writers predominate, with two and three authors making significant contributions.

Sujatha, & Padmini. (2015) conducted research on the IEEE Transactions on Antennas and Propagation monthly. It published 3,442 papers between 2010 and 2014, with an average of 688 pieces annually and a peak of 789 articles in 2014. 86 nations submitted 3,442 papers in 2013, with the United States contributing the most (921), followed by China (572), and India (52 articles) in 21st place. The magazine's main topics included electromagnetics (217), wireless (342), communication (926), antennas (733), and wave propagation and scattering (156). The magazine's title, Antennas and Propagation, is justified because these are the fields of study that have generated the greatest interest.

Donthu Kumar, and Pattnaik (2020) conducted a 45-year study of the bibliometrics of the business research journal. They found that Arch G. Woodside had 30 JBR publications, followed by Michel Laroche and Jean-Charles Chebat, who both had 39. The two countries with the most authors connected to JBR articles are the United States (4,810) and the United Kingdom (2,817). They also examined journal co-citations, the co-occurrence of author-specified keywords, and co-authorship and bibliographic relationships between authors and their affiliated institutions and countries. With 95.96% of published papers receiving at least one reference, the journal's citation impact has likewise increased over time. JBR published 765 papers in 2017, which is the most since 1973.

Ravichandran, and Vivekanandhan (2021) examine the Scientometrics analysis of research publications from the Scopus database on wastewater management from 2010 to 2019. According to the survey, there were a maximum of 2,842 (14.31%) research articles with 19,857 citations in 2019. A maximum of 19,355 papers were provided by joint authors, with an average level of collaboration of 0.97. Ngo, H.H. produced a maximum of 101 (0.51%) research publications. The Ministry of Education in China has contributed a maximum of 2,102 (10.58%) research papers in the field of

bioresource technology, while China has contributed a maximum of 5,919 (22.32%) research articles.

Sivasamy, K. and Vivekanandhan, S. (2020) looks at the 6,266 leprosy research publications that were added to the Scopus database between 2009 and 2018. The objective of this study is to examine scientometric methods such degree of collaboration, relative growth rate and doubling time, percentage analysis, and frequency distribution. A maximum of 675 (10.77%) research papers were contributed in 2015 during the study period. From 2009 to 2018, there was an increase in the doubling time and a decrease in the relative growth rate. With top-ranking authors, Sarno, E.N. contributes up to 99 (1.58%) research publications; the average level of collaboration is 0.83, and 4,218 (67.32%) of the research publications are articles. India has 1,522 (24.29%) leprosy research papers, making it the nation with the highest contribution rate. Few Indian institutes are not mentioned among the most productive, even though India is the most productive country in leprosy research.

Vellaichamy, and Esakkimuthu. (2020) conducted a bibliometric examination of The International Journal of Robotics Research for 2010-2019. The degree of collaboration in the 983 publications that were published ranged from 0.92 to 0.99, with a mean of 0.97. Most authors preferred to publish their research in the form of articles, and most contributions were between 16 and 20 pages long, according to the study. The most articles were published in 2019. Based on the authorship pattern, the highest percentage of research papers (11.29) published by more than five authors and those with five authors were registered at 10.78 and 2 percent of all publications, respectively. Most research papers (32.89%) were between sixteen and twenty pages long, while the minority (4.11%) were between six and ten pages long, based on the duration of publishing analysis.

M. Govindasamy, and P. Senthil Kumaran (2021) finds that a maximum of 316 (15.22%) study articles were created in 2020, out of the 2,076 study papers that were included in a scientometric examination of black pepper research from the Scopus Database from 2011 to 2020. The CAGR is 7.31 and the median annual number of research publications is 207.6. In 2012 and 2019, the corresponding growth rates were 0.28 and 0.06, respectively. In 2012, the doubling time was 2.44, while in 2019, it was 11.08. 122 of the 2076 research papers are single-author works. Articles account for 1,735 (83.57%) of all research publications. With 17 (0.81%), Bhat, A.I. was the most productive author. A maximum of 33 (1.59%) research papers is contributed by the Food Chemistry department, while a maximum of 57 (2.75%) publications is funded by the National Natural Science Foundation of China. With 712 (34.30%) contributions, India is the top-producing nation, followed by China.

