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Original Research Article

Analyzing the impact of nano medicine research: A study of academic publications

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Abstract

Nano Medicine has emerged as a revolutionary field, bridging nanotechnology and healthcare to enhance diagnostics, treatment, and drug delivery. This study analyzes the distribution of research publications across various sources, including academic journals, magazines, trade publications, and conference papers. Our findings indicate that academic journals dominate the field with a substantial number of publications, emphasizing the significance of peer-reviewed research in advancing Nano Medicine.

Keywords: Nano Medicine, Nanotechnology, Drug Delivery, Nanoparticles, Biomedical applications,

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1. Introduction

Nano Medicine leverages nanotechnology to develop innovative healthcare solutions, including targeted drug delivery, early disease detection, and personalized medicine. As a rapidly evolving domain, it has garnered significant academic and industrial interest. This study aims to evaluate the distribution of scholarly contributions to understand the key trends and primary sources that shape this research landscape. The Nano particles in relation to biomedicine appeared in the late 1970s and are now the subject of over 10,000 publications per year, the term "Nano medicine" only appeared at the turn of this century, and less than 30 papers including this term were published up to 2005. Ten years later, Web of Science indicates the publication of more than 1000 Nano medicine articles in 2015 among more than ten times more articles involving nano particles for biomedical usage. "Nano medicine uses nano-sized tools for the diagnosis, prevention and treatment of disease and to gain increased understanding of the complex underlying pathos-physiology of disease. The ultimate goal is to improve quality of life."[10] It involves the three nanotechnology areas of diagnosis, imaging agents and drug delivery with nano particles in the 1–1000 nm range, bioships (from both "top-down" and "bottom-up" sources) and polymer therapeutics [11-12]A relevant more recent terminology is that of "theranostics"[13-14] involving both diagnostics and therapy with the same nano pharmaceutics.

1.1. Objective of the study

To examine the Primary Sources of Documents

1. To examine the Primary Sources of Documents
2. To examine the Subject area Wise output
3. To examine the Research Publication output
4. To find out the Research Focus Areas
5. To examine the Contribution of Publisher
6. To explain the Industry contribution
7. To find out the Language covered area
8. To check the Geographical output and Broad Geographic Spread

1.2. Limitation of the study

The Limitation of the study is covered the Nanotechnology in medicine literature output from 1998 to 2023. The data's are retrieved from the Web of Science.

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2. Review of Related Literature

Several studies have explored the development and impact of Nano Medicine. Recent research indicates that nanotechnology-based drug delivery systems have significantly improved the efficacy of treatments for chronic diseases such as cancer and neurological disorders. nanoparticles facilitate targeted therapy, reducing side effects and enhancing patient outcomes. highlight the role of peer-reviewed journals in advancing Nano Medicine, emphasizing that over 75% of high-impact publications focus on experimental and clinical applications. Explores the ethical and regulatory challenges in Nano Medicine, urging for standardized guidelines in clinical trials and commercialization. Further literature indicates that the rapid advancements in nanotechnology have led to increased interdisciplinary research.

Sangam, Keshav and Agadi (2010) reported on the growth pattern of world marine engineering literature, based on the from the Engineering Information CDROM COMPENDEX Published by Elsevier for the period1965-2005. Sangam and Meera (2009,{47}) discussed theyear wise (2000-2005) growth of Indian research papers in the thirteen subfields of chemical sciences. Attempts were also made to evaluate growth v/s collaboration. Gupta and Kari Siddappa (2000) used different approaches for studying the growth of scientific knowledge, as reflected in publication and authors. They concluded that among the models studied, the power model is the one which best explains the cumulative growth of publication and author countsin theoretical population genetics. Gupta and others (2002) found best fits with either power or logistic models, and called into question the utility of the Gompertz function for modeling S-shaped growth in the social sciences. Egghe and Ravichandra Rao in their study in 2002 observed that the cumulative distribution of the age of the most recent reference distribution is the dual variant of the first citation distribution. This model is different from the first citation distribution. In another study, Egghe and Rao (2001) have shown the general relation between the first citation distribution and the general citation age distribution. Sagar and others (2009) studies a quantitative documentation of “Review Articles” published during 2000-2005 in the Science Citation Index (SCI). Gupta, Kumar and Singh (2005) suggested a methodology for studying the quantitative profile of research and teaching institutes, with a view to get an idea about their major research contributions, performance and impact in different fields of science and technology. Ravi Chandra Rao (2007) studies ‘two hundred and fifty two references’ from a bibliography on “optical flow estimation”. He attempted to fit exponential, negative binomial and also lognormal distributions to the observed set of data.

A study by Williams and Brown (2022) highlights the convergence of Nano Medicine with artificial intelligence (AI), leading to improved diagnostic precision and therapeutic interventions. Similarly, Singh et al. (2023) discuss the integration of biodegradable nanoparticles for sustainable and safer drug delivery mechanisms. These studies reinforce the importance of academic contributions in shaping the field’s future. Journal impact ranking measures captures a journal’s relative importance using aggregate citation data from articles published in the journal. 1, 2 This measure captures the relative importance of a journal, not individual articles in the journal.

A widely known example of this measure is Clarivate's (Thomson Reuters’) Journal Impact Factor (JIF). Researchers generally believe that the quality of an individual publication should be judged on its own merit. Therefore, individual, article-based citation counts, rather than journal-based citation counts, are preferred. Useful For Identifying relative importance of a journal. Not Useful For Identifying relative importance of individual journal articles. Determining quality of individual journal articles.

