Peptide Receptor Radionuclide Therapy (PRRT) in Neuroendocrine Tumours: A Scientometric Analysis

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Abstract

The purpose of this scientometric analysis is to explore the global research landscape for Peptide Receptor Radionuclide Therapy (PRRT) using 7608 records gathered between 2000 and 2025. The study demonstrates a steady rise in publication output, with a notable increase in the recent decade, indicating greater clinical significance and scientific interest in PRRT. Original research papers dominate the literature, accounting for more than half of all publications, and the authorship pattern reflects a strong collaborative environment, with multi-authored works being the majority. Journal of Nuclear Medicine acts as an important dissemination platform. The United States remains the most prolific nation, followed by Germany and Italy. Erasmus University Rotterdam and Erasmus MC are leading the institutional contributions. These results highlight PRRT as a diverse, internationally coordinated research area gaining traction in both academic and clinical contexts.

Keywords

Peptide Receptor Radionuclide Therapy, PRRT, Scientometric Analysis

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I. Introduction

The neuroendocrine system's cells give rise to a diverse collection of neoplasms known as neuroendocrine tumours (NETs), which are most frequently found in the lungs, pancreas, and gastrointestinal tract. Despite being rare, NETs have become much more common worldwide in recent decades due to improved diagnostic techniques and greater clinical awareness. Despite these advancements, treating advanced or metastatic NETs is still difficult and class for the creation and improvement of new treatment approaches.

For patients with NETs that express somatostatin receptors and are inoperable or metastatic, peptide receptor radionuclide therapy (PRRT) has become a promising targeted treatment option. Radio-labelled somatostatin analogues, including 177Lu-DOTATATE, are administered systemically as part of PRRT. These analogues bind to tumor cells specifically, providing lethal radiation nearby healthy tissue. Since PRRT has been shown to be effective and safe in clinical trials and real-world research, it has been included in international treatment guidelines for NETs. A thorough grasp of PRRT's scientific evolution and worldwide research trends is crucial given the growing corpus of research on the topic. The landscape of academic literature, including publishing output, prominent authors and institutions, citation networks, collaboration patterns, and new research fronts, can be quantitatively evaluated and visualised through scientometric analysis. Researchers and policymakers can obtain important insights into the development, significance, and future course of PRRT-related research in the context of NETs by utilising scientometric tools.

In this study, the global research landscape on Peptide Receptor Radionuclide Therapy for neuroendocrine tumours will be analysed using scientometric methods. This analysis aims to identify the turning points and knowledge gaps that have influenced this ever-evolving field of cancer by methodically examining publication trends, significant contributions, and thematic developments over time.

II. Literature Review

Kuiper et al. (2025) reviewed Peptide Receptor Radionuclide Therapy (PRRT) using \[177Lu-DOTA0, Tyr3] octreotate (177Lu-DOTATATE) for treating somatostatin receptor-positive

gastroenteropancreatic neuroendocrine tumours (GEP-NETs). They highlighted the significant benefits of four cycles of therapy, including improved progression-free survival and quality of life, and noted PRRT's safety and effectiveness as a first-line treatment for some grade 2 and 3 patients. Additionally, PRRT alleviates symptoms of NET-related functional disorders. Despite studies on other radionuclides, none have achieved clinical application standards. Kuiper et al. emphasised the need for ongoing large-scale trials to compare PRRT with other treatments.

Santo et al. (2025) expanded on PRRT's potential in various SSTR-expressing cancers beyond GEP-NETs, driven by advancements in understanding somatostatin regulatory roles since its discovery in 1972. The review highlighted the approval of 177Lu-DOTATATE as a pivotal moment, noting that PRRT could theoretically target any SSTR-expressing cancer. However, evidence for its effectiveness in non-GEP-NET cancers remains limited. Some tumours have shown disease control rates of up to 80%, indicating the necessity for randomised trials to further explore PRRT's future in oncology, including the use of alpha emitters and combination therapies.