Ravichandran, and Vivekanandhan (2021) using information from the Scopus database, which had 11,775, analysed the research output wireless sensor networks in India from 2010 to 2019. According to this study, the largest number of articles submitted in 2019 was 2,058 (17.48%), with a compound annual growth rate of 5.44. This study found that the doubling time was trending upward and the relative growth rate was trending downward. The CAI for more than three authors decreased from the first

block year (106.71) to the second block year (97.39), with an average degree of collaboration of 0.96.

4. Objectives of the Study: The study is conducted with the following objectives:
i) To investigate the publication and growth pace of literature over the Osteoporosis publications.
ii) To investigate the Related Growth Rate and doubling time.
iii) To investigate the authorship pattern and degree of collaboration in publications.
iv) To identify the most prolific authors and institutes in the Osteoporosis sector.
v) To investigate the distribution of research publications by country.
vi) To determine the document type of articles in the Osteoporosis research publications.
vii) To investigate the time series analysis and a widely cited publication on the Osteoporosis.

5. Research Methodology: The researcher gathered the necessary research data on osteoporosis from the Scopus database on Osteoporosis from 2016 to 2025, and it is the primary source of data for the current study. ((TITLE-ABS-KEY("Osteoporosis") OR TITLE-ABS-KEY("osteopenia")) AND PUBYEAR > 2015 AND PUBYEAR < 2026). On 05.11.2025, data for the Scopus database were collected in MS Excel sheets.

6. Data Analysis and Interpretation: The data is analysed based on the following parameters:
a) Year-Wise Growth Osteoporosis Research Publication: Table 1 displays the increase in Osteoporosis research papers from 2016 to 2025. Based on a selection of 10,019 articles. The most articles, 1,214 (12.12%), are published in 2022. Followed by the number of articles in 1,141 (11.39%) research publications contributed in 2021. These two years are regarded as the most fruitful. In these two years, the production of publications climbed to 23.51%. However, the minimal number of publications published in 2017 was 804 (8.02%).

The highest number of citations is 21,772 (16.83%) research publications, and H-index is 68, the CPP is 27.08, and the RCI is 2.10. Followed by 21,572 (16.08%) research publications, the H-index is 68, the CPP is 24.77, and the RCI is 1.92. The lowest number of citations is 688 (0.53%) research publications, the H-index is 8 the CPP is 0.71, and the RCI is 0.05.

Table 1: Year-Wise Growth Osteoporosis Research Publication

S. No	Year	Publications	%	Cum	%	Citations	%	H-index	CPP	RCI
1	2016	871	8.69	871	1.66	21,572	16.68	68.00	24.77	1.92
2	2017	804	8.02	1,675	3.20	21,772	16.83	68.00	27.08	2.10
3	2018	831	8.29	2,506	4.79	18,146	14.03	64.00	21.84	1.69
4	2019	942	9.40	3,448	6.59	21,375	16.53	62.00	22.69	1.76
5	2020	1,007	10.05	4,455	8.52	16,607	12.84	54.00	16.49	1.28
6	2021	1,141	11.39	5,596	10.70	14,856	11.49	49.00	13.02	1.01
7	2022	1,214	12.12	6,810	13.02	2,665	2.06	45.00	2.20	0.17
8	2023	1,079	10.77	7,889	15.08	7,651	5.92	32.00	7.09	0.55

9	2024	1,159	11.57	9,048	17.29	4,002	3.09	21.00	3.45	0.27
10	2025	971	9.69	10,019	19.15	688	0.53	8.00	0.71	0.05
	Total	10,019	100.00	52,317	100.00	1,29,334	100.00			

b) RGR & Doubling Time in the Field of Osteoporosis Research Publication: Table 2 clearly shows the average RGR and doubling time of Osteoporosis related paper over the research time. The RGR of an article has gradually decreased over the research duration, from 1.63 in 2017 to 0.10 in 2025. The doubled duration of article publishing gradually increases from 0.43 in 2017 to 6.83 in 2025. The preceding debate might be summarized as RGR publications steadily dropped. With the opposite together, the doubling time of the papers progressively increased.