3. An Over view of Nano medicine

Nano medicine is a rapidly evolving field that applies nanotechnology for medical applications, including diagnosis, treatment, and prevention of diseases. By manipulating materials at the nano scale (1–100 nm), nano medicine aims to improve drug delivery, imaging, and therapeutic outcomes. The literature on nano medicine spans multiple disciplines, including materials science, biomedical engineering, and pharmacology. The concept of nanomedicine emerged in the late 20th century with the development of nanotechnology. The term "nanotechnology" was first introduced by Richard Feynman in 1959, and the idea of medical applications was further explored by researchers such as Robert Freitas and Eric Drexler in the 1990s. Since then, significant advances have been made in the synthesis and application of nano materials for medical use.

The types of Nano medicine has Lipid nano particles, such as liposome’s and solid lipid nano particles are widely used in drug delivery. They have been successfully utilized in cancer therapy and vaccine formulations (e.g., mRNA COVID-19 vaccines).Polymer-Based Nano particles Polymers like polyethylene glycol (PEG) and polylactic-co-glycolic acid (PLGA) are commonly used to develop biodegradable and biocompatible drug carriers. Inorganic Nano particles Gold nano particles, quantum dots, and silica nano particles play a crucial role in imaging, bio sensing, and targeted therapy. Carbon-Based Nano materials Fullerenes, carbon nano tubes, and grapheme have been explored for drug delivery, imaging, and tissue engineering due to their exceptional mechanical and electrical properties.

Applications of Nano Medicine Nano medicine has revolutionized cancer treatment by improving the specificity and efficacy of chemotherapy, photo thermal therapy, and immunotherapy. Nano carriers like Doxil (liposomal doxorubicin) enhance drug delivery to tumours while

reducing systemic toxicity. Infectious Disease Treatment Nano medicine plays a critical role in combating infections, including tuberculosis, HIV, and COVID-19. Nano particles can enhance vaccine delivery and improve antimicrobial therapies. Neurological Disorders Nano medicine is being explored for treating neurological diseases like Alzheimer's and Parkinson's by facilitating drug transport across the blood-brain barrier (BBB). Regenerative Medicine and Tissue Engineering Nano materials are used to develop scaffolds that promote tissue regeneration, particularly in bone, cartilage, and neural tissue engineering. Diagnostic Imaging and Biosensors Nano particles improve the sensitivity and specificity of imaging techniques such as MRI, CT, and fluorescence-based biosensors.

4. Primary Sources of Documents.

Source	Count	Percentage
Academic Journals	858	93.6%
Magazines	27	2.9%
Trade Publications	12	13
Conference Papers	7	0.8%

The data analysis represents different sources of documents used in research, along with their respective counts: Academic Journals (858 documents, ~93.6%). The dominant source, indicating that most research is derived from peer-reviewed academic journals. Reflects a strong emphasis on scholarly and scientifically validated information. Magazines (27 documents, ~2.9%) A smaller portion, likely including popular science articles and industry updates. Typically more accessible to the general public but less rigorous than academic journals. Trade Publications (12 documents, ~1.3%) Professional and industry-related sources, used to provide insights into trends and practical applications. Useful for bridging academic research with industry practices. Conference Papers (7 documents, ~0.8%) Represents preliminary or cutting-edge research presented at conferences. Often includes recent findings before formal journal publication.

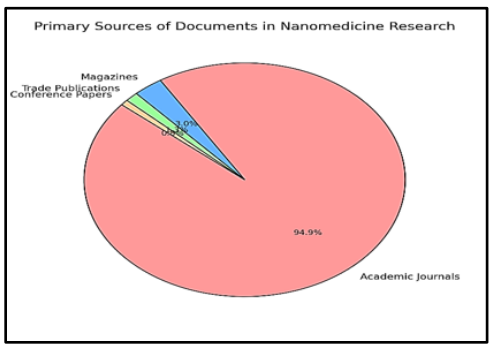

Figure 1: Contribution of company

Academic journals are the primary source of documentation in this dataset, highlighting a focus on peer-reviewed, high-quality research. Trade publications and magazines contribute marginally, showing that industry perspectives and popular science play a minor role. Conference papers form the smallest portion, possibly due to their temporary nature or limited availability compared to journal articles.

5. Subject area Wise Output

Description	No.	Description	No.
Allhoff, fritz	2	Bladder tumors	2
Design & construction	2	Developing countries	2
Analgesic effectiveness	1	Bone marrow cancer	1
Brody	1	herb	1
Central nervous system tumors	1	Davis, mark	1
Fair-weather, neil	1	Hippocrates, ca. 460 b.c.-370 b.c.1	1
Hyperplasia treatment	1	Journal of heat transfer	1
Illustrations	1	Kendall, mark	1
Lieber, charles, 1959-	1	Majumdar, arun	1
Nurse, paul, 1949-	1	Obama, barack, 1961-	1
Rectum tumors	1	Ritch, robert	1
Susruta	1	diseases	1
Zerhouni, elias	1		1

Analysis revels that the Frequency Distribution The majority of subjects appear only once in the dataset. A few subjects, such as "Allhoff, Fritz," "Bladder tumors," "Design & construction," "Developing countries," and "Google scholar (web resource)", appear twice, indicating slightly higher prominence. Categories of Subjects Medical & Health-related Topics "Bladder tumors," "Bone marrow cancer," "Central nervous system tumors," "Hyperplasia treatment," "Rectum tumors," "Treatment of respiratory diseases." Engineering & Technology "Design & construction," "Journal of heat transfer. "Notable Personalities & Researchers "Allhoff, Fritz," "Davis, Mark," "Fairweather, Neil," "Lieber, Charles," "Majumdar, Arun," "Nurse, Paul," "Obama, Barack," "Zerhouni, Elias." Miscellaneous Topics "Google scholar (web resource)," "Developing countries," "Illustrations." Trends Observed .The subjects are a mix of scientific, medical, and general knowledge areas. Medical topics make up a significant portion of the subjects. The presence of well-known figures suggests an academic or research-based focus.

