Productivity, Collaboration and Impact of Cuban Scientific Research on Parkinson's Disease in Scopus

Hector Julio Piñera-Castro, Fidel Jesús Moreno-Cubela

Original article

Productivity, Collaboration and Impact of Cuban Scientific Research on Parkinson's Disease in Scopus

Productividad, colaboración e impacto de las investigaciones científicas cubanas sobre enfermedad de Parkinson en Scopus

Hector Julio Piñera-Castro[1]* https://orcid.org/0000-0002-2491-489X

Fidel Jesús Moreno-Cubela[2] https://orcid.org/0000-0001-9963-692X

[1]Universidad de Ciencias Médicas de La Habana, Facultad de Ciencias Médicas "Victoria de Girón". Havana, Cuba.

[2]Universidad de Ciencias Médicas de Granma, Facultad de Ciencias Médicas de Manzanillo "Celia Sánchez Manduley". Granma, Cuba.

*Corresponding author: hectorpinera18100@gmail.com

ABSTRACT

Introduction: Parkinson's disease is the second most common neurodegenerative disease in the world. This fact, in addition to the role of Scopus as a high-quality bibliometric data source, Cuba's privileged position among Latin American countries in terms of neuroscientific output, and the absence of bibliometric studies on Parkinson's disease in this context motivated the present study.

Objective: To evaluate the productivity, collaboration, and impact of Cuban scientific research on Parkinson's disease indexed in Scopus between 2012 and 2021.

Methods: A descriptive bibliometric study was performed on 84 articles that had at least one author with a Cuban institutional affiliation. Indicators of productivity, collaboration and impact were used.

Results: The highest output corresponded to the journals *Neuroscience* and *Behavioral Sciences* (5 documents each). *Parkinsonism and Related Disorders* led in terms of number of citations (NC = 201) and average number of citations per paper (ANC = 67). The year with the highest productivity was 2019 (Ndoc = 13). Articles represented 69 % of the documents. Of the 11 most productive authors, 6 were major producers and only one of them is Cuban. The top funding sponsor was Medicinska Forskningsrådet. The Subramanyan's index was 98,8. The top contributing country was Spain (Ndoc = 25). International collaboration was the most common (79,8 %). The publications reached 1 592 citations. The *h*-index was 22.

Conclusions: The scientific output was scarce, tended to be in quantitative decline, had few major Cuban producers, presented a high rate of international collaboration, and achieved a notable scientific impact.

Keywords: Parkinson Disease; Bibliometrics; Scientific Publication Indicators; Cuba; Neurosciences; Neurodegenerative Diseases.

RESUMEN

Introducción: la enfermedad de Parkinson es la segunda enfermedad neurodegenerativa más frecuente en el mundo. Este hecho, sumado al papel de Scopus como fuente de datos bibliométricos de alta calidad, la posición privilegiada de Cuba entre los países latinoamericanos en cuanto a producción neurocientífica, y la ausencia de estudios bibliométricos sobre la enfermedad de Parkinson en este contexto motivaron el presente estudio.

Objetivo: evaluar la productividad, colaboración e impacto de las investigaciones científicas cubanas sobre la enfermedad de Parkinson indexadas en Scopus entre 2012 y 2021.

Métodos: se realizó un estudio bibliométrico descriptivo de 84 artículos que tenían al menos un autor con afiliación institucional cubana. Se utilizaron indicadores de productividad, colaboración e impacto.

Resultados: la mayor producción correspondió a las revistas *Neuroscience* y *Behavioral Sciences* (5 documentos cada una). *Parkinsonism and Related Disorders* lideró en número de citas (NC = 201) y promedio de citas por documento (NCP = 67). El año con mayor productividad fue 2019 (Ndoc = 13). Los artículos originales representaron el 69 % de los documentos. De los 11 autores más productivos, 6 fueron grandes productores y solo uno de ellos es cubano. El principal patrocinador de financiación fue Medicinska Forskningsrådet. El índice de Subramanyan fue de 98,8. El principal país contribuyente fue España (Ndoc = 25). La colaboración internacional fue la más frecuente (79,8 %). Las publicaciones alcanzaron 1 592 citas. El índice *h* fue de 22.

Conclusiones: la producción científica fue escasa, tendió a la disminución cuantitativa, tuvo pocos grandes productores cubanos, presentó una alta tasa de colaboración internacional y alcanzó un notable impacto científico.

Palabras clave: enfermedad de Parkinson; bibliometría; indicadores de producción científica; Cuba; neurociencias; enfermedades neurodegenerativas.

INTRODUCTION

Neurological conditions are the leading cause of disability worldwide. People affected by these diseases are unable to function normally in daily life and work, which leads to economic, psychological, and social difficulties. In this context, the importance of developing neuroscientific studies lies in the improvements these can represent in the cognition, functionality, and well-being of those affected; for example, such research can provide alternative solutions to counteract the motor and non-motor difficulties of those suffering from neurodegenerative diseases such as Parkinson's disease (PD).[1]

PD is the most common type of parkinsonism, a term reflecting a group of neurological disorders with PD-like movement problems such as rigidity, slowness, and tremor.[2]

It has a large effect on society. In terms of the number of people affected, this disease is a common condition, with a global prevalence that is expected to double from 6,2 million cases in 2015 to 12,9 million cases by 2040.[2,3] For reasons that are not yet fully understood, the incidence and prevalence of

this disease have risen in the past two decades,[4] even more rapidly than other disorders of the nervous system.[2]

During the last two decades, the scientific publishing activity on PD has also increased tremendously, well beyond that of the global scientific literature. This literature growth accompanies the important scientific progress made in PD, along with the growing interest among researchers.[5] The aforementioned reasons justify the need and relevance of the bibliometric study of this scientific output.