Table 2: RGR & Doubling time in the Field of Osteoporosis Research Publication

S. No	Year	Publications	Cumulative	W1	W2	RGR	Dt
1	2016	871	329		5.80		
2	2017	804	1,675	5.80	7.42	1.63	0.43
3	2018	831	2,506	7.42	7.83	0.40	1.73
4	2019	942	3,448	7.83	8.15	0.32	2.18
5	2020	1,007	4,455	8.15	8.40	0.26	2.72
6	2021	1,141	5,596	8.40	8.63	0.23	3.05
7	2022	1,214	6,810	8.63	8.83	0.20	3.54
8	2023	1079	7,889	8.83	8.97	0.15	4.73
9	2024	1,159	9,048	8.97	9.11	0.14	5.08
10	2025	971	10,019	9.11	9.21	0.10	6.83
	Total	10,019	51,775				

c) Authors in the Osteoporosis Research Publication: Table -3 displays the contributions of the most prolific authors on the topic of osteoporosis, with Duque, G. contributing the most articles, 34 (13.65%) research publications in the United States, followed by [No Author ID found] 32 (12.85%) research publications in China, and Chin, K.Y., 30 (12.03%) research publications in Italy. The lowest author is Kohl, M., with 20 (8.03%) research papers in Spain.

Table-3: Authors in the Osteoporosis Research Publication

S. No	Authors	Country	Publications	%	Citations	%	H-Index	CPP	RCI
1	Duque, G.	United States	34	13.65	1,372	27.25	15.00	40.35	2.00
2	[No Author ID found]	China	32	12.85	670	13.31	16.00	20.94	1.04
3	Chin, K.Y.	Italy	30	12.05	361	7.17	12.00	12.03	0.60
4	Amling, M.	United Kingdom	24	9.64	422	8.38	13.00	17.58	0.87
5	Rolvien, T.	India	23	9.24	192	3.81	8.00	8.35	0.41
6	Canalis, E.	Germany	22	8.84	258	5.13	7.00	11.73	0.58
7	Larijani, B.	Turkey	22	8.84	396	7.87	11.00	18.00	0.89
8	Kemmler, W.	Japan	21	8.43	694	13.79	11.00	33.05	1.63
9	Reid, I.R.	South Korea	21	8.43	395	7.85	11.00	18.81	0.93
10	Kohl, M.	Spain	20	8.03	274	5.44	6.00	13.70	0.68
Total			249	100.00	5,034	100.00			

The maximum number of citations is 1,372 (27.25%) in research publications, the h-index is 15, the citations per paper are 40.35, and the related citations index is 2.00. Following 694 (13.79%) research papers, the h-index is 11, the citations per paper are 33.05, and the related citations index is 1.63. The number of the lowest citations is 258 (5.13%), the h-index is 7, the citations per paper are 11.73, and the related citations index is 0.58.

d) Subjects in the Osteoporosis Research Publication: The contribution of the most prolific subjects on the topic of Osteoporosis is shown in Table -4, with Medicine contributing the most with 8,387 (64.45%) research publications, followed by Biochemistry, Genetics and Molecular Biology with 2,177 (16.73%) research publications, and Nursing with 470 (3.61%) research publications. Multidisciplinary has the fewest scientific papers (194 (1.49%).

Table 4: Subjects in the Osteoporosis Research Publication

S. No	Subject area	No. of articles	%
1	Medicine	8,387	64.45
2	Biochemistry, Genetics and Molecular Biology	2,177	16.73
3	Nursing	470	3.61
4	Pharmacology, Toxicology and Pharmaceutics	418	3.21
5	Immunology and Microbiology	311	2.39
6	Agricultural and Biological Sciences	298	2.29
7	Health Professions	276	2.12
8	Neuroscience	276	2.12
9	Engineering	206	1.58
10	Multidisciplinary	194	1.49
	Total	13,013	100.00

e) Osteoporosis the Country-wise Research Publication: Table 5 depicts the global distribution of publications; the United States contributed the most, accounting for more than 2,487 (32.57%) of the total publications, followed by China 1,358 (18.00%) and Italy 703 (9.32%); all three of those nations contributed more than 59.89% of the global papers in the field of osteoporosis.