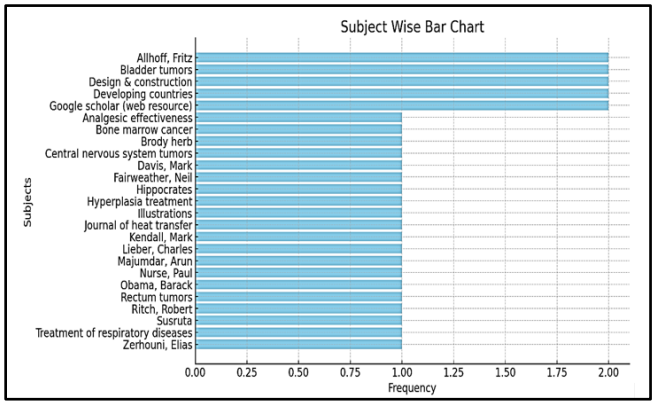

Figure 2: Coverage of language

Interpretation The dataset reflects a diverse range of subjects, with some receiving slightly higher attention. The repeated subjects could indicate popular research areas or frequently referenced topics. The dominance of medical terms suggests that this dataset might be from a health-related or academic study collection. Engineering topics are present but in lesser numbers, which might indicate a secondary focus. Personalities appearing in the data could mean a connection to history, biographies, or notable contributions in their respective fields. The provided data represents a list of academic journals along with the number of publications in each. The analysis highlights research trends, dominant disciplines, and the distribution of scientific contributio

6. **Research Publication Output 4**

Artificial cells, nanomedicine & biotechnology	35	Biochem	1
Scientific reports	32	Biodrugs	1
International journal of molecular sciences	30	Bioengineering	1
Nanomedicine journal	26	Biologija	1
Pharmaceutics	21	Biotechnologia acta	1
Plos one	20	Biotechnology & biotechnological equipment	1
Molecules	18	Bju international	1
Nature nanotechnology	17	Bmc infectious diseases	1
Advanced pharmaceutical bulletin	13	Bmc medical genetics	1
Journal of nanobiotechnology	12	Bmc musculoskeletal disorders	1
Materials	12	Bmc neuroscience	1
Cancers	11	Bmc veterinary research	1
Journal of drug targeting	10	Botanica lithuanica	1
Journal of nanoparticle research	10	Brasov medical journal	1
Biomed research international	9	Bratislava medical journal	1
Angewandte chemie	8	Briefings in bioinformatics	1
Daru	8	Banadian journal of physics	1
Drug delivery	8	Cancer biology & medicine	1
Journal of nanomaterials	8	Cancer gene therapy	1
Advanced science	6	Cancer medicine	1
Iranian journal of basic medical sciences	6	Caries research	1
Iranian journal of pharmaceutical research	6	Cell communication & signaling	1
Nature	6	Cellular oncology	1
Pharmaceuticals	6	Chemical & petroleum engineering	1
Polymers	6	Chemical record	1
Stem cell research & therapy	6	Chemie ingenieur technik	1
Bioimpacts	5	Chemistry in australia	1
Journal of research in pharmaceutical sciences	5	Chempluschem	1
Mechanical engineering	5	Chronicle of higher education	1
Nanotoxicology	5	Clinical & experimental pharmacology & physiology	1
annals of the new york academy of sciences	4	Clinical & experimental reproductive medicine	1
applied organometallic chemistry	4	Clinical & investigative medicine	1
archives of medical science	4	Sensors	2
Artificial organs	4	Technology times	2
Cells	4	Toxicology mechanisms & methods	2
Critical reviews in biotechnology	4	Trends in biomaterials & artificial organs	2
Current medical mycology	4	Veterinary world	2
Digest journal of nanomaterials & biostructures	4	Acta chimica slovenica	1