Bibliometric analyses are useful for deciphering and mapping the cumulative scientific knowledge and evolutionary nuances of well-established fields by making sense of large volumes of unstructured data in rigorous ways. Therefore, bibliometric studies that are well done can build firm foundations for advancing a field in novel and meaningful ways —they enable and empower scholars to gain a one-stop overview, identify knowledge gaps, derive novel ideas for investigation, and position their intended contributions to the field.[6]

The well-known role of Scopus as a high-quality bibliometric data source for academic research,[7] Cuba's privileged position among Latin American countries in terms of neuroscientific output,[8] and the absence —to the best of the authors' knowledge— of bibliometric studies on PD in this context motivated this study, which aimed to evaluate the productivity, collaboration, and impact of Cuban scientific research on PD indexed in Scopus between 2012 and 2021.

METHODS

A descriptive bibliometric study of the Cuban scientific output on PD, indexed in Scopus between 2012 and 2021, was conducted. The population consisted of 84 articles that had at least one author with a Cuban institutional affiliation.

To obtain the information, Scopus was accessed in November 2022 and an advanced search was performed with the following strategy: TITLE-ABS ("Parkinson Disease") AND AFFILCOUNTRY (Cuba) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012)).

The recovered data were exported in a RIS (Research Information Systems) file and normalized in Zotero 6.0.16 to reduce the dispersion of the scientific output of authors with more than one signature pattern.

Productivity, collaboration and impact indicators were used. Some of them were extracted from Scopus and SciVal.

Scientific productivity indicators

Scientific productivity [number of documents (Ndoc)] was studied according to: scientific journal, year of publication, type of document, authors [Lotka's productivity index (LPI)], subject area, topic, contributing countries, and funding sponsor.

LPI[9] was calculated using the equation LPI = logN, where N is the Ndoc published by the author. An author was considered a small producer if LPI = 0, a medium producer if 0 < LPI < 1, and a major producer if LPI ≥ 1.

It was also studied the rate of variation (RV) by year of publication, defined as the increase or decrease (%) in the Ndoc with respect to the initial year of the period analyzed. It was calculated using the equation $RV = [(Ndoc_f - Ndoc_i)/Ndoc_f * 100]$, where $Ndoc_f$ and $Ndoc_i$ are, respectively, the Ndoc corresponding to the final and initial years of the analysis period.

The keyword co-occurrence network was visualized in VOSviewer 1.6.11 (counting method: fractional counting; threshold: 5; scale: 1,25; weights: occurrences; size variation for labels and lines: 1; minimum link strength: 0).

Scientific collaboration indicators

The collaboration indicators analyzed were:

- Subramanyan's index (SI):[10] relative frequency of papers with more than one author.
- Collaboration between authors (co-authorship network).
- Contributing countries: countries to which non-Cuban authors belong.
- Type of collaboration:
  — International collaboration: Ndoc with authors from more than one country.
  — Only national collaboration: Ndoc with authors from Cuba only.
  — Only institutional collaboration: Ndoc with Cuban authors from the same institution only.
  — No collaboration: Ndoc with only one author.

VOSviewer 1.6.11 also allowed visualization of the co-authorship network (counting method: fractional counting; threshold: 5; scale: 1,25; weights: documents; size variation for labels and lines: 1; minimum link strength: 0).

Scientific impact indicators

To study scientific impact, the following indicators were used:

- Number of citations (NC): number of citations on Scopus at the time this research was conducted.
- Average number of citations per document (ANC): arithmetic mean of the NC.
- CiteScore (CS):[11] its calculation is based on the NC to documents by a journal over 4 years, divided by the number of the same document types indexed in Scopus and published over the same 4 years.
- SCImago Journal Rank (SJR):[11] it is based on the concept of a transfer of prestige between journals via their citation links. It weights each incoming citation to a journal by the SJR of the citing journal, with a citation from a high-SJR source counting for more than a citation from a low-SJR source. Like CiteScore, SJR accounts for journal size by averaging across recent publications and is calculated annually.
- *h*-index:[12] there is *h*-index if *h* of the documents have at least *h* citations each, and the rest of the documents have fewer than *h* citations each.

CiteScore and SJR metrics were obtained from Scopus. Harzing's Publish or Perish 8.4.4041.8250 was used to determine the *h*-index.

RESULTS

Scientific productivity

In the decade studied (2012-2021), the Cuban scientific output on PD indexed in Scopus was 84 documents.

The highest output corresponded to the journals *Neuroscience* (Ndoc = 5) and *Behavioral Sciences* (Ndoc = 5). *Parkinsonism and Related Disorders* led in terms of number of citations (NC = 201) and average number of citations per paper (ANC = 67). *Journal of Neurology, Neurosurgery and Psychiatry* had a CS of 15,1 and an SJR of 2,9222, which were the highest (Table 1).

