Scientific production of CNPq researchers in the areas of physical therapy and occupational therapy, Brazil

Produção científica dos pesquisadores do CNPq nas áreas de fisioterapia e terapia ocupacional, Brasil

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Abstract

Introduction: The scientific production of the areas of physical therapy and occupational therapy presented important growth and international visibility. **Objective:** To evaluate technical and scientific indicators, in addition to the training of human resources, of scholarship researchers of scientific productivity of CNPq (PQ), in the area of physical therapy and occupational therapy. **Methods:** A cross-sectional, census and quantitative study was conducted from the Lattes curricula of CNPq researchers with active scholarships in December 2021. The information was extracted through the Lattes Platform of CNPq, including three dimensions of variables for analysis: a) researcher profile; b) scientific production; c) training of human resources. **Results:** The evaluation included 73 PQ CNPq, in the areas of physical therapy and occupational therapy. The majority were female (n = 42; 57.5%), distributed in 26 different institutions in the country, with the Southeast region being the most prevalent. The largest portion of the PQ completed their doctorate between 11 and 20 years ago (n = 41; 56.2%) and did postdoctoral work (n = 55; 75.3%) abroad (n = 32; 58.2%). The group published 9,486 scientific articles throughout its career, averaging 129.94 scientific articles per PQ. The group of PQ supervised a total of 2,561 undergraduate students, 1,748 master's and 800 doctoral students. The mean H index of PQ was 19.74 (CI 95% = 18.40-21.11; SD = 5.71; median = 19). **Conclusion:** The PQ scholarship researchers presented significant scientific production and training of human resources, which confirms the important development of the areas in the last ten years. However, a strong nucleation of this production was observed.

Keywords: Health sciences. Research personnel. Scientific publication indicators.

Resumo

Introdução: *A produção científica das áreas de fisioterapia e terapia ocupacional apresentou importante crescimento e visibilidade internacional.* ***Objetivo:*** *Avaliar indicadores técnicos e científicos, além da formação de recursos humanos, de pesquisadores bolsistas de produtividade científica do CNPq (PQ), nas área de fisioterapia e terapia ocupacional.* ***Métodos:*** *Realizou-se estudo transversal, censitário e quantitativo, a partir dos currículos Lattes dos pesquisadores do CNPq, nas áreas mencionadas, com bolsas ativas em dezembro de 2021. As informações foram extraídas da Plataforma Lattes do CNPq, incluindo três dimensões de variáveis para análise: a) perfil do pesquisador; b) produção científica; c) formação de recursos humanos.* ***Resultados:*** *Foram incluídos na avaliação 73 PQ do CNPq, nas áreas de fisioterapia e terapia ocupacional. A maioria foi do sexo feminino (n = 42; 57,5%), distribuída em 26 instituições distintas no país, sendo a região Sudeste a mais prevalente. A maior parcela dos PQ finalizou o doutorado entre 11 e 20 anos atrás (n = 41; 56,2%) e realizou pós-doutorado (n = 55; 75,3%) no exterior (n = 32; 58,2%). O grupo publicou 9.486 artigos científicos durante toda a carreira, com média de 129,94 artigos científicos por PQ. O conjunto dos PQ orientou um total de 2.561 estudantes de iniciação científica, 1.748 de mestrado e 800 de doutorado. O índice H médio dos PQ foi de 19,74 (IC 95% = 18,40-21,11; DP = 5,71; mediana = 19).* ***Conclusão:*** *Os bolsistas PQ apresentaram significativa produção científica e formação de recursos humanos, o que confirma o importante desenvolvimento das áreas nos últimos dez anos. Observou-se, entretanto, forte nucleação dessa produção.*

Palavras-chave: *Ciências da saúde. Pesquisadores. Indicadores de produção científica.*

Introduction

Brazilian scientific production presented important growth and international visibility. This fact influenced the country's position in the world ranking in the number of publications in journals indexed in the Scopus database. The country jumped from 17th in 2000 to 11th in 2018, among the most important producers of science, with an annual growth rate of 5.42%, surpassing Canada, Spain and Australia.[1] However, such growth indicators need to be accompanied by continuous financial investments not to compromise this quantitative and qualitative expansion.[2]