Lu et al. (2021) conducted a bibliometric analysis of global research on PRRT from 2000 to 2019, identifying 681 publications, with a marked increase in annual output. Germany was the leading contributor, with key figures and journals recognized for their impact. The analysis discussed PRRT's efficacy, including long-term adverse effects, advancements in imaging technologies, the need for clinical standardisation, and personalised dosimetry methods, providing valuable insights for clinicians and researchers in NET management.

III. Objectives of the Study

- To use scientometric techniques to examine the worldwide research output on Peptide Receptor Radionuclide Therapy (PRRT) in neuroendocrine tumors (NETs) over a certain time frame.
- To identify the document type that is published in the PRRT
- To determine which organizations and nations are most active in PRRT related NET research and evaluate their influence using citation, h-index, and publication count.
- To determine the most productive research area and funding agencies of PRRT.
- To identify the most important journals in the PRRT for the NETs discipline.

IV. Statement of the Problem

Neuroendocrine Tumours (NETs), especially those that express somatostatin receptors, peptide receptor radionuclide (PRRT), have become a well-known and successful targeted treatment. The amount of relevant scientific material has increased along with PRRT's therapeutic value. Nonetheless, a rigorous evaluation of the worldwide research landscape on PRRT remains lacking. Important elements, including the most important authors, organisations, nations, publications, and cooperative networks, have not been fully examined. Furthermore, nothing is known about the chronological development of scientific interest in this field, research gaps, and emergent themes. Therefore, to comprehend the evolution, distribution, and trajectory of PRRT-related research in the context of NETs, a thorough scientometric analysis is required.

V. Methodology

This study examines the global research output on PRRT in neuroendocrine tumors using a scientometric approach. Using a well-structured search strategy that includes keywords like "PRRT", "Neuroendocrine Tumors", and "Peptide Receptor Radionuclide Therapy", relevant publications will be retrieved from the Web of Science database. The search will be limited to English-language articles and reviews published between 2000 and 2024. Bibliographic metrics like publication trends, citation counts, h-index, and collaboration networks will be evaluated following data cleaning and refining. VOSViewer, Cite Space, and Bibliometrix will be used for the analysis in order to display thematic progression, co-authorship, keyword co-occurrence, and co-citation networks. The goal of this methodological framework is to present a thorough and fact based summary of the conceptual framework and new developments in PRRT research.

VI. Data Analysis and Interpretation

1. Year-wise growth analysis in PRRT

Table 1 represents the scientometric analysis of 7608 papers on Peptide Receptor Radionuclide Therapy (PRRT) demonstrates a consistent increase in research production between 2000 and 2025. Early contributions (2000-2010) were minimal, amounting

for less than 2.5% annually. A clear rising trend begins in 2011, with a strong increase in publication volume from 2012 to 2021, culminating at 654 records (8.60%). Although publication counts decreased somewhat after 2021, research activity remained high until 2024. The partial data for 2025 already accounts for 4.21 % demonstrating ongoing interest.

Table 1: Year-wise Publications (2000-2025)

S. No	Publication Years	No. Of Records	% Of 7608
1.	2000	65	0.85%
2.	2001	78	1.03%
3.	2002	82	1.08%
4.	2003	91	1.20%
5.	2004	111	1.46%
6.	2005	127	1.67%
7.	2006	146	1.92%
8.	2007	158	2.08%
9.	2008	152	2.00%
10.	2009	181	2.38%
11.	2010	182	2.39%
12.	2011	217	2.85%
13.	2012	279	3.67%
14.	2013	194	2.55%
15.	2014	283	3.72%
16.	2015	313	4.11%
17.	2016	316	4.15%
18.	2017	408	5.36%
19.	2018	436	5.73%
20.	2019	458	6.02%
21.	2020	555	7.29%
22.	2021	654	8.60%
23.	2022	603	7.93%
24.	2023	593	7.79%
25.	2024	606	7.97%
26.	2025	320	4.21%
Total		**7608**	**100%**