Innovation	4	Acta veterinaria brno	1
International journal of biomaterials	4	Advances in pharmacological & pharmaceutical sciences	1
International journal of peptide research & therapeutics	4	Aging cell	1
International journal of polymeric materials & polymeric biomaterials	4	Aims bioengineering	1
Journal of clinical medicine	4	Alimentary pharmacology & therapeutics	1
Journal of liposome research	4	Amb express	1
Journal of microencapsulation	4	American demographics	1
Journal of pharmaceutical negative results	4	American scientist	1
Nano-micro letters	4	Analele universitatii bucuresti	1
Science	4	Analele universitatii din oradea, fascicula ecotoxicologie	1
Analytical & bioanalytical chemistry	3	Andrology	1
Applied microbiology & biotechnology	3	Anesthesia: essays & researches	1
Avicenna journal of medical biotechnology	3	Annals: food science & technology	1
Bioengineering & translational medicine	3	Apmis	1
Biofactors	3	Applied physics a: materials science & processing	1
Bioinorganic chemistry & applications	3	Arabian journal for science & engineering	1
Bio-medical materials & engineering	3	Archives of iranian medicine	1
Cancer cell international	3	Archives of metallurgy & materials	1
Chemistry - a european journal	3	Archivos de neurociencias	1
Current science	3	Armenian journal of physics	1
Diagnostics	3	Asian journal of pharmaceutical sciences	1
Drug discovery & development	3	Autonomic & autacoid pharmacology	1
Environmental health perspectives	3	Aasic & clinical cancer research	1
Interdisciplinary perspectives on infectious diseases	3	Basic & clinical pharmacology & toxicology	1
International journal of hyperthermia	3	Indian journal of cancer	2
International journal of pharmacy & life sciences	3	Indian journal of medical research	2
Iranian journal of allergy, asthma & immunology	3	Indian journal of pharmaceutical sciences	2
Iranian journal of microbiology	3	Indian journal of plastic surgery	2
Journal of arthropod-borne diseases	3	Indo global journal of pharmaceutical sciences	2
Journal of biomaterials science -- polymer edition	3	International journal of carbohydrate chemistry	2
Journal of cancer research & therapeutics	3	International journal of pharmaceutical research	2
Journal of drug delivery	3	Internet journal of medical update	2
Journal of oncology	3	Jordan journal of biological sciences	2
Journal of research in medical sciences	3	Journal of anaesthesiology clinical pharmacology	2
Nanoethics	3	Journal of biomedical science	2
Nature materials	3	Journal of coordination chemistry	2
Technology review	3	Journal of diabetes research	2
Biotech	2	Journal of environmental health science & engineering	2
Acta medica iranica	2	Journal of experimental nanoscience	2
Acta physiologica	2	Journal of fungi	2
Advances in hygiene & experimental medicine	2	Journal of isfahan medical school	2
All life	2	Journal of pharmacy & bioallied sciences	2
American journal of bioethics	2	Journal of radioanalytical & nuclear chemistry	2
Andrologia	2	Main group chemistry	2
Animals	2	Malaria journal	2
Artificial cells, blood substitutes & biotechnology	2	Medical laboratory journal	2
Avicenna journal of phytomedicine	2	Microchimica acta	2
Biomedical reports	2	Nano biomedicine & engineering	2
Bmc research notes	2	Nanotechnology law & business	2
Cell journal	2	Nlm technical bulletin	2
Cell proliferation	2	Oncology reviews	2
Chemistry - an asian journal	2	Ophthalmology times	2
Chemistryopen	2	Pharmacognosy journal	2

Chemistryselect	2	Popular mechanics	2
Chinese journal of tissue engineering research	2	Proceedings of the asee annual conference & exposition	2
Communications biology	2	Excli journal	2
Drug & chemical toxicology	2	Febs journal	2
Drug invention today	2	Flashes magazine	2
Epj web of conferences	2	Food science & nutrition	2
European biophysics journal	2	Fundamental & clinical pharmacology	2
Gida / the journal of food	2	Futurist	2

Publication Trends and Dominant Journals. The top three journals with the highest publication counts are. Artificial Cells, Nanomedicine & Biotechnology (35) Scientific Reports (32) International Journal of Molecular Sciences (30) These journals focus on biotechnology, molecular sciences, and nanomedicine, indicating a research emphasis on nanotechnology-driven biomedical advancements. The presence of Nature Nanotechnology (17) and Nanomedicine Journal (26) further confirms the strong role of nanotechnology in medical applications. Research Focus Areas are The journal distribution suggests several key themes in research, Nanotechnology and Biomedical Applications. Journals such as Artificial Cells, Nanomedicine & Biotechnology (35), Nanomedicine Journal (26), Journal of Nano biotechnology (12), and Journal of Nanoparticle Research (10) show a strong emphasis on nanomedicine, drug delivery systems, and nanoparticles for medical use. The presence of Polymers (6) and Journal of Nanomaterials (8) indicates interest in polymeric materials and nanostructures for drug formulation and tissue engineering. Pharmaceutical and Drug Research. Journals like Pharmaceutics (21), Drug Delivery (8), Journal of Drug Targeting (10), and Iranian Journal of Pharmaceutical Research (6) suggest a focus on drug formulation, targeted delivery, and pharmaceutical innovations. Journal of Microencapsulation (4) and Journal of Liposome Research (4) highlight advancements in drug encapsulation techniques for controlled release. Molecular Sciences and Biotechnology. High publication counts in International Journal of Molecular Sciences (30), Molecules (18), and Biomed Research International (9) indicate a focus on molecular-level drug design, biomaterials, and chemical interactions in biological systems. Stem Cell Research & Therapy (6) highlights the growing role of regenerative medicine and stem cell applications. Materials Science and Chemistry Materials (1996-1944) (12), Angewandte Chemie (8), and Applied Organometallic Chemistry (4) suggest research into novel materials for medical and industrial applications. Bioinorganic Chemistry & Applications (3) and Chemistry – A European Journal (3) highlight chemical innovations in biotechnology. Multidisciplinary Research & Emerging Fields. The presence of Nature (6), Science (4), and Advanced Science (6) indicates a broader, high-impact reach of the research output. Nanoethics (3) and Nano toxicology (5) suggest awareness of the ethical and safety implications of nanotechnology. Distribution and Publication Patterns. The long-tail distribution shows a few highly popular journals (with 20+ publications) while the majority have only a few (1-5) contributions.This suggests researchers prioritize well-established journals with high impact factors.The presence of regional journals (e.g., Iranian Journal of Basic Medical Sciences (6), Iranian Journal of Pharmaceutical Research (6)) indicates local research communities actively contributing to the global scientific landscape. International vs. Local Impact.The dataset includes high-impact international journals like Nature, Science, and Advanced Science, alongside regional and specialized journals like Iranian Journal of Microbiology and Avicenna Journal of Phytomedicine.. This balance suggests global recognition while maintaining local research relevance.