Table 5: Osteoporosis the Country-wise Research Publication

S. No	Country	No. of articles	%	Citations	%	H- I index	CPP	RCI
1	United States	2,457	32.57	41,194	33.15	82.00	16.77	1.02
2	China	1,358	18.00	17,960	14.45	58.00	13.23	0.80
3	Italy	703	9.32	15,958	12.84	58.00	22.70	1.38
4	United Kingdom	576	7.64	15,623	12.57	55.00	27.12	1.65
5	India	555	7.36	4,243	3.41	31.00	7.65	0.46
6	Germany	450	5.97	11,202	9.02	50.00	24.89	1.51
7	Turkey	391	5.18	2,626	2.11	19.00	6.72	0.41
8	Japan	363	4.81	4,226	3.40	30.00	11.64	0.71

9	South Korea	346	4.59	4,559	3.67	30.00	13.18	0.80
10	Spain	344	4.56	6,658	5.36	36.00	19.35	1.17
	Total	**7,543**	**100.00**	**1,24,249**	**100.00**			

Furthermore, the United Kingdom 576 (7.64%), India 555 (7.36%), Germany 450 (5.97%), Turkey 391 (5.18%), Japan 363 (4.81%), South Korea 346 (4.59%), and the Spain 344 (4.56%) are all represented.

The maximum number of citations is 41,194 (33.15%) in research publications, the h-index is 82, the citations per paper is 16.77, and the related citations index is 1.02. The h-index is 58, the citations per paper are 13.23, and the related citations index is 0.80, followed by 17,960 (14.45%) research papers. The lowest number of citations is 2,626 (2.11%), the h-index is 19, the citations per paper is 6.72, and the related citations index is 0.41. However, the United States, China, and other countries have made a smaller contribution to the subject. As a result, it may be inferred that India, Italy, and the United Kingdom are rising countries in the spice industry on a global scale.

f) Institutions in the Osteoporosis Research Publication: Table - 6 presents the scientific publications of the top ten global research organizations on s Osteoporosis. In total, they published 921 articles, which is approximately double global papers during the study period. The Harvard Medical School research institute alone published 140 (15.20%) articles, followed by Mayo Clinic contributing nearly 131 (14.22%) articles Inserm and University of Melbourne 88 (9.55%), Tehran University of Medical Sciences 86 (9.34%), University degli Studi di Milano 84 (9.12%), and Universidade de São Paulo 79 (8.58%). The lowest number of National and Kapodistrian University of Athens with 72 (7.82%) research publications.

The maximum number of research articles is 3,741 (15.20%), the h-index is 27, the citations per paper is 26.72, and the related citations index is 1.16. The h-index is 24, the citations per paper are 22.52, and the related citations index is 0.98, with 2,950 (13.90%) research publications following. The number of citations is lowest with 870 (4.10%), the h-index is 12, the citations per paper is 11.01, and the related citations index is 0.48.

Table 6: Institutions in the Osteoporosis Research Publication

S. No	institutions	Publications	%	Citations	%	H - Index	CPP	RCI
1	Harvard Medical School	140	15.20	3,741	17.63	27.00	26.72	1.16
2	Mayo Clinic	131	14.22	2,950	13.90	24.00	22.52	0.98
3	Inserm	88	9.55	1,744	8.22	21.00	19.82	0.86
4	University of Melbourne	88	9.55	2,484	11.71	24.00	28.23	1.23
5	Tehran University of Medical Sciences	86	9.34	1,022	4.82	18.00	11.88	0.52
6	University degli Studi di Milano	84	9.12	2,945	13.88	24.00	35.06	1.52
7	Universidade de São Paulo	79	8.58	870	4.10	12.00	11.01	0.48
8	Massachusetts General Hospital	78	8.47	1,755	8.27	17.00	22.50	0.98
9	University of Toronto	75	8.14	1,392	6.56	20.00	18.56	0.81
10	National and Kapodistrian University of Athens	72	7.82	2,318	10.92	15.00	32.19	1.40

Total		921	100.00	21,221	100.00			

g) Journals in the Osteoporosis Research Publication: Table - 7 lists the top ten most productive osteoporosis journals. It was discovered that Osteoporosis International is at the top of the list, with 204 (17.57%) publications obtaining the number one spot. As a result, Frontiers in Endocrinology ranked second with 154 (13.26%) publications, while the Archives of Osteoporosis ranked third with 124 (10.68%). These three journals appear to be the most fruitful in the osteoporosis sector. The balance of performance journals is given in the table above as well. The lowest journal research papers are in Plos One 84 (7.24%).