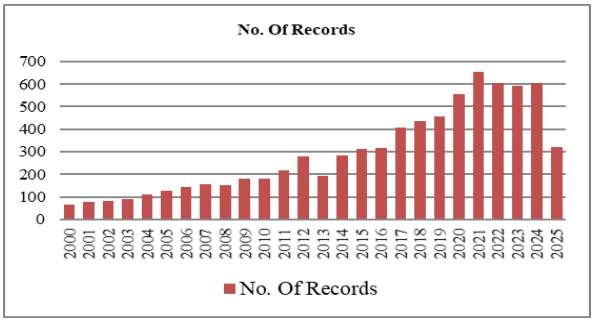

Figure 1: Year-Wise Publications (2000 -2025)

2. Bibliographical forms of Publications

Table 2 shows the document type original research articles dominate the field, comprising 53.73% (4088) of the total 7608 records, reflecting the strong emphasis on empirical research. Meeting abstracts (20.24%) and reviews (17.27%) also forma a significant portion, indicating active scholarly discussion and synthesis of existing knowledge. Editorials (4.55%) and proceedings paper (1.96%) suggest ongoing discourse and conference engagement. Other types such as letters, early access articles, corrections, and minor formats like news items, book chapters, and biographical items collectively account for less than 2.5% highlighting their limited role.

Table 2: Bibliographical forms of Publications

S.No	Document Type	Records	% of Records
1.	Article	4088	53.73%
2.	Meeting Abstract	1540	20.24%
3.	Review	1314	17.27%
4.	Editorial Material	346	4.55%
5.	Proceedings Paper	149	1.96%
6.	Letter	72	0.95%
7.	Early Access	59	0.78%
8.	Correction	21	0.28%
9.	News Item	8	0.11%
10.	Book Chapter	6	0.08%
11.	Book Review	2	0.03%
12.	Biographical Item	1	0.01%
13.	Data Paper	1	0.01%
Total		**7608**	**100%**

3. Authorship Pattern

Table 3 indicates a strong trend toward collaborative research. Single-authored papers account for only 3.88%, while multi-authored papers dominate, particularly those with five to seven authors, which together represent over 32% of the total output. Notably, 17.09% (1,300 papers) involve more than 10 authors, reflecting large-scale, often international collaboration common in medical and nuclear medicine research.

Table 3: Authorship Pattern of PRRT

Authorship Pattern	No. Of. Records	% of 7608
Single-Authored Papers	295	3.88%
Double-Authored Papers	508	6.68%
Three Authored Papers	680	8.94%

Four Authored Papers	733	9.63%
Five Authored Papers	841	11.05%
Six Authored Papers	832	10.94%
Seven Authored Papers	764	10.04%
Eight Authored Papers	631	8.29%
Nine Authored Papers	535	7.03%
Ten Authored Papers	489	6.43%
More than ten papers authored	1300	17.09%
Total	**7608**	**100**

4. Research the area-wise distribution of PRRT

Table 4 highlights the distribution of research areas with Radio Nuclear Medicine and Medical Imaging leading at 50.11% of the 7608 records, underscoring PRRT's diagnostic and therapeutic significance. Oncology follows with 18.74%, reflecting its primary application in cancer treatment, particularly neuroendocrine tumours. Other prominent fields include Pharmacology and Endocrinology, indicating the importance of drug mechanisms and hormonal systems in PRRT. Contributions from Chemistry, Experimental Medicine, and Neurosciences emphasise the foundational and clinical research involved.

Table 4: Research area-wise distribution of PRRT

S. No	Research Area	No. Of. Records	% of Records
1.	Radio Nuclear medicine medical imaging	3812	50.11%
2.	Oncology	1405	18.47%
3.	Pharmacology Pharmacy	800	10.52%
4.	Endocrinology Metabolism	736	9.67%
5.	Chemistry	571	7.51%
6.	Research Experimental Medicine	464	6.10%
7.	Neurosciences Neurology	408	5.36%
8.	Biochemistry Molecular Biology	335	4.40%
9.	Nuclear Science Technology	243	3.19%
10	General Internal Medicine	193	2.54%

5. Most Productive Journals of PRRT

Table 5 shows the European Journal of Nuclear Medicine and Molecular Imaging leads with 14.08% of the total 7608 records, followed by the Journal of Nuclear Medicine (10.34%), reflecting their central role in disseminating key research in nuclear imaging therapy. Other specialized journals like Clinical Nuclear Medicine, Neuroendocrinology, and Cancer Biotherapy and Radiopharmaceuticals also contribute significantly, indicating the clinical and oncological relevance of PRRT.