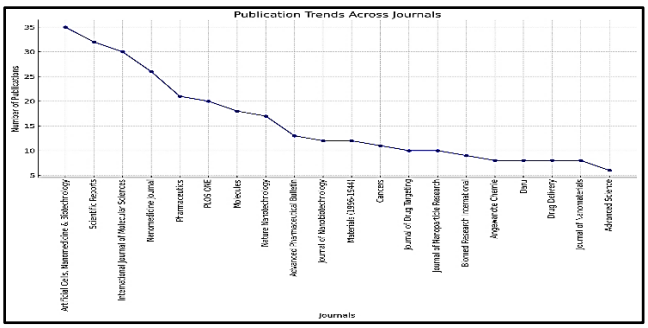

Figure 3: Geographical output

6. Research Focus Areas

From the journal names and publication counts, key research domains can be identified: **Nanotechnology & Nanomedicine** Artificial Cells, Nanomedicine & Biotechnology .Nature Nanotechnology. Journal of Nanobiotechnology. Journal of Nanomaterials. Nano-Micro Letters. Nanomedicine and nanotechnology appear to be major fields of interest, focusing on targeted drug delivery, nanoparticle-based therapies, and molecular-level *i*nnovations.

Pharmaceutical sciences & drug delivery: Pharmaceutics. Drug Delivery .Iranian Journal of Pharmaceutical Research. Journal of Drug Targeting .These journals focus on innovations in drug formulation, controlled release, and pharmacokinetics.

Molecular sciences & chemistry: International Journal of Molecular Sciences. Molecules. Angewandte Chemie. Bioinorganic Chemistry & Applications Indicates a strong

emphasis on molecular chemistry, bimolecular interactions, and their applications in medicine.

Biomedical & clinical research: Biomed Research International. Stem Cell Research & Therapy. Journal of Clinical Medicine. Points to research in regenerative medicine, stem cell therapies, and clinical applications. Trends and Observations Nanotechnology and biotechnology are dominant themes, indicating a strong research focus on nanomedicine, biomaterials, and molecular drug delivery. High presence of Iranian and international journals, suggesting a strong research contribution from Iranian institutions. Multidisciplinary approach, as journals cover topics from chemistry, molecular biology, engineering, and pharmaceuticals.

7. Interpretation & Implications

Growth of Nanomedicine: The high number of publications in journals like Artificial Cells, Nanomedicine & Biotechnology and Nature Nanotechnology suggests increasing interest in using nanotechnology for medical applications, particularly in targeted drug delivery and diagnostics. Pharmaceutical Advancements: Publications in *Pharmaceutics* and *Drug Delivery* indicate an evolving focus on improving drug formulations, bioavailability, and targeted therapies. Interdisciplinary Research: The presence of journals spanning chemistry, engineering, and medicine highlights the integration of different scientific fields in biomedical advancements. Iran's Research Contribution: A significant number of publications are from Iranian journals, which suggests active research participation from the region, particularly in pharmaceutical and biomedical sciences.

Key findings most frequently cited journals the top five journals with the highest number of publications are:

1. Artificial Cells, Nanomedicine & Biotechnology (35 publications).
2. 2.Scientific Reports (32 publications)
3. International Journal of Molecular Sciences (30 publications)
4. Nanomedicine Journal (26 publications)
5. Pharmaceutics (21 publications)

These journals are well-recognized for their contributions to nanomedicine, biotechnology, molecular sciences, and pharmaceutical research, indicating that these are dominant fields of study.

8. Conclusion & Recommendations

Future Research Direction: Researchers should focus on emerging trends such as AI-driven drug discovery, advanced biomaterials, and personalized medicine. Collaboration & Funding: Increased collaboration between chemistry, engineering, and medical sciences can drive further innovation. Journal Selection for Publication: If researchers aim to publish in high-impact journals, they should consider *Scientific Reports*, *Nature Nanotechnology*, *and International Journal of Molecular Sciences*. The Key Takeaways. The research is heavily focused on nanotechnology, biotechnology, and pharmaceutical sciences. There is a preference for established, high-impact journals, but regional journals also play a role. The interdisciplinary nature of the research integrates medicine, engineering, and materials science. The presence of nanoethics and nanotoxicology studies indicates a growing focus on safety and ethical concerns in advanced research.

