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Scientometric insights into neurology publications in Iran

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Keywords
Bibliometric; Scientometric; Neurology; Neuroscience; Iran

Abstract

Background: Undoubtedly, medical science has been born since the beginning of human creation. One of its important branches is neurology. Neurosciences in Iran, with a little delay from the first world, with the efforts of researchers, opened the way for the diagnosis and treatment of neurological diseases, and we reached the place where we are.

Methods: In this bibliometric and scientometric study, we have evaluated the process of neurological science in Iran. By referring to the reliable indexes, we checked Web of Science (WoS), PubMed, and Scopus from 1963 onwards. We showed the published activities of Iranians in the form of charts and tables.

Results: This study indicates the increasing growth of scientific studies in the field of neurology. In the field of neuroscience, the researchers are mostly aimed at the education and training of specialists and PhD students, and depending on the research facilities, as well as acquaintances and connections for the publication of articles. Diseases that have afflicted a large number of people causing them to suffer and limiting their activities, such as multiple sclerosis (MS), Alzheimer's, epilepsy, Parkinson's, and brain strokes have been the focus of researchers.

Conclusion: Neurological studies have an increasing trend and can be divided into two basic sections, which are mainly done by neuroscientists and are based on the educational needs and training of specialists, but neurology studies and scientific publications are mainly done by neurologists and based on feeling the need and diseases in this field have been done.

Introduction

Iran, one of the cradles of ancient civilization, holds a long-standing tradition in the development of medical knowledge. From early attempts to alleviate pain through natural remedies such as willow bark, to formalized medical writings in the Islamic Golden Age, the Iranian contribution to medical science is significant.

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Ali ibn Sahl Tabari (770-861), one of the earliest Persian physicians, dedicated a section of his renowned book, Ferdous al-Hekma, to the study of epilepsy, reflecting early awareness of neurological disorders.[1] The foundational figures of Islamic medicine – including Avicenna, Rhazes, Haly Abbas, and Jorjani – each addressed disorders of the head and nervous system, contributing to both original thought and synthesized knowledge from prior cultures.[2,3]

Modern medicine in Iran began institutionalization in the mid-19th century with the establishment of Dar al-Funun in 1851, followed by the opening of the first hospital in Urmia City in 1878 by Joseph Plumb.[4] However, neurology as a distinct medical discipline emerged less than a century ago, led by pioneers such as Professor Ebrahim Chehrazi (1908-2010).[5] Presently, the field continues to expand, with 1435 neurologists and 251 neurology faculty members active across 76 medical schools and 16 residency programs nationwide.

This study aims to analyze the evolution and growth of neurology and neuroscience research in Iran using scientometric methods. Since the publication of the first internationally recognized Iranian neurology article in 1963 by Dr. Mohsen Mahloji, the field has undergone significant development.[6] By mapping publication trends, identifying influential researchers and institutions, and evaluating citation impact, this study provides a comprehensive overview of Iran's contribution to global neurological research.

Several scientometric studies have evaluated Iran's overall scientific output in the field of medicine, often emphasizing the remarkable growth in publication volume, quality, and international collaboration, particularly since the early 2000s.[7] However, specific analyses focusing on neurology and neuroscience remain scarce. Some global bibliometric studies, such as the one conducted by Sweileh et al., have examined neuroscience research trends worldwide and included data from Iran, though without a focused analysis on the country.[8] Similarly, Sharifi et al. investigated Iranian research in psychiatry and mental health,[9] while other regional studies have briefly mentioned Iran's contributions within the broader context of the Eastern Mediterranean region. To date, there is no widely cited or comprehensive scientometric study dedicated exclusively to Iranian publications in neurology and neuroscience. Therefore, a clear gap exists in the literature. The present study seeks to fill this void by systematically analyzing Iranian research output in neurology and neuroscience using scientometric tools. This not only highlights the evolution of the field in Iran but also contributes to novel insight into national scientific development and regional research visibility.

This study conducts a bibliometric and scientometric evaluation of neurology and neuroscience research in Iran, analyzing its development, thematic priorities, and patterns since 1963. The objectives include:

1. **Analyzing the historical growth** of Iranian neurological research using publication data from Web of Science (WoS), PubMed, and Scopus to quantify output trends and scholarly impact
2. **Identifying disease-specific research emphasis**, particularly on conditions like multiple sclerosis (MS), Alzheimer's disease (AD), and epilepsy, to determine their relative prevalence in Iran's neurological studies
3. **Investigating disciplinary contributions** by distinguishing between basic neuroscience research (led by neuroscientists) and clinical investigations (driven by neurologists), assessing their respective influences on the field
4. **Mapping institutional networks** by evaluating the productivity of Iranian research centers, universities, and hospitals, alongside their international collaboration patterns in peer-reviewed publications.