Table 1. Most productive scientific journals and impact indicators

Scientific journal	Ndoc	NC	ANC	CS (2021)	SJR
Neuroscience	5	57	11,4	6,4	1,008
Behavioral Sciences	5	29	5,8	3,8	0,571
Current Neuropharmacology	4	77	19,3	11,7	1,722
Parkinsonism and Related Disorders	3	201	67	7,2	1,093
Neuromethods	3	9	3	0,8	-
Revista Habanera de Ciencias Médicas	3	1	0,3	0,6	0,153
Movement Disorders Clinical Practice	3	63	21	3,3	0,651
Revista Cubana de Investigaciones Biomédicas	2	0	0	0,4	0,117
European Journal of Neurology	2	105	52,5	7,9	1,662
Journal of Neurology, Neurosurgery and Psychiatry	2	26	13	15,1	2,922
Clinical Autonomic Research	2	10	5	8,1	1,009
MEDICC Review	2	31	15,5	1,5	0,26
IFMBE Proceedings	2	1	0,5	0,9	-
Procedia Computer Science	2	6	3	3,6	-
npj Parkinson's Disease	2	32	16	9	2,25

The year with the highest productivity was 2019 (Ndoc = 13), while 2012 and 2014 were the years with the lowest (6 documents each). According to the RV, productivity tended to quantitative decrease (Figure 1).
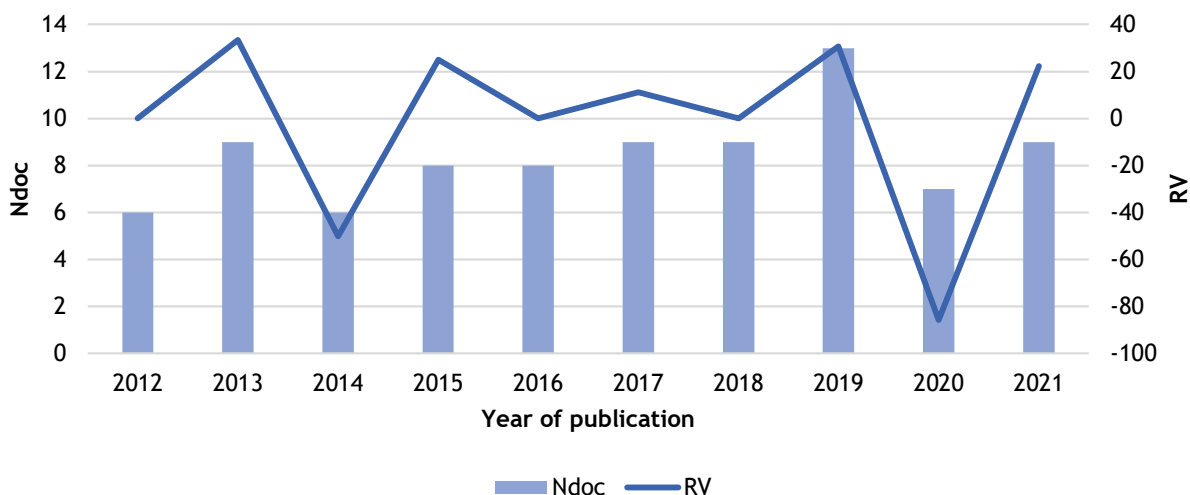

Figure 1. Ndoc and RV by year of publication.

Regarding the type of document, the following distribution was found: article (Ndoc = 58; 69 %), review (Ndoc = 11; 13 %), conference paper (Ndoc = 7; 8,3 %), book chapter (Ndoc = 6; 7,1 %), and letter (Ndoc = 2; 2,4 %).

382 authors were found. Of the 11 most productive ones, 6 were major producers and only one of those is Cuban (Table 2).

Table 2. Most productive authors and some of their characteristics

Author	Ndoc	NC*	LPI	*h*-index*	Specialization	Institutional affiliation**
Cuban authors						
Mario Álvarez Sánchez	10	1 390[GS]	1 (MaP)	12[GS]	Neurologist	Dumont University Hospital Centre, Canada
Lisette Blanco Lezcano	9	271[RG]	0,9 (MeP)	10[RG]	Neurophysiologist	International Center of Neurologic Restoration (CIREN), Cuba
Ivonne Pedroso Ibáñez	9	N/F	0,9 (MeP)	N/F	Neurologist	International Center of Neurologic Restoration (CIREN), Cuba
Dasiel Oscar Borroto Escuela	8	5 340[RG]	0,9 (MeP)	42[RG]	Biochemist, neuroscientist	Karolinska Institutet, Sweden
María Luisa Bringas Vega	8	1 845[GS]	0,9 (MeP)	22[GS]	Neuropsychologist	Clinical Hospital of Chengdu Brain Science Institute, China
Non-Cuban authors						
Nélida Susana Garretto	11	N/F	1,04 (MaP)	N/F	Neurologist	José María Ramos Mejía Hospital, Argentina
Pablo Martínez Martín	11	35 965[GS]	1,04 (MaP)	87[GS]	Neurologist	Carlos III Health Institute, Spain
Carmen Rodríguez Blázquez	11	7 259[GS]	1,04 (MaP)	44[GS]	Psychologist, medical doctor	Carlos III Health Institute, Spain
Juan Carlos Martínez Castrillo	10	4470[GS]	1 (MaP)	28[GS]	Neurologist	Ramón y Cajal University Hospital, Spain
Tomoko Arakaki	10	951[RG]	1 (MaP)	13[RG]	Neurologist	José María Ramos Mejía Hospital, Argentina
Kjell Fuxe	8	108 416[RG]	0,9 (MeP)	150[RG]	Histologist, neuroscientist	Karolinska Institutet, Sweden