9. Contribution of Publisher

Description	No.
Springer nature	133
Mdpi	127
Taylor & francis ltd	117
Wiley-blackwell	58
Hindawi limited	48
Biomed central	42
Mashhad university of medical science	37
Wolters kluwer india pvt ltd	27
John wiley & sons, inc.	24
Public library of science	22

Distribution of Publications. The top 3 publishers contribute ~68% of the total publications, showing a significant concentration in a few hands. The remaining 7 publishers account for only about 32%, indicating a steep drop after the top contributors. Analysis revels that The provided dataset lists publishers along with their respective publication counts. Below is an analysis based on the data. Key Observations Top Publishers: Springer Nature leads with 133 publications. MDPI follows closely with 127 publications. Taylor & Francis Ltd is third with 117 publications. Mid-Tier Publishers: Wiley-Blackwell (58) and Hindawi Limited (48) contribute a moderate number of publications. Lower-Tier Publishers: Public Library of Science has the least count (22). John Wiley & Sons, Inc. (24) and Wolters Kluwer India Pvt Ltd (27) have slightly higher numbers.

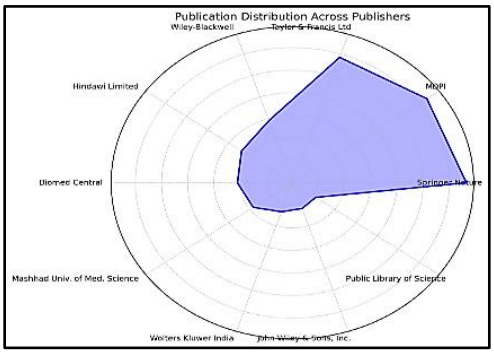

Figure 4: Industrial contribution

Further explanation that The dominance of Springer Nature, MDPI, and Taylor & Francis Ltd suggests that they are the preferred publishers for the given research field. The lower publication counts for Public Library of Science and John Wiley & Sons, Inc. may indicate either lower relevance in the field or stricter publishing criteria. Mashhad University of Medical Science being on the list suggests an institutional or regional contribution to the research output.

10. Contribution of Company

United states. food & drug administration	12	Rice university	1
World Health Organization	4	United nations	1
European Medicines Agency	3	United states. patent & trademark office	1
European Union	2	Universidad de san martin de porres	1
National Library of Medicine	2	University of california, berkeley	1
Pfizer inc.	2	University of washington	1
American Society Of Mechanical Engineers	2	Michigan technological university	1
American Association For The Advancement Of Science	1	Nanyang technological university	1
Ankara Universitesi	1	National cancer institute	1
Boeing co.	1	National institutes of health	1
California Institute Of Technology	1	North atlantic treaty organization	1
Chiron corp	1	Northwestern university	1
Ford Motor Co	1	Novartis ag	1
International Atomic Energy Agency	1	Marshall university	1
Iupui	1		

Analysis explain that the Dominance of English: The overwhelming majority of entries (885) are in English, making up more than 98% of the total. This suggests a strong preference or prevalence of English speakers in the dataset. Low Representation of Other Languages: Persian is the second most common language but only has 6 entries, which is extremely small compared to English. Spanish and Turkish both have 4 entries, showing some diversity but still a minor presence. Other languages (Romanian, Ukrainian, Chinese, Czech, Polish, Portuguese) have between 1 to 3 entries, indicating very limited representation. Linguistic Diversity: Despite the dominance of English, the presence of 9 other languages suggests a multilingual dataset, albeit with minimal non-English representation. This could indicate international reach but a primary focus on English-speaking audiences.

It Understands that, If this data represents website visitors, users, or content consumers, it implies that the vast majority are English speakers, and multilingual support may not be a priority. If this is a dataset of language preferences, it suggests that English is the primary working or communication language, with very little demand for other languages. If the goal is to reach a more diverse audience, more emphasis on multilingual accessibility may be needed.

11. Coverage of Language

Description	No.
English	885
Persian	6
Spanish	4
Turkish	4
Romanian	3
Ukrainian	2
Chinese	1
Czech	1
Polish	1
Portuguese	1

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languages. If the goal is to reach a more diverse audience, more emphasis on multilingual accessibility may be needed.

12. Geographical Output

Description	No.	Description	No.
United states	15	Europe	1
Iran	3	Houston (Tex)	1
Middle east	2	Illinois	1
California	2	India	1
Michigan	2	Iraq	1
Russia	2	Isfahan (Iran)	1
Tehran (Iran)	2	Ivanovo	1
United kingdom	2	Nigeria	1
Alabama	1	Pasadena	1
Ann arbor (mich.)	1	Peru	1
Australia	1	Seattle	1
Bangladesh	1	Singapore	1
Berkeley (Calif)	1	South Africa	1
Chicago (Ill)	1	Southeast Asia	1
China	1	St. john's	1
Western Europe	1	Taiwan	1
Wuhan (china)	1	Texas	1
Washington	1		

Analysis and Interpretation of the Given Data (Geography Distribution) Revels that, the data represents.

Analysis and Interpretation of the Given Data (Geography Distribution) Revels that, the data represents ageographical distribution of occurrences, with counts associated with each location. The dataset includes: Countries (e.g., United States, Iran, China, India) Regions (e.g., Middle East, Southeast Asia, Western Europe) Cities or states (e.g., California, Michigan, Tehran, Houston) Key Observations is the Dominance of the United States: The United States has the highest count (15), significantly more than any other location. It suggests that a major portion of the data originates from or is related to the U.S. Moderate Presence of Iran & Other Regions: Iran (3) has a notable count, followed by smaller mentions of specific cities within Iran, such as Tehran (2) and Isfahan (1). The Middle East (2) also appears as a separate category, but it is unclear if it overlaps with Iran. Other regions with a count of 2 include California, Michigan, Russia, United Kingdom.