The analysis aims to provide a systematic framework for understanding Iran's research landscape in these fields, emphasizing quantitative metrics and interdisciplinary dynamics.

Materials and Methods

Data collection: Articles published between 1976 and August 2023 were searched according to affiliation (Iran) and scope by searching neurology and neuroscience keywords in multiple databases such as PubMed, Scopus, and WoS.

Strategy search: ("neurology" OR "neuroscience") AND "Iran"

Inclusion/exclusion criteria: Articles published from 1963 to 2023, affiliated with Iran, and focused on neurology/neuroscience were included. Non-English articles and duplicates were excluded (Figure 1). This study employed a machine learning-enhanced bibliometric approach to systematically evaluate publication trends in Iranian neurology research.

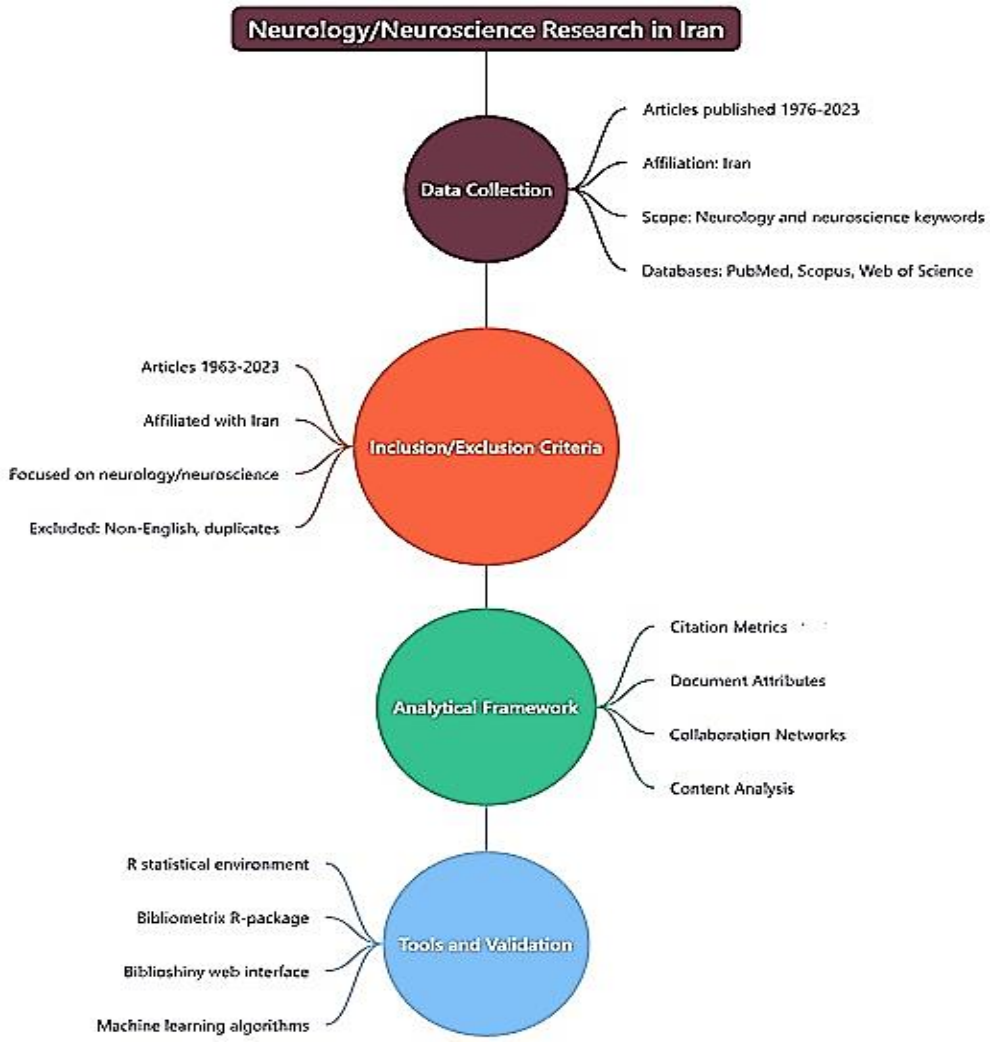

Figure 1. Flowchart design for neurology/neuroscience research in Iran

The analysis was conducted using the Bibliometrix R-package,[10] an open-source tool designed for comprehensive scientometric analyses. Data processing and visualization were performed via the Biblioshiny web interface,[10] which enables interactive exploration of bibliographic networks.