Among the funding agencies for Brazilian research, the National Council for Scientific and Technological Development (CNPq) has acted to encourage and foster scientific production through funding and research grants. Among the types of scholarships offered by CNPq is the productivity in research (PQ), which is granted to researchers based on various technical criteria such as quality of scientific publications, training of human resources in research, scientific contribution, technological and innovation, including patents, participation or coordination in research projects, editorial activities, and scientific and academic management.[3]

Previous studies highlighted the importance of PQ performance and its contributions in areas such as medicine,[4-6] dentistry[7] and physical therapy.[8] In Brazil, there are only 29 specific postgraduate programs in the area of physical therapy and occupational therapy, with the Southeast being the region with the highest number of courses.[9,10] Despite the still limited number, there is a growing scientific development of the areas, confirmed from the number of scholarships granted over the years by CNPq. Between 2010 and 2021, there was an increase of 40.4% of PQ scholarship researchers in these areas.[11]

In this sense, the objective of the present study was to evaluate technical and scientific indicators, in addition to the training of human resources, of CNPq's PQ in the area of physical therapy and occupational therapy.

Methods

A cross-sectional, census and analytical study was conducted. The list of PQ in the areas of physical therapy and occupational therapy[12] showed the presence of 73 researchers with ongoing scholarships in December 2021. From the identification of the PQ, there was the extraction of information from the Lattes curricula, in an individualized way, through the Lattes Platform of CNPq between March and September 2022.

The information extracted from the Lattes curricula allowed the construction of a database, using the statistical program Statistical Package for the Social Sciences® 20.0. The data obtained were grouped into three sets of variables for analysis: characteristics of the researcher, scientific publications and training of human resources. The dimension profile of the researchers, information about gender, state of the federation and geographic region where they develop their professional

activities, graduation, academic institution of affiliation, year of conclusion of the doctorate, postdoctoral work, postdoctoral site, when carried out, scholarship level (1A, 1B, 1C, 1D and 2) and the Web of Science H index were extracted.[13] The criteria defined by the advisory committees for establishing the scholarship level include leadership in research, quality of scientific production, training of qualified human resources and adherence to the criteria established for the notice, contribution to innovation, coordination of funded research projects, participation in scientific and technological management activities of unequivocal relevance to the area.[3]

Category 2 is the entry level for researchers to the productivity scholarship program; researchers are evaluated in the last five years and must have published 5 articles in the Institute for Scientific Information (ISI) journals and 10 indexed in the Scielo/Scopus databases, have completed 4 master's/doctorate orientations and still be in research and orientation activities in graduate program. At level 1D, in addition to the larger numbers (10 articles in journals ISI and 20 indexed in Scielo/Scopus), researchers are evaluated in the last 10 years and must have a recent history of research projects financed by a funding agency. Levels 1C, 1B and 1A must present even higher numbers (15 articles in journals ISI and 30 indexed in Scielo/Scopus) and demonstrate regularity in obtaining financial support for their research projects.[3]

Information on scientific publications involved the number of scientific articles published throughout the PQ's career (period defined between the first scientific publication until December 2021), scientific articles published in the last five years (2017-2021) and total citations in the SciELO Scopus and Web of Science databases. In the dimension training of human resources, the information obtained was about guidelines carried out for scientific initiation, master's and doctorate in the career and in the last five years (2017-2021). The H index was calculated through the Lattes curriculum of the PQ, that aims to measure research productivity and impact based on the most cited articles.[13] The study used public and secondary data, not requiring submission to a Research Ethics Committee.

Results

The study included 73 PQ, with a predominance of female researchers (n = 42; 57.5%), distributed in 24 institutions in the country. The Southeast region was the most prevalent among the PQ (74%), and the majority were linked to Universidade de São Paulo (19.1%), Universidade de São Carlos (17.8%), Universidade Federal de Minas Gerais (12.3%) and Universidade Nove de Julho (9.6%). The majority of PQ completed their doctorate between 11 and 20 years (56.2%), with an average time of 18.25 years (95%CI = 16.90-19.44; SD = 5.43; minimum and maximum value = 8 and 31), and did postdoctoral work (75.3%) abroad (58.2%) (Table 1).

Table 1 - Profile of CNPq research productivity scholarship researchers in the field of physical therapy and occupational therapy (n = 73), in December 2021

Variables	n (%)
Gender	
Female	42 (57.5)
Male	31 (42.5)
Degree/area of study	
Physical therapy	66 (90.4)
Occupational therapy	5 (6.8)
Physical education	1 (1.4)
Medicine	1 (1.4)
State	
São Paulo	43 (58.9)
Minas Gerais	10 (13.7)
Rio Grande do Sul	5 (6.8)
Paraná	3 (4.1)
Goiás	3 (4.1)
Pernambuco	2 (2.7)
Rio Grande do Norte	2 (2.7)
Rio de Janeiro	1 (1.4)
Other states	4 (5.6)
Region	
Southeast	55 (75.3)
South	10 (13.7)
Northeast	6 (8.2)
Midwest	2 (2.7)
Researcher's institution	
Universidade de São Paulo	14 (19.2)
Universidade Federal de São Carlos	13 (17.8)
Universidade Federal de Minas Gerais	9 (12.3)
Universidade Nove de Julho	7 (9.6)
Universidade Federal de Ciências da Saúde de Porto Alegre	4 (5.5)

Table 1 - Profile of CNPq research productivity scholarship researchers in the field of physical therapy and occupational therapy (n = 73), in Dec 2021 (continued)

Variables	n (%)
Researcher's institution	
Faculdade de Ciências e Tecnologia Presidente Prudente	3 (4.1)
Universidade Estadual de Londrina	3 (4.1)
Universidade Cidade de São Paulo	3 (4.1)
Universidade Federal de Pernambuco	2 (2.7)
Universidade Federal de São Paulo	2 (2.7)
Universidade Federal do Rio Grande do Norte	2 (2.7)
Other institutions	11 (15.2)
Time since doctorate (years)	
≤ 10	6 (8.2)
11-20	41 (56.2)
21	26 (35.6)
PhD	
Yes	55 (75.3)
No	18 (24.7)
PhD site	
Brazil	17 (30.9)
More than one country	6 (10.9)
Abroad	32 (58.2)

Note: CNPq = National Council for Scientific and Technological Development.

The PQ published 9,486 scientific articles in journals throughout their careers, with an average of 129.94 per scholarship holder (minimum and maximum values = 45 and 328). There was a predominance of researchers at level 2 (n = 51; 69.8%). The category with the highest average of articles published throughout the career and in the last five years was 1B (career average = 169.89; average in the last five years = 52.22). The same group also had a higher average of scientific articles per year, considering the five-year period from 2017 to 2021 (average of 10.44). Level 1D had the highest average of citations per article in the career (mean = 31.07), followed by category 1B (mean = 25.29). All 73 scholarship researchers had 9,905 citations in SciELO, 59,206 in Scopus and 86,264 in Web of Science (Table 2).

The 73 PQ supervised 2,561 graduate students (minimum and maximum values = 0 and 130), 1,748 master's degree (minimum and maximum values = 9 and 53) and 800 doctorate (minimum and maximum values = 3 and 39). Category 1A had the highest average career orientation in scientific initiation and doctoral studies (Table 3).

The mean H-index of the group was 19.74 (95%CI = 18.40-21.11; SD = 5.71; median = 19), maximum value of 37 and minimum value of 8. Category 1D had the highest mean value (mean = 28; SD = 8.02; 95%CI = 22.57-33.70) (Table 4).

Table 2 - Number of publications (scientific articles) and citations per database of CNPq research productivity scholarship researchers in the field of physical therapy and occupational therapy (n = 73), in December 2021

Scholarship category (n)	Total articles in career*	Total articles, 2017-2021*	Average articles per year, 2017-2021	Average citations per article over career	Total citations		
					SciELO	Scopus	WoS
1A (3)	477 (159.00)	126 (42.00)	8.40	20.59	508	3,095	5,798
1B (9)	1,529 (169.89)	470 (52.22)	10.44	25.29	2,617	10,079	13,159
1C (3)	444 (148.00)	137 (45.67)	9.13	12.76	553	1,874	2,980
1D (7)	1,100 (157.14)	363 (51.86)	10.37	31.07	964	10,174	11,507
2 (51)	5,936 (116.39)	2,210 (43.33)	8.67	24.03	5,263	33,984	52,820

Note: *Average value per scholarship researchers. CNPq = National Council for Scientific and Technological Development; WoS = Web of Science. Category criteria: Level 2) 5 articles in the Scientific Information Institute (ISI) journals and 10 indexed in the Scielo/Scopus databases, have completed 4 master's/doctorate orientations and are still carrying out research and supervision activities in a postgraduate program -graduation; Level 1D) 10 articles in ISI journals and 20 indexed in Scielo/Scopus, have a recent history of research projects financed by a funding agency; Levels 1C, 1B and 1A) 15 articles in ISI journals and 30 indexed in Scielo/Scopus and demonstrate regularity in obtaining financial support for their research projects.

Table 3 - Training of human resources carried out by CNPq research productivity scholarship researchers in the field of physical therapy and occupational therapy (n = 73), in December 2021

Scholarship category (n)	Total career supervisions			Total supervisions 2017-2021		
	SI*	M*	D*	SI*	M*	D*
1A (3)	184 (61.33)	65 (21.67)	75 (25.00)	24 (8.00)	7 (2.33)	22 (7.33)
1B (9)	393 (43.67)	272 (30.22)	134 (14.89)	101 (11.22)	52 (5.78)	47 (5.22)
1C (3)	140 (46.67)	106 (35.33)	37 (12.33)	22 (7.33)	13 (4.33)	19 (6.33)
1D (7)	262 (37.43)	204 (29.14)	87 (12.43)	39 (5.57)	42 (6.00)	40 (5.71)
2 (51)	1,582 (31.02)	1,101 (21.59)	467 (9.16)	392 (7.69)	335 (6.57)	242 (4.75)

Note: *Average value per researcher. CNPq = National Council for Scientific and Technological Development; SI = scientific initiation; M = master's degree; D = doctorate. Category criteria: Level 2) 5 articles in the Scientific Information Institute (ISI) journals and 10 indexed in the Scielo/Scopus databases, have completed 4 master's/doctorate orientations and are still carrying out research and supervision activities in a postgraduate program -graduation; Level 1D) 10 articles in ISI journals and 20 indexed in Scielo/Scopus, have a recent history of research projects financed by a funding agency; Levels 1C, 1B and 1A) 15 articles in ISI journals and 30 indexed in Scielo/Scopus and demonstrate regularity in obtaining financial support for their research projects.

Table 4 - Values related to the H index for CNPq research productivity scholarship researchers in the field of physical therapy and occupational therapy (n = 73), in December 2021

Scholarship category (n)	H Index					
	Mean	Median	SD	95%CI	Minimum	Maximum
1A (3)	20.00	23	7.00	12.00-25.00	12	25
1B (9)	23.11	25	4.65	20.11-26.11	16	30
1C (3)	19.67	21	4.16	15.00-23.00	15	23
1D (7)	28.00	25	8.02	22.57-33.70	18	37
2 (51)	18.00	18	4.30	16.86-19.22	8	29

Note: CNPq = National Council for Scientific and Technological Development; SD = standard deviation Category criteria: Level 2) 5 articles in the Scientific Information Institute (ISI) journals and 10 indexed in the Scielo/Scopus databases, have completed 4 master's/doctorate orientations and are still carrying out research and supervision activities in a postgraduate program -graduation; Level 1D) 10 articles in ISI journals and 20 indexed in Scielo/Scopus, have a recent history of research projects financed by a funding agency; Levels 1C, 1B and 1A) 15 articles in ISI journals and 30 indexed in Scielo/Scopus and demonstrate regularity in obtaining financial support for their research projects.

Discussion

The areas of physical therapy and occupational therapy of CNPq have evolved considerably in the last ten years.[8] In this sense, it is relevant to understand the profile of researchers in these areas in Brazil, since the results can influence the identification of gaps in knowledge and the development of goals that benefit the scientific production of this group.[9]

There was an increase of 30 PQ scholarship researchers compared to 2008.[14] There was a predominance of female scholarship researchers, similar to the literature.[6,14,15] This female prevalence has been highlighted since the opening of research areas for this group.[16] A potential explanation for this occurrence is due to the process of feminization of the labor market resulting from modernization and cultural changes, which allowed a substantial increase in the participation of women in health areas.[6,15]

There is no homogeneous geographical distribution of Brazilian scientific production. The Southeast region concentrates most of the researchers and, consequently, knowledge production. This grouping is also observed in other studies that describe the predominance of

scholarship holders mainly in the states of São Paulo and Minas Gerais,[14,15] and the same pattern occurs in other areas of knowledge.[4-6,17,18] This discrepancy can be understood by the fact that the Southeast region has a significant number of graduate programs, including in the areas of physical therapy and occupational therapy. Of the 29 postgraduate programs in these areas in Brazil, 12 are located in Southeast region. In addition, the Southeast region has the largest investment in relation to research, which stimulates and encourages researchers working in this region of the country.[15] The scientific development in physical therapy and occupational therapy in the North, Northeast and Midwest regions still depends on the creation of new postgraduate courses (at master's and/or doctoral levels) that are often limited.[9] In the last 14 years, most research productivity scholarships were granted to researchers from São Paulo (an increase of 17 scholarships), and the number of PQ in Minas Gerais and Paraná remained unchanged.[14]

Four universities stood out in relation to the distribution of PQ in the country: Universidade Federal de São Carlos, Universidade Federal de Minas Gerais, Universidade de São Paulo and Universidade Nove de Julho. Although most of the institutions highlighted in Table 1 are public, it is believed that private institutions can achieve quite favorable indicators, especially when they have an internal policy aimed at promoting research and institutional programs for scholarships of studies.[9]

Important portion (56.2%) of the PQ completed their doctorate between 11 and 20 years. This diverges from a study conducted in 2013,[14] which pointed to a prevalence of researchers who completed their doctorate between six and ten years. This result may be related to the maintenance of scholarships for the same researchers, which proves the leadership of older and consolidated PQ's in this modality.[19] Nevertheless, this time, apparently, does not influence the category occupied by the search.[20] The post-doctoral internship abroad was more prevalent among PQ. There is a tendency to look for this internship abroad due to the significant practical experience that it can provide to the researcher, in addition to generating greater curricular visibility.[21]

Studies conducted in 2013[14,20] demonstrated a concentration of scholarship holders in category 2, also observed in this study. This result is repeated in other areas of knowledge, such as neuroscience, hematology/oncology, dentistry and infirmary.[4,7,17,22] In this study, it is noteworthy that category 1B had a higher average of articles per year and category 1D had a higher average of citations per article. The training of human resources focused on scientific initiation, followed by the training of masters and doctors, similar to a study conducted from data from current scholarship holders from the same areas in 2010.[20] The ability to train new human resources is essential for the continuity and development of the scientific production of the area.[9]

The H index allows quantifying the impact of the scientific production of researchers. Despite being influenced by career time, publications and areas with a higher frequency of citations,[6,17] it does not privilege the excessive amount of publications with few citations or the low productivity with many citations. This allows a better analysis of the scientific productions of the scholarship researchers,[17] since the evaluation of proposals, researchers, research projects and funding requests from funding agencies are often influenced by comparative criteria and deeply affected by complex phenomena, even unconscious, that sometimes do not allow true isonomy with the process and people involved in scientific production.[9]

The median of the H index found among the scholarship holders in this study was 19, especially the categories 1B and 1D that presented higher values. This number is much higher than the median 3, observed in 2013 in a study conducted among 53 PQ scholarship researchers in the area of physical therapy and occupational therapy.[20] This result confirms the growth of the area in the last ten years, as well as the impact of scientific production on the development of new knowledge generated by the scholarship researchers.

There is a higher density of physical therapy (n = 66) in the assessed group compared to other training courses, in particular, occupational therapy (n = 5); this disproportion is not visible within the area and disguises the lower participation of this group of researchers. This low number may be a result of the smaller number of graduations and post-graduations in the area of occupational therapy in Brazil. In this sense, we suggest that strategies that can effectively increase the participation of occupational therapy in CNPq, especially due to its interdisciplinary nature.

A limitation in this study is the possibility of the information declared in the Lattes curriculum of the scholarship researchers being mistaken or outdated at the time of the investigation. However, it is a relevant

platform for the registration of information and scientific dissemination in the country and in the world, and the scholarship researchers themselves are responsible for their correct and current completion.

Conclusion

The scholarship researchers in research productivity in the areas of physical therapy and occupational therapy of CNPq presented significant scientific production and training of human resources, which confirms the important development of the area in the last ten years. However, the study revealed a regionalization of this production. Decentralization strategies should be designed to encourage the development of the area in other regions and states of the country. Also noteworthy is the female predominance among scholarship researchers, corroborating the increase in the visibility of women in Brazilian science.

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Authors' contributions

AADS, DRBM and HMJ collaborated with the study conception. AADS, AMGB, SAFA, JVJV and VGBO, with data collection, analysis and interpretation of the results. All authors collaborated with the critical reviewing of intellectual content, approved the final version of the manuscript and declared themselves to be responsible for all aspects of the work, including ensuring its accuracy and integrity.

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