Legend: GS – On Google Scholar (January 24, 2023), RG – On ResearchGate (January 24, 2023), MaP – Major producer, MeP – Medium producer, N/F – Not found. *Notes:* *Total indicator for the author's whole scientific output up to the time of this research. **Most updated affiliation found on Google Scholar, ResearchGate and/or the ORCID profile.

Table 3 shows the most frequent subject areas and topics.

Table 3. Most frequent subject areas and topics

Subject area	Ndoc
Medicine	48

Neuroscience	46
Pharmacology, Toxicology and Pharmaceutics	16
Biochemistry, Genetics and Molecular Biology	14
Psychology	9
Topic	
Quality Of Life; Propylene Diquat; Levodopa	8
G-Protein-Coupled Receptor; Guanine Nucleotide Binding Protein; Dopamine 2 Receptor	7
Pedunculopontine Tegmental Nucleus; Parkinson Disease; Brain Depth Stimulation	6
Brain Depth Stimulation; Subthalamic Nucleus; Parkinson Disease	4
Machado-Joseph Disease; Spinocerebellar Ataxias; Polyglutamine	4
Parkinson's Disease; Cognition; Cognitive Dysfunction	4
Monoamine Oxidase Inhibitors; Inhibitor; Clorgyline	4

The funding sponsors with the largest scientific output were:

- Medicinska Forskningsrådet (Swedish Medical Research Council): Ndoc = 7.
- International Parkinson and Movement Disorder Society: Ndoc = 6.
- Michael J. Fox Foundation for Parkinson's Research: Ndoc = 5.
- UCB: Ndoc = 5.

The keyword co-occurrence map (Figure 2) consisted of 5 clusters: cluster 1 "red" [main node: *human* (total link strength: 47; occurrences: 48)], cluster 2 "green" [main node: *nonhuman* (total link strength: 20; occurrences: 20)], cluster 3 "blue" [main node: *pathophysiology* (total link strength: 13; occurrences: 13)], cluster 4 "yellow" [main node: *unclassified drug* (total link strength: 9; occurrences: 9)], and cluster 5 "violet" [main node: *brain* (total link strength: 5; occurrences: 5)].
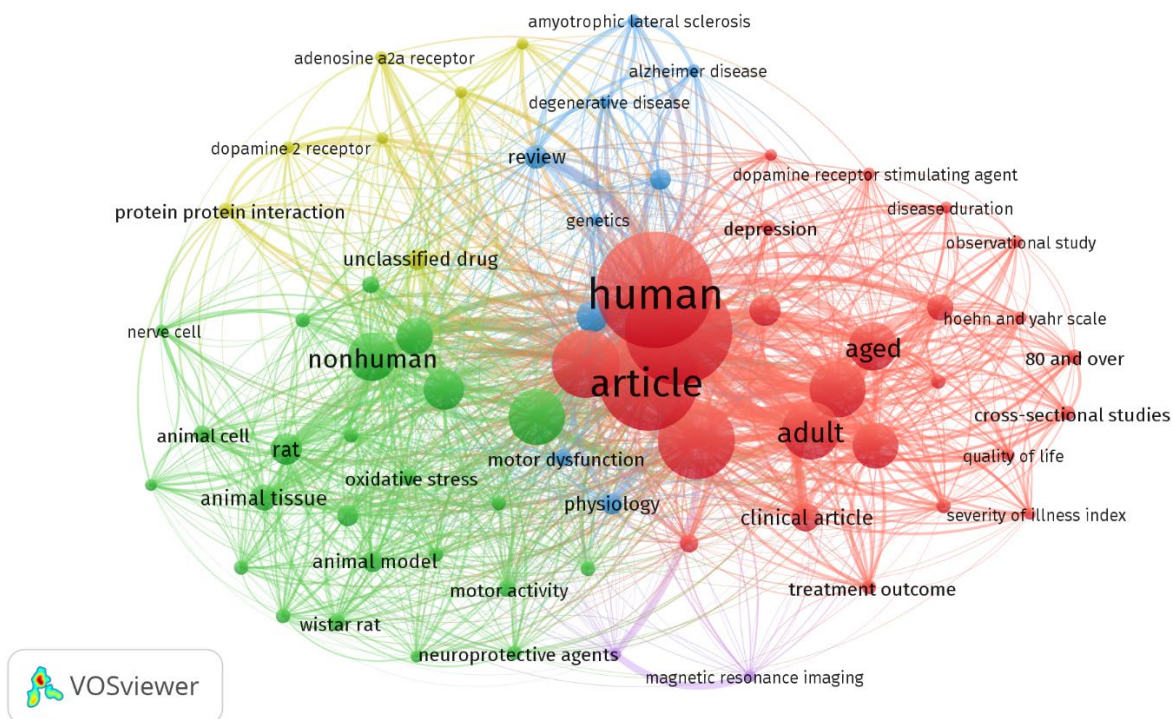

Figure 2. Keyword co-occurrence network.