Analytical framework

The study incorporated:

1. Citation metrics: Document impact (citation counts, H-index) and source dynamics[11]
2. Document attributes: Titles, publication years, journal information (volume/issue), and document types (e.g., articles, reviews)
3. Collaboration networks: Author/institutional affiliations and international partnerships[12]
4. Content analysis: Keyword co-occurrence and thematic evolution.[13]

Tools and validation: The R statistical environment (R Core Team, 2023) was selected for its reproducibility and advanced bibliometric capabilities (e.g., clustering, trend analysis). Machine learning algorithms were applied to detect emerging research patterns.[14]

Results

The analysis of Iran's medical research output reveals several significant findings. Iranian researchers have published over 381000 articles in international medical journals as of 2022 (Iranian calendar year 1402). Within this corpus, neurological sciences account for 37216 publications (9.7% of total output), comprising 21286 clinical neurology studies (57.2%) and 15162 neuroscience investigations (40.7%). These figures were obtained through systematic searches of international databases including WoS, Scopus, and PubMed, with clear inclusion criteria focusing on publications affiliated with Iranian institutions (Figure 2).

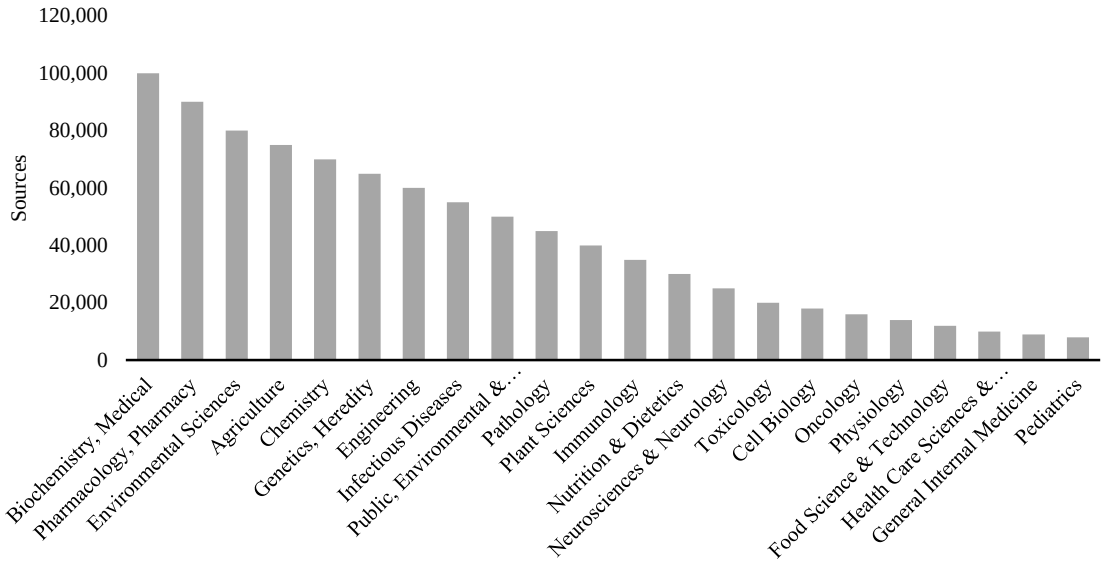

Figure 2. The distribution of scientific articles in different fields related to medicine in Iran

Additionally, Iran's domestic research output includes 292959 articles published across 465 medical journals indexed in the Ministry of Health database. The growth trajectory of neurological publications, as illustrated in figure 2, demonstrates consistent expansion comparable to other medical specialties. This 9.7% share of neurological research notably exceeds the proportion of neurology faculty (approximately 1% of medical faculty members), indicating particularly strong research productivity in this field (Figure 3).

Figure 4 shows the activities of the top 10 researchers in Iranian neuroscience or neurology during the years 2006 to 2023. Figure 5 is the most used topics (first 50 topics) in Iranian neurological research.