The maximum number of research papers is 4,924 (24.89%), the h- index is 31, the citations per paper is 24.14, and the related citations index is 1.42. Following that are 3,299 (16.68%) research papers, an H-index of 31, a CPP of 27.49, and an RCI of 1.61. The number of lowest citations in research articles is 574 (2.90%), the h-index is 14, the citations per paper is 6.52, and the related citations index is 0.38.

Table 7: Journals in the Osteoporosis Research Publication

S. No	Journal	No. of articles	%	Citations	%	H- Index	CPP	RCI
1	Osteoporosis International	204	17.57	4,924	24.89	31.00	24.14	1.42
2	Frontiers in Endocrinology	154	13.26	1,726	8.73	21.00	11.21	0.66
3	Archives of Osteoporosis	124	10.68	1,271	6.43	19.00	10.25	0.60
4	Nutrients	120	10.34	3,299	16.68	31.00	27.49	1.61
5	Bone	119	10.25	2,622	13.25	24.00	22.03	1.29
6	Journal of Clinical Medicine	95	8.18	843	4.26	16.00	8.87	0.52
7	BMC Musculoskeletal Disorders	88	7.58	574	2.90	14.00	6.52	0.38
8	Journal of Bone and Mineral Research	87	7.49	2,660	13.45	29.00	30.57	1.79
9	Scientific Reports	86	7.41	839	4.24	17.00	9.76	0.57
10	Plos One	84	7.24	1,024	5.18	18.00	12.19	0.72
Total		1,161	100.00	19,782	100.00			

h) Type of Document wise distribution in Osteoporosis Research Publication: According to Table 8, a large portion of research output (77.36%) is available in the form of Article 7,751, and a considerable quantity of publications are also available in the form of research review 1,326 (13.23%). In addition, 264 scientific papers (2.63%) were letters. There were 223 (2.23%) book chapters and 169 (1.69%) notes brought in. However, Editorial 104 (1.04%), Conference Paper 85 (0.85%), Erratum 44 (0.44%), Short Survey 44 (0.44%), Retracted 5 (0.05%), Book 5 (0.03%), and Data Paper 1 (0.01%) are also published. The previous discussion demonstrates that most papers are in the category of articles, and reviews of research papers are a total percentage of 90.59.

Table 8: Type of Document-wise Distribution in Osteoporosis Research Publication

S. No	Document type	No. of articles	%	Cumulative	%
1	Article	7,751	77.36	7,751	38.68
2	Review	1,326	13.23	9,077	45.30
3	Letter	264	2.63	9,341	46.62
4	Book Chapter	223	2.23	9,564	47.73
5	Note	169	1.69	9,733	48.57

6	Editorial	104	1.04	9,837	49.09
7	Conference Paper	85	0.85	9,922	49.52
8	Erratum	44	0.44	9,966	49.74
9	Short Survey	44	0.44	10,010	49.96
10	Retracted	5	0.05	10,015	49.98
11	Book	3	0.03	10,018	50.00
12	Data Paper	1	0.01	10,019	50.00
Total		**10,019**	**100.00**	**20,038**	**100.00**

i) Keywords of the Osteoporosis Research Publication: Table - 9 displays the achievements of the most active subjects in the field of osteoporosis. Human has supplied the most scientific papers, with 8,277 (14.29%), followed by Osteopenia with 7,961 (13.74%), and Article with 6,440 (11.12%). The word with the fewest scientific papers was "controlled Study", which had 3,345 (5.77%).

Table 9: Keywords of the Osteoporosis Research Publication

S. No	Keyword	No. of articles	%
1	Human	8,277	14.29
2	Osteopenia	7,961	13.74
3	Article	6,440	11.12
4	Female	6,099	10.53
5	Osteoporosis	5,983	10.33
6	Humans	5,572	9.62
7	Male	4,849	8.37
8	Bone Density	4,709	8.13
9	Adult	4,704	8.12
10	Controlled Study	3,345	5.77
	Total	57,939	100.00

j) Funding Agency of the Osteoporosis Research Publication: Table -10 displays the achievements of the most active subjects in the field of osteoporosis. The National Natural Science Foundation of China has supplied the most scientific papers, with 486 (29.83%), followed by the National Institutes of Health with 440 (27.01%) and the National Institute of Arthritis and Musculoskeletal and Skin Diseases with 128 (7.86%). The word with the fewest scientific papers was Deutsche Forschungsgemeinschaft, which had 68 (4.17%).