Scientific collaboration

The SI was 98,8. Figure 3 shows the largest co-authorship network, in which some of the most productive authors can be seen.
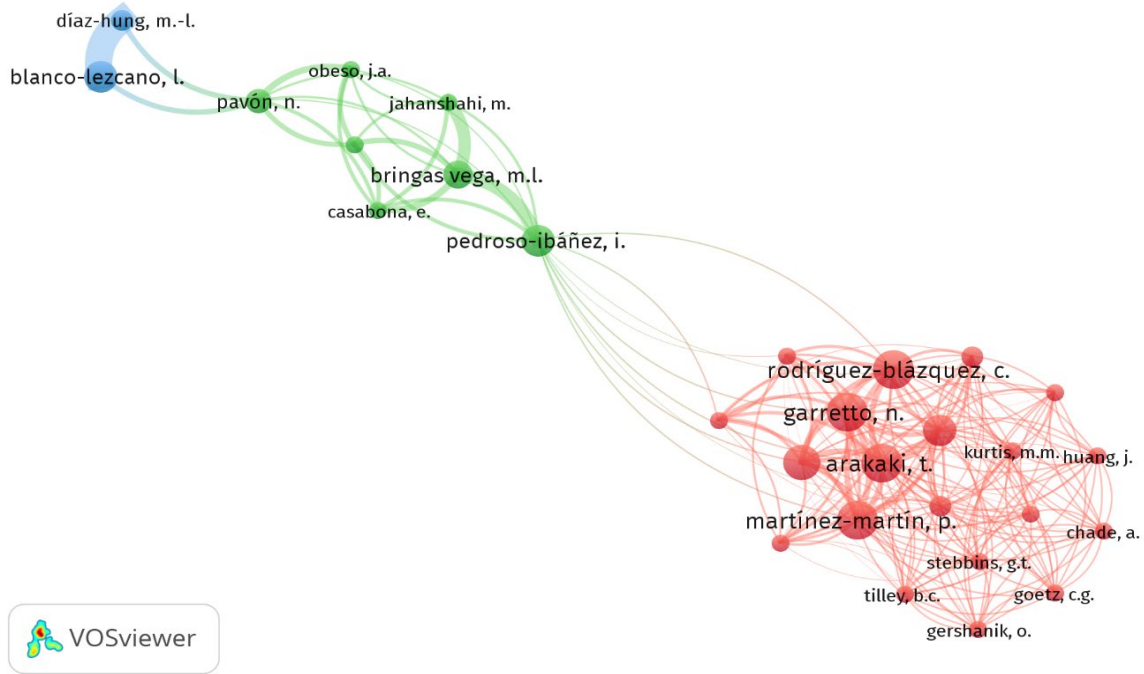

Figure 3. Largest co-authorship network.

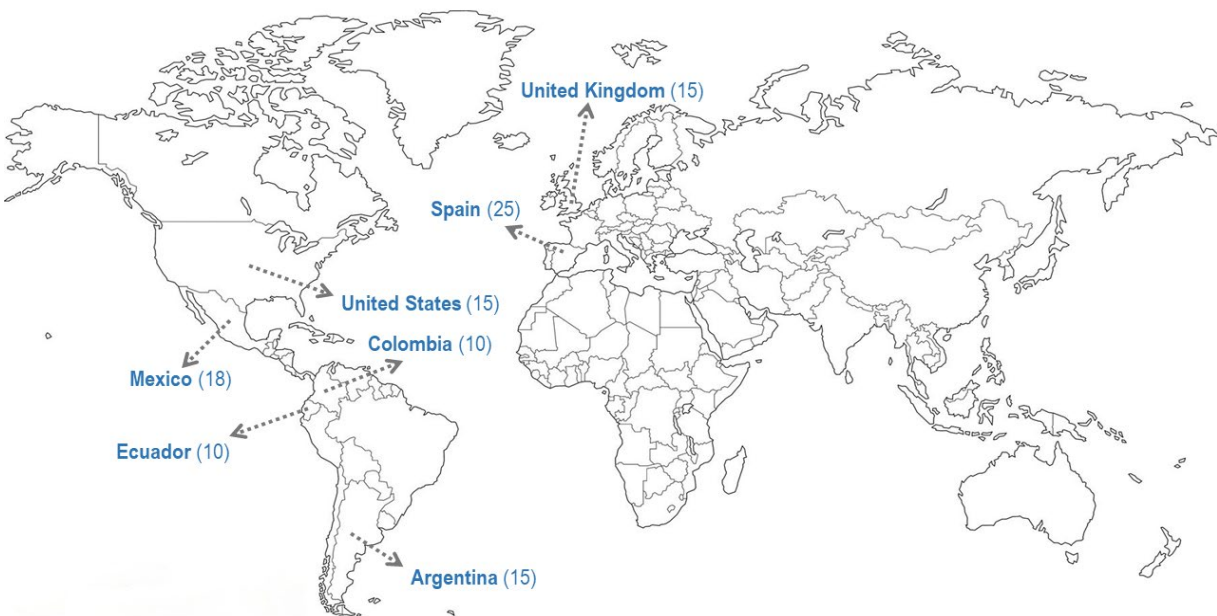The top contributing country was Spain (Ndoc = 25), followed by Mexico, with 18 documents (Figure 4).