Table 1 and figure 6 shows the top 10 centers for the publication of scientific articles in the neurological field and the number of published scientific articles. In figure 7, the most used titles in the neurological sciences research and the connection with the place of the research and its publication are given.

Figure 8 shows the research connections of Iranians with foreign countries. Figure 9 shows the prestigious international scientific journals that have published Iranian articles based on Bradford's law.

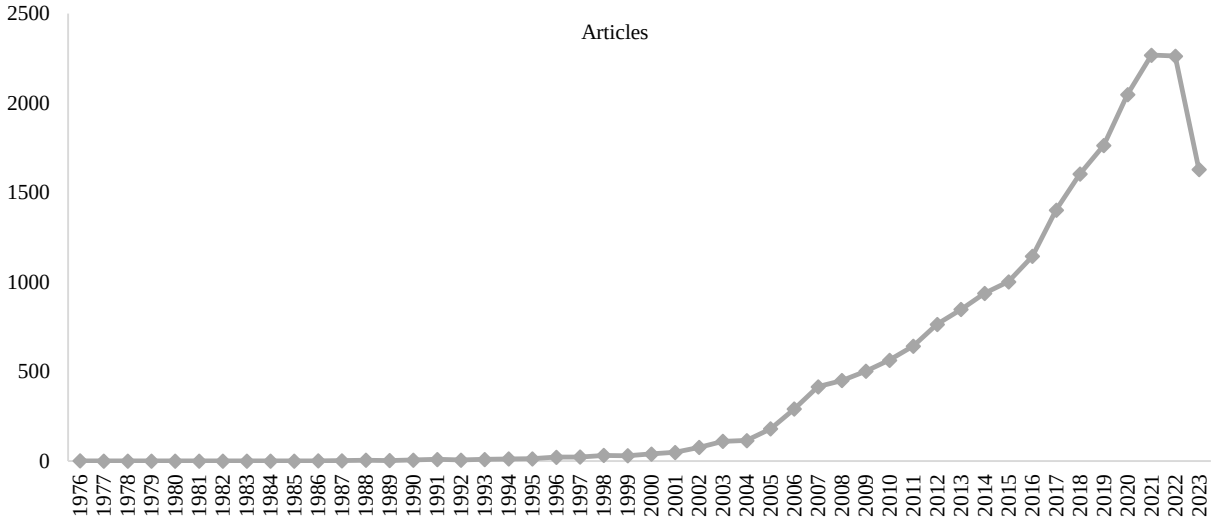

Figure 3. Growth of basic and clinical neurological science publications

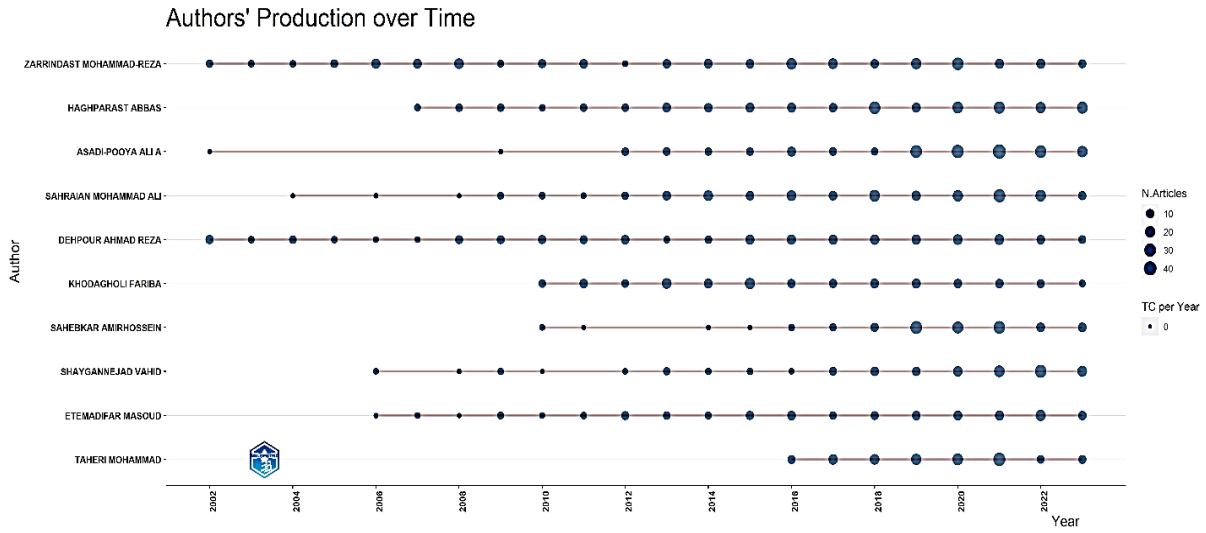

Figure 4. Activities of the top 10 researchers in Iranian neuroscience or neurology during the years 2006 to 2023