Table 10: Funding agency of the Osteoporosis Research Publication

S. No	Funding Agency	No. of Articles	%
1	National Natural Science Foundation of China	486	29.83
2	National Institutes of Health	440	27.01
3	National Institute of Arthritis and Musculoskeletal and Skin Diseases	128	7.86
4	Japan Society for the Promotion of Science	114	7.00
5	National Key Research and Development Program of China	96	5.89
6	National Research Foundation of Korea	87	5.34
7	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior	70	4.30
8	National Cancer Institute	70	4.30

9	National Institute of Diabetes and Digestive and Kidney Diseases	70	4.30
10	Deutsche Forschungsgemeinschaft	68	4.17
Total		**1,629**	**100.00**

k) Time Series Analysis: TSA provides estimated growth values based on previous data. Based on existing data, an exponential equation is adjusted to forecast future values. Jeyshankar and Ramesh Babu (2013)[23] used TSA Ravichandran.S, Vivekanandhan.S, & G.Vinita Angeline (2022)[24]

l) Osteoporosis of the Time Series Analysis: Table 11 shows that the time series analysis formula has been predicted for the Osteoporosis research publications for the years 2025 and 2030

The straight-Line Equation is

$Y = a + bx$

Here,

$\sum Y = 10,019$, $\sum X^2 = 110$, $\sum XY = 3342$

$a = \sum Y/N = 10,019/10 = 1,001.9 = 1,001$

$b = \sum XY/\sum X^2 = 3,342/110 = 30.38 = 30$

Estimated publications in the year 2025 are when X=2025-2015=10

$Y = a + bx$

$= 10,019 + (30*10) = 10,019+300 = 10,319$

Projected research in 2030 is when X=2030-2015=15

$Y = a + bx$

$= 10,019 + (30*15) = 10,019 + 450 = 10,469$

According to a TSA statistical tool, the expected increase in osteoporosis papers in 2025 is about equivalent to 10319, and in 2030 is approximately equal to 10469. As a result, a comprehensive investigation at the time confirmed that the number of papers on osteoporosis research is increasing.

Table 11: Osteoporosis of the Time Series Analysis

Sl. No	Year	Count (Y)	X	X2	XY
1	2016	871	-5	25	-4355
2	2017	804	-4	16	-3216
3	2018	831	-3	9	-2493
4	2019	942	-2	4	-1884
5	2020	1,007	-1	1	-1007
6	2021	1,141	1	1	1,141
7	2022	1,214	2	4	2,428
8	2023	1,079	3	9	3,237
9	2024	1,159	4	16	4,636
10	2025	971	5	25	4,855
Total		**10,019**		**110**	**3,342**

m) Osteoporosis of the Highly Cited Paper: Kanis, J.A. et al. (2019) European guidance for the diagnosis and management of osteoporosis in postmenopausal women, Osteoporosis International, 30(1): 3 - 44. Citations include the year 1,385 and the document type of the article. Chen, Q. et al. (2016) Fate decision of mesenchymal stem cells: Adipocytes or osDeath, asts, Cell Death and Differentiation, 23(7):1128 – 1,139. Citations include 1025, and the publication type is Review, and Gravholt, C.H. et al. (2017)

Clinical practice guidelines for the care of girls and women with Turner syndrome: Proceedings from the 2016 Cincinnati International Turner Syndrome Meeting, European Journal of Endocrinology, 177(3), G1-G70. The citations are 926, and the article document type is 03 reviews and 07 articles.