Figure 4. Ndoc by top contributing countries.

International collaboration was the most common type of collaboration (Ndoc = 67; 79,8 %) and had the highest scientific impact (Table 4).

Table 4. Type of collaboration and impact indicators

Type of collaboration	Ndoc	%	NC (%)	ANC
International collaboration	67	79,8	1533 (96,2 %)	22,9
Only national collaboration	2	2,4	14 (0,9 %)	7
Only institutional collaboration	14	16,7	45 (2,8 %)	3,2
No collaboration	1	1,2	1 (0,1 %)	1

Scientific impact

The scientific output on PD reached a total of 1 592 citations, for an average of 19 per paper. The *h*-index was 22. The most cited documents are shown in Table 5.

Table 5. Most cited documents

NC	Title	Author(s)	Journal	Year	Type
194	On-shoe wearable sensors for gait and turning assessment of patients with Parkinson's disease	Mariani B, Jiménez MC, Vingerhoets FJG, Aminian K	*IEEE Transactions on Biomedical Engineering*	2013	Article
135	Parkinson's disease severity levels and MDS-Unified Parkinson's Disease Rating Scale	Martínez-Martín P, Rodríguez-Blázquez C, Álvarez-Sánchez M, Arakaki T, Arillo VC, Chaná, P, *et al*.	*Parkinsonism and Related Disorders*	2015	Article
131	Expanded and independent validation of the Movement Disorder Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS)	Martínez-Martín P, Rodríguez-Blázquez C, Álvarez-Sánchez M, Arakaki T, Bergareche-Yarza A, Chade A, *et al*.	*Journal of Neurology*	2013	Article

DISCUSSION

Cuban scientific productivity on PD was scarce in the period (2012-2021). The trend toward quantitative decline coincides with what was reported by Zayas-Fundora *et al*.[13] on a decrease in Cuban neuroscientific output in journals indexed in Scopus between 2011 and 2021. It also contrasts with the vast output on the subject in industrialized countries such as the United States, the United Kingdom, and Germany. However, it is important to assert that any publication, no matter how modest it may seem, contributes to progress in research on the disease and the future development of better treatments and a possible cure for it.[5]

The authors associate the fact of this scarce production with a group of factors. On the one hand, they agree with Perodis-Hernández *et al*.,[14] whom in a review article and bibliometric analysis of publications from the Cuban Neuroscience Center (2015-2020) found a similar pattern of productivity associated with methodological and writing deficiencies present in the publishable articles analyzed, which led them to be rejected.

On the other hand, according to Fajardo-Quesada *et al*.,[15] "this fact may be determined by another element: the existence in the national territory of a wide network of scientific journals, indexed in SciELO, which are used as the main channel for the dissemination of the science produced". The authors consider it logical and well-founded what is stated in the aforementioned study in terms of promoting

more vigorously, from the resolutions that control and evaluate scientific work, the publication in high-impact journals.

The authors also agree with what has been pointed out by other authors who have analyzed the subject[13,16,17] and emphasize that the existence of other priorities —such as assistance and teaching— influences the level of scientific productivity of researchers in the medical sciences, with emphasis on the fast-paced field of neurosciences.

Even though the scientific output was not abundant, the authors consider that the NC was remarkable in correspondence with the Ndoc analyzed and the extension of the study period. This situation has also been observed in countries such as India, which have shown a considerable impact in terms of the NC despite their low scientific productivity on PD.[18]

Most of the published articles were original research —indicating the contribution and generalization of new knowledge and experience in the area— followed by reviews, which, in turn, reflect the authors' ability to analyze and synthesize published advances in the disease. In the study by Pajo *et al*.[19] on scientific output on movement disorders between 2000 and 2019 —in which the largest output was on parkinsonism— original articles also predominated, while in the study conducted in India by Gupta *et al*.[18] review articles were the most common.

It was found that most of the articles were published in neuroscience journals, which received more citations than non-specialized ones. It is noteworthy that two of the most productive journals were multidisciplinary Cuban serial publications —*Revista Habanera de Ciencias Médicas* and *Revista Cubana de Investigaciones Biomédicas*—, which enjoy notable prestige in the Cuban scientific community.

Most of the journals with the highest production have English as their main publication language, which suggests that Cuban authors who research PD prefer to publish in this language. This is a strength because of the greater visibility and citations that it can provide to publications since it is the language par excellence for contemporary scientific communication.[20]

Among the most productive Cuban authors, most of them were medium producers, while the most common finding among non-Cuban researchers was the category of major producers. It is noteworthy that only two of the Cuban authors declared an institutional affiliation with Cuba. The institution was the International Center of Neurologic Restoration (CIREN, as it stands in Spanish), which ratifies its reputation and leadership in neuroscientific research, especially, in relation to this disease. It should also be noted that the most productive authors were not Cuban.

The areas and topics most treated were related to medicine, neurosciences, pharmacology, biochemistry, and psychology. Özgül[21] found, in his bibliometric analysis of the most cited articles on PD, that the most frequent subject matter was laboratory studies, followed by genetic studies and those related to medical, surgical, and clinical perspective treatment.