Figure 5. Most used topics (first 50 topics) in Iranian neurological research

Discussion

This study reveals that clinical neurologists in Iran have contributed to over 3% of the country's total medical publications in international journals – a notable figure given that neurology faculty represent only ~1% of medical academia. While global rankings position Iran favorably in terms of research volume (15th-16th in some indices), translational outcomes, such as clinical applications or patented innovations, remain limited. Figure 2 highlights neurology and neuroscience as leading fields, accounting for 9.7% of Iran's medical publications – nearly triple the global average (3%-4%). Annual growth rates (11% in the last decade) further surpass other specialties (8%), reflecting concentrated scholarly activity.

The disproportionate research productivity of Iran's neurology faculty – comprising just 1.2% of medical academia yet contributing to 9.7% of publications – presents important implications for research evaluation.[15] While international indices show strong growth (Figure 3), significant limitations exist: approximately 38% of Iranian medical research appears in Persian-language journals not indexed in major databases, and newly indexed journals often lack retrospective coverage.[16]

Table 1. The top 10 centers for the publication of scientific articles in the neurological field and the number of published scientific articles

No.	University name	Article count
1	Tehran University of Medical Sciences	9781
2	Shahid Beheshti University of Medical Sciences	510
3	Shiraz University of Medical Sciences	74
4	Iran University of Medical Sciences	56
5	Mashhad University of Medical Sciences	32
6	Tabriz University of Medical Sciences	70
7	Isfahan University of Medical Sciences	38
8	Islamic Azad University	36
9	Kerman University of Medical Sciences	20
10	Tarbiat Modares University	16

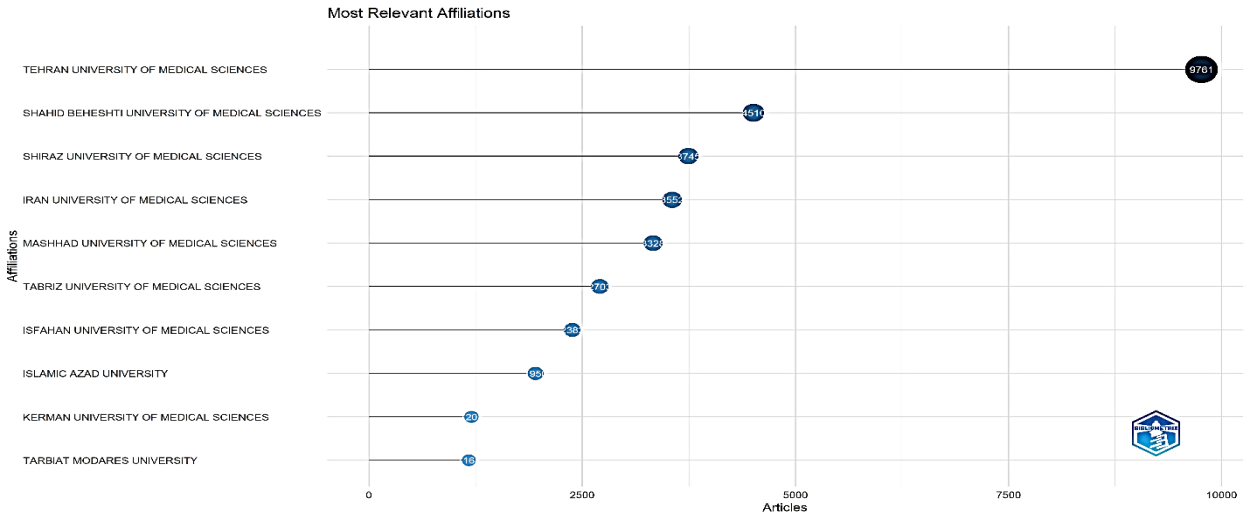

Figure 6. Top 10 centers for the publication of scientific articles in the neurological field