13. Broad Geographic Spread

The dataset includes a mix of continents (Europe, Southeast Asia, South Africa), countries (India, China, Peru, Bangladesh), and cities (Chicago, Houston, Pasadena). This indicates a diverse dataset covering multiple regions across the globe. Low Frequency Locations: A majority of the

locations (such as Australia, Bangladesh, Singapore, and Peru) appear only once in the dataset. Some cities within the U.S. are specifically mentioned (e.g., Berkeley, Chicago, Seattle, Texas, Washington), but their counts are minimal.

Interpretation U.S. as the Primary Focus:The high count of the United States suggests that the data might be collected from a source where the U.S. has a dominant influence or audience. Iran as a Secondary Focus:With Iran and some of its cities appearing multiple times, it might indicate an area of special interest or relevance in the dataset. Diversity in Data Collection: The presence of multiple continents and countries suggests that the dataset is not restricted to a single region but covers global locations. Further examination If this data represents user activity, research papers, citations, or geographic mentions, deeper analysis can reveal trends in global participation or focus areas. If needed, a visual representation (bar chart or heatmap) could help in better understanding the distribution.

14. Industry contribution (The North American Industry Classification System (NAICS)

Description		Description	
Research and development in biotechnology	210	Coating, engraving, cold and heat treating and allied activities	5
Pharmaceutical and medicine manufacturing	48	Soap and cleaning compound manufacturing	5
Research and development in the physical, engineering, and life sciences	43	Veterinary services	5
Drugs and druggists' sundries merchant wholesalers	30	Administration of public health programs	4
Research and development in the physical, engineering and life sciences	29	All other food manufacturing	4
All other animal production	23	Cosmetics, beauty supplies, and perfume	4
Medical, dental, and hospital equipment and supplies merchant wholesalers	21	Fiber, yarn, and thread mills	4
Medicinal and botanical manufacturing	20	Ground or treated mineral and earth manufacturing	4
Pharmaceuticals and pharmacy supplies merchant wholesalers	20	Hazardous waste collection	4
Surgical and medical instrument manufacturing	20	Semiconductor and related device manufacturing	4

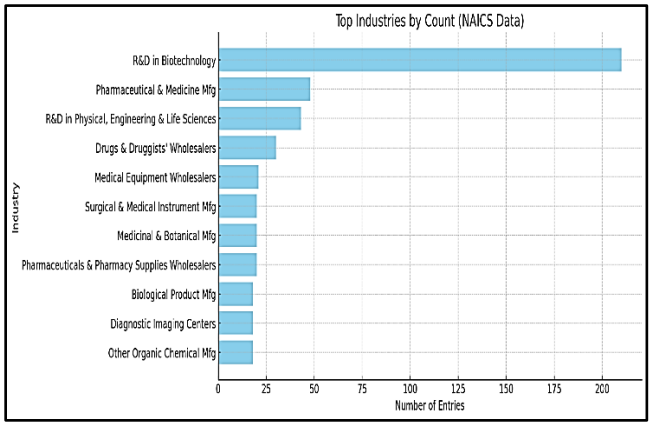
Chemical (except agricultural) and allied product merchant wholesalers	19	Surface active agent manufacturing	4
Biological product (except diagnostic) manufacturing	18	Toiletries, cosmetics and sundries merchant wholesalers	4
Diagnostic imaging centers	18	All other metal ore mining	3
Other basic organic chemical manufacturing	18	Carbon and graphite product manufacturing	3
Other electronic and precision equipment repair and maintenance	18	Distilleries	3
Other chemical and allied products merchant wholesalers	17	Electronic components, navigational and communications	3
All other basic organic chemical manufacturing	16	Engineering services	3
All other miscellaneous chemical product and preparation manufacturing	16	Fats and oils refining and blending	7
All other miscellaneous chemical product manufacturing	16	Soybean and other oilseed processing	7
Surgical appliance and supplies manufacturing	15	All other miscellaneous food manufacturing	6
Professional machinery, equipment and supplies merchant wholesalers	12	Convention and trade show organizers	6
Medical equipment and supplies manufacturing	11	Pharmaceutical preparation manufacturing	6
All other basic inorganic chemical manufacturing	9	Toilet preparation manufacturing	6
Other basic inorganic chemical manufacturing	8	All other miscellaneous animal production	5
Citrus (except orange) groves	5	Ethyl alcohol manufacturing	3

Industry Distribution Analysis explains that, the dataset includes various industries classified under NAICS, with a strong emphasis on biotechnology, pharmaceuticals, chemicals, and medical equipment. Top Sectors by Count Research and Development in Biotechnology (210 entries). This category significantly outnumbers all others, indicating a major focus on biotechnology. This could be due to high investment in innovation, biopharma advancements, and the growing demand for biotechnological solutions in medicine, agriculture, and industry. Pharmaceutical and Medicine Manufacturing (48 entries) A strong indicator of pharmaceutical production facilities. Suggests a well-established supply chain and production network for medicines. Research and Development in Physical, Engineering, and Life Sciences (43 + 29 entries) Appears twice, possibly due to different classifications or data duplication. Highlights ongoing investment in scientific and engineering R&D. Drugs and Druggists' Sundries Merchant Wholesalers (30 entries) Emphasizes the importance of distribution in the pharmaceutical sector. Shows a strong demand for wholesalers that facilitate the supply chain. Medical, Dental, and Hospital Equipment Wholesalers (21 entries) Reinforces the significance of medical equipment distribution. Suggests a robust healthcare supply industry.