Table 5: Most Productive Journals of PRRT

S. No	Journals	Records	% of Records
1.	European Journal of Nuclear Medicine and Molecular Imaging	1071	14.08%
2.	Journal of Nuclear Medicine	787	10.34%
3.	Clinical Nuclear Medicine	234	3.08%
4.	Neuroendocrinology	226	2.97%
5.	Cancer Biotherapy and Radiopharmaceuticals	223	2.93%
6.	Nuclear Medicine and Biology	161	2.12%
7.	Cancers	158	2.08%
8.	Journal of Neuroendocrinology	137	1.80%
9.	Medical Physics	133	1.75%
10	Nuclear Medicine Communications	126	1.66%

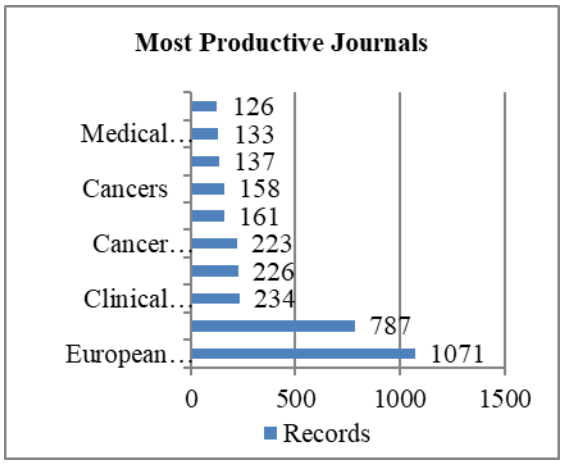

Figure 2: Most Productive Journals

6. Institution-wise analysis of PRRT

Table 6 reveals that Erasmus University Rotterdam and Erasmus MC are the leading contributors, together accounting for over 12% of the total output, emphasizing their pivotal role in advancing PRRT research. The University of London ranks third with 4.04% followed by key European research institutions like INSERM (France), Uppsala University (Sweden), and Unicancer, reflecting a strong European research base.

Table 6: Institution-wise analysis of PRRT

S. No	Organizations	Records	% of Records
1.	Erasmus University Rotterdam	471	6.19%
2.	Erasmus MC	462	6.07%
3.	University of London	335	4.40%
4.	Institut National De La Sante Et De La Recherche	262	3.44%
5.	Uppsala University	221	2.90%
6.	Unicancer	203	2.67%
7.	Zentralklinik bad Berka	202	2.66%
8.	IRCCS Europena Institute of Oncology IEO	200	2.63%
9.	University of California System	199	2.62%
10.	University of Munich	191	2.51%