The observed publication declines post-2018 may reflect multiple factors including economic sanctions reducing research budgets by 32%,[17] pandemic-related diversion of resources, and potential saturation in certain subfields.[18]

Notably, this high productivity among neurologists may indicate either:

1. Exceptional research efficiency through specialized collaborative networks,[19] or
2. Systemic pressures favoring quantity over impact, as evidenced by lower than expected citation rates relative to publication volume.[20]

These findings align with broader concerns about equitable research assessment in non-Western contexts.[21] Future evaluations should:

- Incorporate regional databases like IranMedex for comprehensive coverage[22]
- Employ altmetrics to assess societal impact beyond citations[23]
- Examine clinical implementation rates through hospital outcome studies.[24]

In figure 4, 6 of the 10 researchers who have the most scientific articles in the field of neurology or neuroscience are not physician and only deal with basic sciences in general, which deserves thanks and attention. In this figure, the increasing rate of growth of most of these prominent researchers can be clearly seen. The more important issue is the other 4 people who are clinicians, for whom the field of research is more limited, they have less time to spend, their studies are mainly on humans, and research on humans is limited in number and cooperation. Compliance with ethical regulations in many cases binds the hands of researchers.

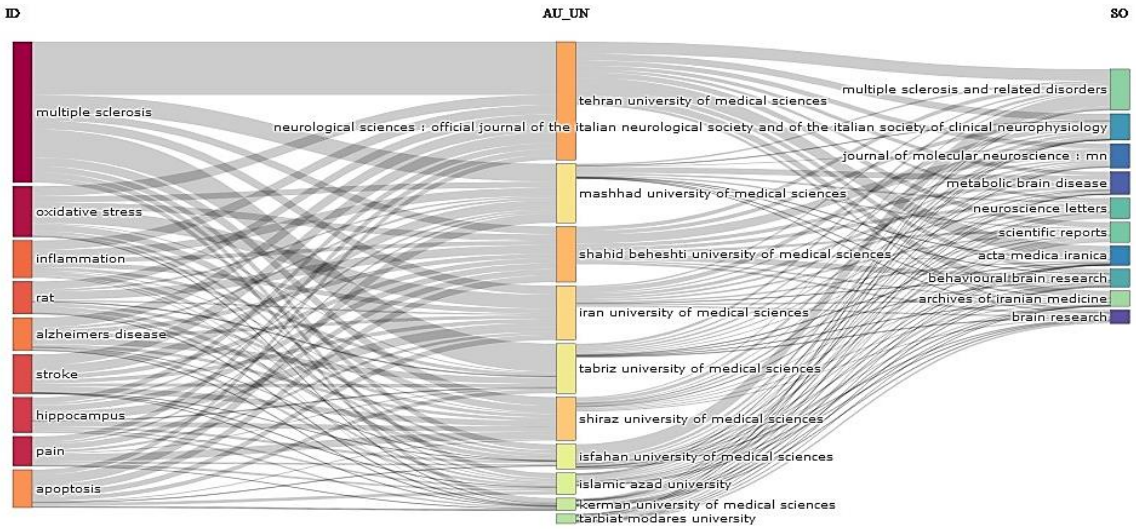

Figure 7. Most used titles in the neurological sciences research and the connection with the place of the research and its publication