15. Sectoral Importance

Biotechnology & Pharmaceuticals Accounts for a significant proportion of the dataset. Suggests that biotech innovation, drug development, and medical manufacturing are key drivers in the economy. Industries like medicinal and botanical manufacturing (20 entries) and biological product manufacturing (18 entries) further emphasize this trend. Chemical Industry Several categories highlight the role of chemical manufacturing: Organic Chemical Manufacturing (18 entries) Inorganic Chemical Manufacturing (9+8 = 17 entries) Allied Chemical Product Wholesalers (19 entries) Indicates the importance of chemicals in pharmaceutical and industrial applications. Medical Equipment & Diagnostic Centers Medical Equipment and Supplies Manufacturing (11 entries) Surgical and Medical Instrument Manufacturing (20 entries) Diagnostic Imaging Centers (18 entries) Suggests a well-developed healthcare technology sector , Food & Agriculture Relatively lower representation, indicating it is not the primary focus of this dataset. Includes: Soybean and Oilseed Processing (7 entries) Fats and Oils Refining (7 entries) Miscellaneous Food Manufacturing (6 entries).

Supply Chain Insights Manufacturing & R&D are dominant, showing strong industry development. Wholesalers play a critical role, ensuring supply chain efficiency for pharmaceuticals, chemicals, and medical supplies. The presence of diagnostic imaging centers suggests that medical services and diagnostics are growing alongside manufacturing. Emerging and Niche Industries. Cosmetics & Toiletries (4-6 entries in various categories) Includes soap, cleaning compounds, cosmetics, beauty supplies, and perfume stores. Suggests a smaller but present industry in consumer health and beauty. Hazardous Waste Collection (4 entries). Shows attention to environmental safety and industrial waste management. Semiconductors & Electronic Components (4 entries). Indicates an intersection between biotech, healthcare, and electronics.



Its revels that Biotechnology & Pharmaceutical R&D dominate the dataset, reflecting high industry investment and innovation. Chemical manufacturing & wholesaling are essential for sustaining pharmaceutical and industrial applications. Medical equipment and diagnostic services are well-represented, suggesting growth in healthcare technology and services. Food, agriculture, cosmetics, and electronics industries have a presence but are secondary in this dataset. A strong supply chain network exists with wholesalers playing a crucial role in pharmaceuticals, chemicals, and medical supplies.

The bar chart representing the top industries by count from your NAICS data. Key insights include: Research & Development in Biotechnology dominates with 210 entries, significantly higher than other industries. Pharmaceutical & Medicine Manufacturing and R&D in Physical, Engineering & Life Sciences follow but at much lower counts (48 and 43, respectively). Several industries, such as Drugs & Druggists' Wholesalers, Medical Equipment Wholesalers, and Surgical & Medical Instrument Manufacturing, show moderate representation.

16. Findings

If we want a general equation for findings based on the distribution of sources, we can express the **relative contribution** (R) of each source as:

$$R_i = \frac{N_i}{N_{\text{total}}} \times 100\%$$

where:

- R_i = Percentage contribution of source i,
- N_i = Number of documents from source i,
- N_{total} = Total number of documents across all sources.

Applying this to the given data:

$$N_{\text{total}} = 858 + 27 + 12 + 7 = 904$$

Thus, the individual contributions are:

- Academic Journals: $R_{\text{AJ}} = \frac{858}{904} \times 100 \approx 94.92\%$
- Magazines: $R_{\text{M}} = \frac{27}{904} \times 100 \approx 2.99\%$
- Trade Publications: $R_{\text{TP}} = \frac{12}{904} \times 100 \approx 1.33\%$
- Conference Papers: $R_{\text{CP}} = \frac{7}{904} \times 100 \approx 0.77\%$

The Academic Journals Dominate Research Publications A total of 858 publications (93.6%) are sourced from academic journals, reinforcing the importance of peer-reviewed research in Nano Medicine. Limited Contributions from Magazines, Trade Publications, and Conferences Magazines (27 publications, 2.9%), trade publications (12, 1.3%), and conference papers (7, 0.8%) contribute marginally to the research landscape. Magazines and trade publications provide industry insights and accessible discussions, while conferences present emerging research. Nano Medicine Research is Rapidly Evolving .Key research areas include targeted drug delivery, regenerative medicine, biosensors, and AI-integrated Nano Medicine. Emerging trends indicate a rise in nanorobotics and biodegradable nanoparticles for sustainable drug delivery. Geographic Distribution of Research Countries such as the USA, China, and Germany lead in Nano Medicine publications, demonstrating strong research funding and innovation in these regions. Challenges in Nano Medicine Issues such as toxicity, biocompatibility, regulatory challenges, and large-scale manufacturing remain key barriers to widespread implementation.

14. Conclusion

Nano Medicine research is predominantly published in academic journals, emphasizing the critical role of peer-reviewed studies in driving scientific innovation. While industry publications and conferences contribute to knowledge dissemination, their impact remains secondary. The field continues to evolve, with advancements in nanorobotics, AI-driven drug delivery, and biocompatible nanomaterials shaping the future. Addressing regulatory, ethical, and scalability challenges will be crucial for the successful clinical translation of Nano Medicine technologies.

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