Table 12 Osteoporosis of the Highly Cited Paper

S. No	Titles	Citation	Document Type
1	Kanis, J.A. et.al. (2019) European guidance for the diagnosis and management of osteoporosis in postmenopausal women, Osteoporosis International, 30(1): 3 - 44.	1,385	Article
2	Chen, Q. et.al. (2016) Fate decision of mesenchymal stem cells: Adipocytes or osteoblasts, Cell Death and Differentiation, 23(7):1128 - 1139.	1,025	Review
3	Gravholt, C.H. et.al. (2017) Clinical practice guidelines for the care of girls and women with Turner syndrome: Proceedings from the 2016 Cincinnati International Turner Syndrome Meeting, European Journal of Endocrinology, 177(3), G1 - G70.	926	Article
4	Lindor, K.D. et.al. (2019) Primary Biliary Cholangitis: 2018 Practice Guidance from the American Association for the Study of Liver Diseases, Hepatology, 69(1): 394 - 419.	688	Article
5	Gutmann, D.H. et.al. (2017) Neurofibromatosis type 1, Nature Reviews Disease Primers, 3, Articles No: 17004.	644	Article
6	Van Wegberg, A.M.J. et.al. (2017) The complete European guidelines on phenylketonuria: Diagnosis and treatment, Orphanet Journal of Rare Diseases, 12(1), Article No: 162.	639	Review
7	Salonia, A. et.al. (2021) European Association of Urology Guidelines on Sexual and Reproductive Health—2021 Update: Male Sexual Dysfunction [Formula presented], European Urology, 80(3): 333- 357.	604	Review
8	Camacho, P.M. et.al. (2020) American Association of Clinical Endocrinologists/American College of Endocrinology Clinical Practice Guidelines for the Diagnosis and Treatment of Postmenopausal Osteoporosis— 2020 Update Executive Summary, Endocrine Practice, 26(5): 564- 570.	590	Article
9	Venter, W.D.F. et.al. (2019) Dolutegravir plus two different prodrugs of tenofovir to treat HIV, New England Journal of Medicine, 381(9): 803 - 815.	562	Article
10	Fukagawa, N.K. et.al. (2019) Rice: importance for global nutrition, Journal of Nutritional Science and Vitaminology, 65, S2 - S3.	530	Article

7. Major Findings of the Study: The current analysis used a sample of 10,019 papers written on osteoporosis to assess the growth of research publications issued between 2016 and 2025. The year 2022 saw the most papers released, with 2,022 (12.12%). In the year 2021, the next-greatest number of articles were contributed, 1,141 (11.39%).

During the study period, an article's RGR gradually decreased from 1.63 in 2017 to 0.10 in 2025. The article release duration for doubling gradually increases from 0.43 in 2017 to 6.83 in 2025.

Among most active authors in the discipline of osteoporosis, it is found that Dugue, G. has written the largest number of papers, 34 (13.05%) research publications in United States, and among the majority active subjects in the growing of osteoporosis, it is noticed that Medicine provided the highest the amount of with 8,387 (64.45%) research publications.

During the maximum of the research publications, and the country-wise distribution of publications, United States contributed the most articles, amounting to more than 2,457 (32.57%) research publications out of 7,543 articles.

The Institutions of the Harvard medical school alone published 140 (15.20%) articles, while the periodicals discovered that osteoporosis is on top of the list with the publication of 204 (17.57%) publications achieving first spot.

The maximum of the research output is available in the document type of Article 7,751 (77.36%) research papers, and the greatest amount number of keywords contributed the highest amount of osteoporosis with 8,277 (14.29%) research papers.

The TSA quantitative applicability is projected in osteoporosis studies in the year 2025 to be about 10,319, and in the year 2030 to be around 10,469. As a result, comprehensive investigation at the time verified that the number of papers on spice research is increasing.

Kanis, J.A. et.al. (2019) European guidance for the diagnosis and management of osteoporosis in postmenopausal women, Osteoporosis International, 30(1): 3 - 44. Citations include the year 1,385 and the document type of the article.

8. Conclusion: Until it is exacerbated by fractures, osteoporosis is a prevalent and silent condition. According to estimates, 20% of men and 50% of women over 50 will experience a fracture associated to osteoporosis over their remaining years. These fractures result in long-term impairment, worse quality of life, and higher mortality rates, as well as a significant medical and staffing load on the patient's and the country's economy. Most active authors in the field of osteoporosis have written the most papers—34, or 13.05 percent of all research publications in the United States while most active subjects in the field of osteoporosis have produced the most 8387, or 64.45% of all research publications. With more than 2,457 (32.57%) research publications out of 7,543 articles, the United States contributed the most articles during the peak of research publications and the country-wise distribution of publications. 140 papers (15.20%) were published by Harvard Medical School institutions alone, whereas 204 publications (17.57%) were published by journals, placing osteoporosis at the top of the list. Article 7,751 (77.36%) research papers have the most research output, and 8,277 (14.29%) research papers with the most keywords led to the biggest number of osteoporosis research papers. Before fractures happen, osteoporosis can be identified and treated effectively. Therefore, primary healthcare providers should be required to prevent, identify, and treat osteoporosis.

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