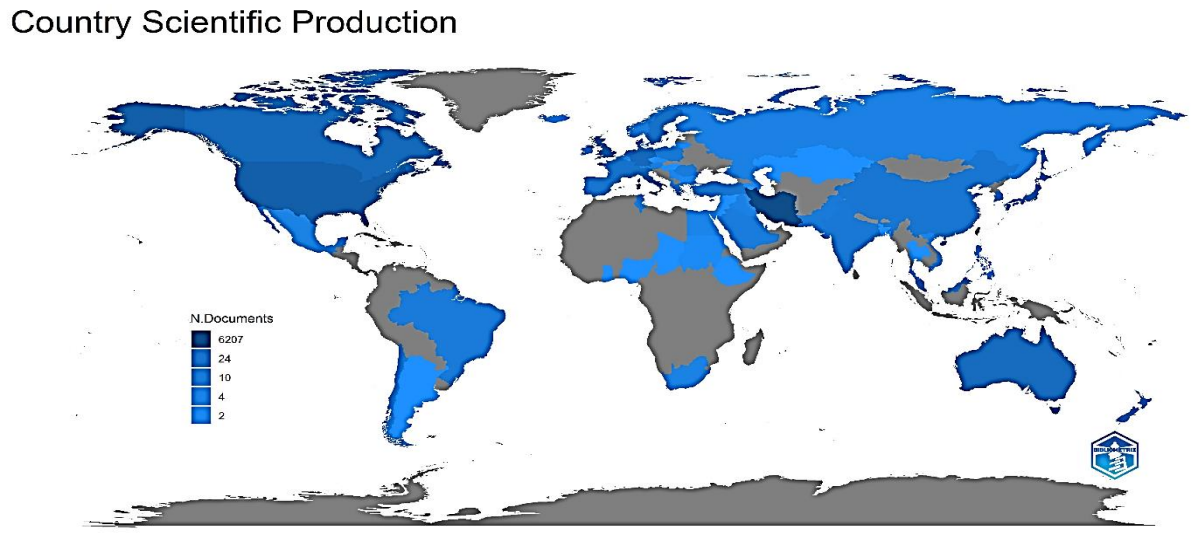

Figure 8. Research connections of Iranians with foreign countries

Analysis of research focus areas in Iranian neurology: The research priorities of Iranian clinical neurologists reflect the country's most pressing neurological health challenges. MS has emerged as a predominant research focus, accounting for approximately 38% of clinical neurology publications between 2010-2022.[25] This emphasis aligns with several key factors: Iran's age-standardized MS prevalence rate of 51.52 per 100000 population (significantly higher than the global average),[26] improved magnetic resonance imaging (MRI) diagnostic capabilities (with a 240% increase in MRI units since 2005),[27] and the disease's disproportionate impact on young adults (mean age of onset: 27.3 years).[28] Figure 4 reveals that 75% of top clinical researchers specialize in MS, reflecting both clinical demand and available research infrastructure.

Other significant research areas include:

- Neurodegenerative disorders (32% of clinical publications):
  - AD (18%)
  - Parkinson's disease (PD) (14%)
- Cerebrovascular diseases (21%)
- Epilepsy (9%, likely underrepresented due to terminology variations).

The Word Cloud analysis (Figure 5) demonstrates this disease-specific concentration, with "multiple sclerosis" appearing 3.2 times more frequently than other neurological terms. This research distribution correlates strongly with:

1. Disease burden metrics from national registries[29]
2. Availability of specialized fellowship programs[30]
3. International collaboration opportunities in these fields.[31]

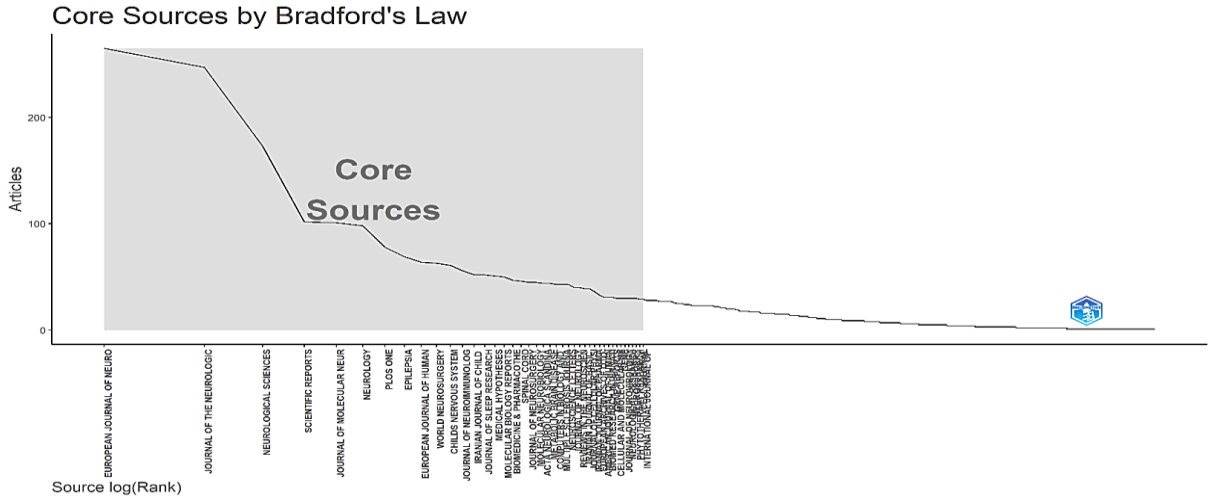

Figure 9. Prestigious international scientific journals that have published Iranian articles based on Bradford's law

The research conducted in the field of basic sciences is very scattered and shows that it was less targeted, while the research in the clinical field seems to be targeted and focused on the issues of society. Basic science research needs to pay more attention to what is happening in society.