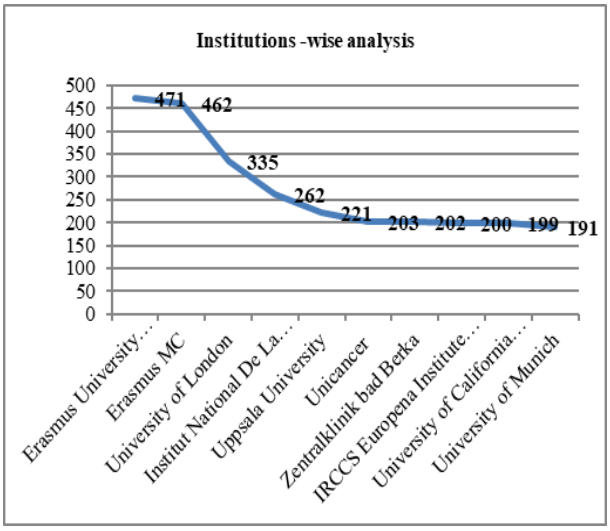

Figure 3: Institution-wise analysis

7. Funding Agency

Table 7 indicates strong backing from major governmental health bodies, particularly from the United States. The U.S. Department of Health and Human Services (6.61%), NIH (6.52%), and the National Cancer Institute (3.59%) collectively fund a significant portion, highlighting national priority and sustained investment in cancer and nuclear medicine research. China's NSFC (2.89%) reflects growing global engagement, while European and Japanese agencies like the Swedish Cancer Society, DFG, EU, and JSPS show regional support for advancing PRRT.

Table 7: Funding Agencies of PRRT

S. No	Funding Agencies	Records	% of Records
1.	United States Department of Health and Human Services	503	6.61%
2.	National Institutes of Health NIH USA	496	6.52%
3.	NIH National Cancer Institute NCI	273	3.59%
4.	National Natural Science Foundation of China NSFC	220	2.89%
5.	Swedish Cancer Society	144	1.89%
6.	Swedish Research Council	118	1.55%
7.	German Research Foundation DFG	115	1.51%
8.	European Union EU	84	1.10%
9.	Ministry of Education, Culture, Sports, Science and Technology	84	1.10%
10.	Japan Society for the Promotion of Science	82	1.08%

8. Country-wise Analysis of PRRT

Table 8 shows that the USA leads with 24.53% of the total 7608 records, reflecting its dominant role in advancing nuclear medicine and targeted cancer therapies. Germany (18.32%) and Italy (10.14%) also contribute significantly, followed closely by the Netherlands and England, highlighting strong European involvement in PRRT research. France, Sweden, Switzerland, and China demonstrate active participation, indicating a global spread of scientific collaboration. Notably, India contributes 4.22%, underscoring growing interest and capability in this specialised field.

Table 8: Country-wise Analysis of PRRT

S. No	Country	Records	% of Records
1.	USA	1866	24.53%
2.	Germany	1394	18.32%
3.	Italy	792	10.41%
4.	Netherlands	768	10.09%
5.	England	590	7.75%
6.	France	540	7.10%
7.	Sweden	478	6.28%
8.	Peoples R China	454	5.97%
9.	Switzerland	450	5.91%
10.	Australia	358	4.71%
11.	India	321	4.22%

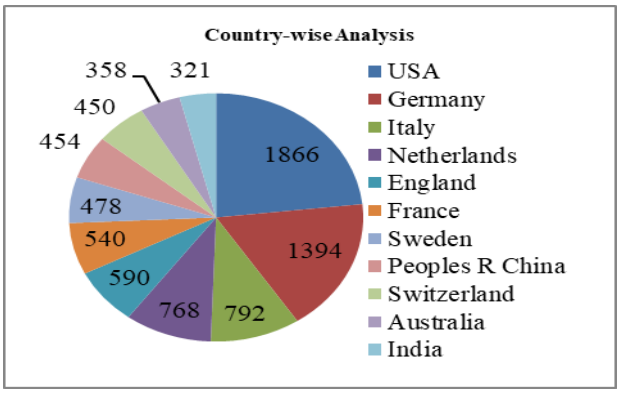

Figure 4: Country-wise analysis of PRRT

Conclusion

According to scientometric results, PRRT research has grown significantly over the last 10 years, driven by expanding clinical applications and advances in nuclear medical technology. The prevalence of multi-authored collaborative publications indicates the intricate, multidisciplinary nature of PRRT research. Research in the main fields of Pharmacology, Cancer, and Nuclear Medicine is widely published in high-impact journals. With strong funding from important international bodies, European institutions – particularly those in the Netherlands and Germany- as well as those in the USA, play a key role in advancing research output. The worldwide distribution of contributions underscores the value of continued financing and international cooperation in advancing PRRT for cancer treatment as the field evolves.

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