Regarding the most addressed topics, in spite of the fact that most of them coincide with those referenced in the studies conducted in the last decades,[21] it stands out in the Cuban neuroscientific medical output the relation with pharmacology and toxicology, as well as a group of studies related to polyglutamine diseases. This last subject may perhaps be associated with the fact that Cuba has the Center for Research and Rehabilitation of Hereditary Ataxias of Holguín as a research power in the national and international contexts.[22]

An essential aspect of research in the area of health sciences is funding. The funding sponsors that offered support to the articles cited in this bibliometric analysis have played an essential role, not only

for the Cuban scientific output on PD but also worldwide.[23,24] In Cuba's context, funding for research lines related to PD should continue to be strengthened in order to achieve better results.

Co-occurrence analyses of keywords contribute to understanding the relationship between socio-psycho-biological risk factors of PD as a neurological and genetic disorder related to other neurodegenerative diseases, and whose treatment depends on a comprehensive approach from the biomolecular, neuroimaging, pharmacological, and non-pharmacological points of view. In the article by Restrepo[1] on the advances in scientific publications on neurosciences during the last 25 years in the world, as in the present study, the topics associated with human beings, the neuroscientific field, genetic studies, and animal studies with a psycho-morpho-physiological component are highlighted.

There was a wide international scientific collaboration and in the co-authorship networks, there was an outstanding presence of the most productive authors. Nowadays, easy communication between countries facilitates the establishment of borderless exchange networks between researchers to the benefit of science, beyond disciplines and institutions. Their measurement even allows the projection of future collaborations.[5,25]

In bibliometric studies regarding the scientific output on PD of other nations, collaboration with countries such as the United States, United Kingdom, and Spain has also stood out, which has given the articles a greater impact.[24] In the present study, the scientific output that derived from international collaboration —probably motivated by the prestige of these countries in the field— also had the greatest scientific impact.

Two of the most cited papers had three of the most productive researchers as main authors, included in the category of major producers. Among the journals that published them, one of the most productive was also included (*Parkinsonism and Related Disorders*), which had the highest ANC of those listed and an SJR of 1,093. The most cited paper —published by a journal and authors that are not included among the most productive ones— may have achieved such status due to the novelty and perspectives of the proposal it captures, as well as to the impact factor of *IEEE Transactions on Biomedical Engineering*, a journal ranked Q1 in Biomedical Engineering, with an SJR of 1,3 in 2021.

Given the importance that PD has today in the political, socioeconomic, and scientific scenarios, it is necessary that decision-makers at the governmental and health levels draw up policies and plans to support and enhance Cuban and international productivity, collaboration, visibility, and impact in terms of research on the subject.

CONCLUSIONS

Cuban scientific output on PD in Scopus during the last decade was scarce, tended to be in quantitative decline in productivity, had few large Cuban producers, presented a high rate of international collaboration, and achieved a notable scientific impact in terms of citation-based bibliometric indicators.

REFERENCES

1. Restrepo Betancur LE. Avances de las publicaciones científicas en neurociencias en los últimos 25 años en el mundo. Rev Cuba Inf Cienc Salud. 2023;34:e2181. Available from: https://acimed.sld.cu/index.php/acimed/article/view/2181

2. Armstrong MJ, Okun MS. Diagnosis and Treatment of Parkinson Disease. A Review. JAMA. 2020;323(6):548-60. DOI: https://doi.org/10.1001/jama.2019.22360

3. Blauwendraat C, Nalls MA, Singleton AB. The genetic architecture of Parkinson's disease. Lancet Neurol. 2019;19(2):170-78. DOI: http://dx.doi.org/10.1016/S1474-4422(19)30287-X

4. Bloem BR, Okun MS, Klein K. Parkinson's disease. Lancet. 2021;397:2248-303. DOI: https://doi.org/10.1016/S0140-6736(21)00218-X

5. Robert C, Wilson CS, Lipton RB, Arreto CD. Parkinson's disease: Evolution of the scientific literature from 1983 to 2017 by countries and journals. Parkinsonism Relat Disord. 2019;61:10-18. DOI: https://doi.org/10.1016/j.parkreldis.2018.11.011

6. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: An overview and guidelines. J Bus Res. 2021;133:285-96. DOI: https://doi.org/10.1016/j.jbusres.2021.04.070

7. Baas J, Schotten M, Plume A, Côté G, Karimi R. Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. Quant Sci Stud. 2020;1(1):377–386. DOI: https://doi.org/10.1162/qss_a_00019

8. Piñera-Castro HJ, Saborit-Rodríguez A, Ruiz-González LA, Smith-Groba J, Bacallao-Salazar D. Producción neurocientífica en revistas estudiantiles cubanas (2019-2021). Ed Méd Sup. 2022;36(3):e3505. Available from: http://ems.sld.cu/index.php/ems/article/view/3505

9. Lotka AJ. The frequency distribution of scientific productivity. J Washing Academ Sciences. 1926;16(12):317-23.

10. Subramanyam K. Bibliometric studies of research collaboration: A review. J Inf Sci. 1983;6(1):33-8. DOI: https://doi.org/10.1177/016555158300600105

11. Measuring a journal's impact [Internet]. Elsevier; 2023. Available from: https://www.elsevier.com/authors/tools-and-resources/measuring-a-journals-impact