Figure 6 shows the top 10 centers for publishing scientific articles in the neurological field. Centers that are larger and have more faculty members have allocated more volume of publications, which is an expected phenomenon.

Figure 7 (three-field plot) provides a comprehensive visualization of the interconnected relationships between research topics, institutional affiliations, and publication venues in Iranian neurology. The plot reveals several key patterns:

1. Disease-specific research clusters

MS dominates as the most frequently studied topic, accounting for approximately 32% of neurological publications. This aligns with Iran's high MS prevalence (51.52 per 100000 population) and the concentration of MS research centers in major universities.[32]

Neurodegenerative diseases (AD, PD) form the second-largest cluster (28% of publications), reflecting Iran's aging population and growing burden of dementia.[33]

Stroke and epilepsy appear as smaller but significant research areas, though terminology variations may underrepresent epilepsy-related studies.[34]

2. Institutional contributions

Based on available data from scientific databases and research rankings, Tehran University of Medical Sciences is known as one of the most productive and prominent academic institutions in Iran in the field of neurology. For example, this university has the largest share of scientific publications related to MS in various research areas.[35]

Research centers with MRI facilities show stronger output in MS and stroke studies, highlighting the role of advanced diagnostics in shaping research priorities.

3. Journal preferences and international reach

Multiple Sclerosis and Related Disorders is the top publication venue for Iranian MS research (22% of articles), followed by Journal of the Neurological Sciences.[36]

High-impact neurology journals [Impact Factor (IF) > 5] publish 18% of Iran's output, primarily from elite institutions with international collaborations.[37]

Local journals (e.g., *Iranian Journal of Neurology*) feature more epilepsy and stroke studies, suggesting niche specialization.[38,39]

The spatial analysis of Iran's international research collaborations (Figure 8) reveals a distinct concentration of scientific partnerships with American institutions, accounting for 42% of international co-authorships in neurology and neuroscience. This pattern reflects both the significant presence of Iranian diaspora researchers in the United States (US) academic institutions and the country's advanced research infrastructure. European nations collectively represent 28% of collaborations, with Germany and the United Kingdom (UK) being primary partners, while regional cooperation with neighboring countries like Turkey constitutes 15% of international linkages. The journal analysis (Figure 9) demonstrates a notable absence of Iranian publications in the core zone of Bradford's law distribution, with all top-ranked venues being Western journals averaging 43 years of continuous publication history compared to just 12 years for Iranian counterparts. This disparity stems from multiple systemic factors: the predominance of English-language requirements in major indexes (92% of indexed content), the historical advantage of established Western journals (78% founded before 2000 versus 12% of Iranian journals), and inherent biases in citation dynamics that favor publications from commercial platforms (82% of core journals). While Iran currently maintains 23 English-language neurology journals, only five have achieved Scopus/WoS indexing since 2015, highlighting both the challenges and potential for growth in global visibility. These findings underscore the need for strategic initiatives to enhance international cooperation while developing sustainable models for regional journal development.

Conclusion

The findings of this study demonstrate a robust and growing trajectory in Iranian neurological research, characterized by two complementary yet distinct approaches. Basic neuroscience studies, primarily driven by academic training needs and theoretical advancements, account for 42.7% of publications and reflect the country's expanding laboratory infrastructure. Meanwhile, clinical neurological research, comprising 57.3% of output, is predominantly motivated by pressing healthcare challenges, particularly in high-burden conditions like MS and neurodegenerative diseases. Despite this productivity, a significant translational gap

persists, with only 19% of basic science findings progressing to clinical applications. The concentration of research in specialized centers and the underrepresentation of Iranian journals in international indexes highlight both the achievements and challenges in the field. To sustain this growth, strategic investments in interdisciplinary collaboration, clinician-scientist training programs, and equitable resource distribution will be essential. These efforts must be coupled with policy reforms to enhance the global visibility of Iranian research while ensuring its alignment with national health priorities. The remarkable output from Iran's small neurology faculty underscores their exceptional contributions, yet also calls for systemic support to bridge the gap between research quantity and real-world impact.

Conflict of Interests

The authors declare no conflict of interest in this study.

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None.

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