12. Hirsch JE. An index to quantify an individual's scientific research output. Proc Natl Acad Sci U S A. 2005;102(46):16569–16572. DOI: https://doi.org/10.1073/pnas.0507655102

13. Zayas-Fundora E, Moreno-Cubela FJ, Iglesias-Sordo G, Jiménez-Pérez MC, Guerra-Chagime R, Lorenzo-Torres H. Tendencias e impacto de la producción científica cubana en Scopus sobre neurociencias 2011–2021. Univ Méd Pinareña. 2022;18(2):e890. Available from: http://revgaleno.sld.cu/index.php/ump/article/view/890

14. Perodin Hernández J, Martinez Rodriguez E, Ariadna Santiuste L, Zulueta Labaceno Y. Revisión de manuscritos y análisis bibliométrico de publicaciones del centro de neurociencias. Período 2015-2020. Rev CENIC Cienc Biol. 2021;52(2):153-163. Available from: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2221-24502021000200153

15. Fajardo Quesada AJ, Cala Torres JJ, Rego Rodríguez FA, Otaño Castillo R, Montiel Alfonso MA. Producción científica cubana sobre Dengue en Scopus en el periodo 2011-2021. Univ Méd Pinareña. 2022;18(2):e892. Available from: http://revgaleno.sld.cu/index.php/ump/article/view/892

16. Vitón-Castillo A. Baja visibilidad de la producción científica cubana de la especialidad Medicina Intensiva y Emergencias. Rev Cub Med Int Emerg. 2021;20(2):e818. Available from: http://www.revmie.sld.cu/index.php/mie/article/view/818

17. Corrales-Reyes IR, Hernández-García F, Vitón-Castillo AA, Mejia CR. Visibility, collaboration and impact of the Cuban scientific output on COVID-19 in Scopus. Heliyon. 2021;7(11):e08258. DOI: https://doi.org/10.1016/j.heliyon.2021.e08258

18. Gupta BM, Dhawan SM. Parkinson's Disease Research by India: A Scientometric Assessment of Publications Output for the Period 1990-2019. J Brain Neursci. 2021;5(1):017. Available from: https://www.heraldopenaccess.us/openaccess/parkinson-s-disease-research-by-india-a-scientometric-assessment-of-publications-output-for-the-period-1990-2019#:~:text=Overall%20publication%20output%20%26%20growth,of%204457.7%20papers%20per%20year

19. Pajo AT, Espiritu AI, Jamora RDG. Scientific impact of movement disorders research from Southeast Asia: A bibliometric analysis. Parkinsonism Relat. 2020;81:205-12. DOI: https://doi.org/10.1016/j.parkreldis.2020.10.043

20. Piñera-Castro HJ, Ruiz-González LA. Producción científica de la Universidad de Ciencias Médicas de La Habana en revistas estudiantiles cubanas. Ed Méd Sup. 37(1):e3662. Available from: https://ems.sld.cu/index.php/ems/article/view/3662

21. Özgül O. A bibliometric analysis of the 50 most cited articles on Parkinson's disease. Ann Clin Anal Med. 2021;12(9):975-79. Available from: https://avesis.comu.edu.tr/yayin/30def3d5-7db3-41ea-8800-3d0b9addb57a/a-bibliometric-analysis-of-the-50-most-cited-articles-on-parkinsons-disease-most-cited-articles-on-parkinsons-disease

22. Velázquez Pérez LC, Pérez Gallardo L. Las ataxias en Cuba: Un proyecto inclusivo desde la ciencia, la sociedad y las familias. An Acad Cienc Cuba. 2022;12(3):e1337. Available from: http://revistaccuba.sld.cu/index.php/revacc/article/view/1337

23. FORTE: Swedish Research Council for Health, Working Life and Welfare. International collaboration [Internet]. Stockholm: Ministry of Health and Social Affairs; 2022. Available from: https://forte.se/en/about-forte/international-collaboration/

24. The Michael J. Fox Foundation for Parkinson's Research [Internet]. New York: The Michael J. Fox Foundation for Parkinson's Research; 2023. Available from: https://www.michaeljfox.org/

25. Amani HA, Widyan AA, Ikram UH, Shafig UR, Rai KF, Foziah AS. Bibliometric analysis of Neurosciences research productivity in Saudi Arabia from 2013-2018. Neurosciences. 2020;25(2):134-143. DOI: https://doi.org/10.17712/nsj.2020.2.20190087

AUTHORS' CONTRIBUTION

Conceptualization: Hector Julio Piñera-Castro.

Data curation: Hector Julio Piñera-Castro.

Formal analysis: Hector Julio Piñera-Castro, Fidel Jesús Moreno-Cubela.

Investigation: Hector Julio Piñera-Castro, Fidel Jesús Moreno-Cubela.

Methodology: Hector Julio Piñera-Castro.

Project administration: Hector Julio Piñera-Castro.

Supervision: Hector Julio Piñera-Castro.

Visualization: Hector Julio Piñera-Castro.

Writing – original draft: Hector Julio Piñera-Castro, Fidel Jesús Moreno-Cubela.

Writing – review and editing: Hector Julio Piñera-Castro, Fidel Jesús Moreno-Cubela.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

FUNDING

This preprint was submitted under the following conditions: