Profile and analysis of scientific production of Brazilian researchers in Clinical Neurosciences

Perfil e análise da produção científica dos pesquisadores brasileiros em Neurociência Clínica

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Abstract

Background: Several studies have examined the scientific production of National Counsel of Technological and Scientific Development (CNPq) researchers in various areas of knowledge. However, specific data about the main Brazilian researchers in Neurosciences are scarce. **Objective:** Evaluate the scientific production of researchers in the field of Neurosciences who receives productivity grant from the CNPq. **Methods:** The Lattes Curriculum of 58 researchers with active grants in the years from 2006 to 2008 were included in the analysis. The variables of interest were: gender, affiliation, human resources training, and scientific production. Grants categories/levels were classified according to CNPq database. **Results:** There was predominance of grants level 1 (55.2%). Researchers published 6,526 articles (median of 90). Of these, 61% were indexed in the ISI database. There was no significant difference between the categories regarding the number of articles (P = 0.12). The median h-index was 10.5 and the median m-index was 0.77. There was no significant difference in m-index between the categories (P = 0.28). **Discussion:** Strategies to qualitatively improve the scientific output possibly can be enhanced by the knowledge of the profile of researchers in the field of Neurosciences.

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Keywords: Researcher performance evaluation systems**,** neurosciences, impact factor.

Resumo

Contexto: Diversos estudos analisaram a produção científica de pesquisadores do Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) em diversas áreas do conhecimento. No entanto, dados específicos sobre os principais pesquisadores brasileiros em Neurociências são escassos. **Objetivo:** Avaliar a produção científica de pesquisadores no campo das Neurociências que recebem bolsa de produtividade do CNPq. **Métodos:** Os currículos lattes dos 58 investigadores com bolsa de produtividade nos anos de 2006 a 2008 foram incluídos na análise. As variáveis de interesse foram: gênero, afiliação, formação de recursos humanos e produção científica. As categorias e os níveis das bolsas de produtividade foram classificados de acordo com o banco de dados do CNPq. **Resultados:** Houve predominância de bolsas do nível 1 (55,2%). Os investigadores publicaram 6.526 artigos (mediana de 90). Destes, 61 foram cadastrados no banco de dados do ISI. Não houve diferença significativa entre as categorias quanto ao número de artigos (P = 0,12). A mediana do índice-h foi de 10,5 e a mediana do índice-m foi 0,77. Não houve diferença significativa do índice-m entre as categorias (P = 0,28). **Conclusão:** Estratégias para melhorar qualitativamente a produção científica possivelmente podem ser reforçadas com o conhecimento do perfil dos pesquisadores no campo da Neurociência Clínica.

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Palavras-chave: Sistemas de avaliação do desempenho de pesquisadores, neurociências, fator de impacto.

Introduction

The research productivity grants was implemented by the National Council of Scientific and Technological Development (CNPq) in the 1970 decade as an incentive to researchers with outstanding scientific contributions in their areas[1]. Several studies have examined the profile and the scientific production of CNPq researchers in various areas of knowledge[1-4]. Recently, we compared the recipients of CNPq research productivity grants in clinical Medicine regarding their specialty[5]. In this analysis, the area of Neurosciences stood out in terms of the production of scientific papers indexed in databases such as the Institute for Scientific Information (ISI) and Scopus[6]. Several studies have assessed the scientific production of Neurosciences in Brazil and Latin America[7-15]. However, specific data about the main Brazilian researchers in this area of knowledge are still relatively scarce[16].

Therefore, this study aims to describe the profile and the scientific production of recipients of CNPq research productivity grants in Medicine, whose main area of expertise is Neuroscience.

Methods

Participants

This was a cross-sectional study conducted on a total of 411 investigators registered as recipients of CNPq research productivity grants in Clinical Medicine according to a list provided by the agency in February 2009[5,6].

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Area of knowledge

For this variable we considered the expertise area specifically assigned by the investigator in the Lattes Curriculum. When this information was missing, we analyzed the researchers' scientific production over the past five years and allocated them to the area of knowledge in which there was a predominance of issues published. Following this methodology, we identified 58 researchers involved in the area of Neuroscience. Of these, 23 (39.7%) researchers declared Psychiatry as their main area of interest.

Data collection

For this investigation, we used the list of researchers in Medicine from CNPq, with active research productivity grants during the triennium 2006-2008[17]. Using the openly available Lattes Curriculum in the CNPq Lattes Platform (www.cnpq.br/lattes) we constructed a database with information on each researcher in terms of geographic distribution, institution, time since receiving the doctoral degree, scientific production (published papers) and training of human resources (supervision of undergraduates and master's and doctoral students). For this data collection, we considered all papers and all students' tutoring during the scientific career span of the researcher. We also analyzed the same content for the last five years, considering the period 2004-2008.

We also searched the databases of Web of Science Thomson – Institute for Scientific Information (ISI) – (http://apps.isiknowledge.com/) and Scopus (http://www.scopus.com/home.url). Both were consulted through the Capes website (http://novo.periodicos.capes.gov.br/). These databases were surveyed for scientific articles published by the researchers. The main problem in processing our data was to properly identify authors, since the same author can provide his/her name in different ways[18,19]. Therefore, the scientific name of the researcher primarily used in this investigation was that provided in the Lattes Curriculum. Furthermore, there was an intense search for possible variations of researchers names. Additionally, data were checked with the following filters available in the ISI and Scopus databases: (i) institution; (ii) subject area; (iii) year of publication, and (iv) source titles. We also used the filter called "Document type" and we excluded abstracts presented at meetings from the analysis.

Variables of interest

The following variables were analyzed: gender, time since receiving the doctorate, and post-doctoral degree. Scientific productivity was evaluated based on the following variables: teaching and mentoring undergraduate master's and doctoral students, number of articles, and number of papers indexed in the ISI and Scopus databases. With regard to publications and student supervision, we analyzed all production during the entire scientific career as well as in the last five-year period. Regarding both student supervision and scientific publications, all data were adjusted by time since receiving the doctoral degree. Research performance indicators were also included in the analysis: adjusted number of citations, number of citations *per* paper, h-index, and m-index[20-23]. Research productivity grants categories/levels were classified in the CNPq database as two main categories (1 and 2) and four levels of category 1 (1A, 1B, 1C and 1D). These categories/levels were taken into account for analysis purposes.

Statistical analysis

The SPSS (*Statistical Package for Social Science for Windows, Inc., USA*) version 18.0 for Windows was used to construct the database and to perform the statistical analysis. Continuous data were reported as medians and interquartile range (IQ) or means and standard deviation (SD), when appropriate. The non-parametric Mann-Whitney and Kruskal-Wallis (KW) tests were used for comparison of these distributions. Dichotomous or nominal variables were compared by the chi-square test.

Results

From a total of 411 researchers in medicine, 58 (14%) were identified as working in the area of Neurosciences. The distribution of researchers by gender and research productivity grant category is summarized in table 1. There was a predominance of males (74%) and grants in category 1 (55.2%). There was no significant difference in the distribution of categories between genders (p = 0.33). Five states of the Federation are responsible for approximately 93% of the researchers: Sao Paulo (32; 55%), Rio Grande do Sul (8; 13.8%), Rio de Janeiro (7; 12%), Santa Catarina (4; 7%) and Minas Gerais (3; 5%). Regarding the home institution, the researchers in Neurosciences are spread over 15 different institutions in the country. Eight institutions are responsible for approximately 88% of researchers and four have more than three researchers: Universidade de São Paulo (USP) (19; 33%), Universidade Federal de São Paulo (Unifesp) (9; 15.5%), Universidade Federal do Rio de Janeiro (UFRJ) (7; 12.1%), and Universidade Federal do Rio Grande do Sul (UFRGS) (4; 7%). The median time since receiving the doctoral degree of 58 researchers was of 15 years (Interquartile range, 10 – 21.2 years). Regarding the doctoral degree, 51 researchers obtained this title in Brazil and seven in institutions abroad. Most researchers (38; 65.5%) have post-doctoral training, predominantly at Brazilian institutions.

Table 1. Distribution of CNPq researches in Neurosciences according scholarships categories and gender (n = 58)

Category	Males (%)	Females (%)	Total (%)
1A	9 (21.0)	0 (00.0)	9 (15.5)
1B	5 (11.60)	1 (6.7)	6 (10.3)
1C	7 (16.3)	3 (20.0)	10 (17.2)
1D	5 (11.6)	2 (13.3)	7 (12.1)
2	17 (39.5)	9 (60.0)	26 (44.8)
Total	43 (100)	15 (100)	58 (100)

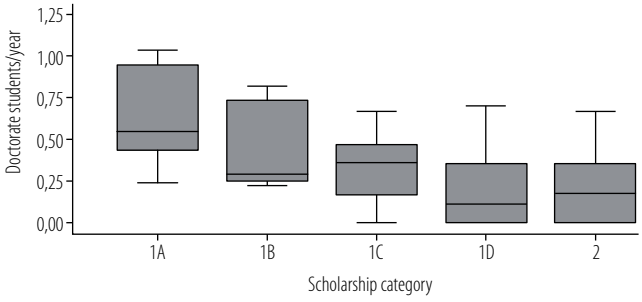

Figure 1. Adjusted number of doctoral students advised throughout the scientific career of CNPq researchers according to grant category/level.

Scientific productivity: human resource training

During their scientific career, CNPq researchers in Neurosciences have trained 453 undergraduate research fellows (a program known as scientific initiation at Brazilian universities), with a median of 4 (IQ, 0 – 13) for each investigator, 568 master's students (median of 8, IQ = 3 – 15) and 347 doctoral students (median of 4, IQ = 1 – 7). Regarding the figures adjusted by the time since receiving the doctoral degree, the median number of mentored students was 0.33, 0.53, and 0.32 for undergraduate, master's and doctoral students, respectively. Considering the adjusted values, there was a significant difference among research productivity grants categories only regarding the number of doctoral students (KW = 16.9, P = 0.002), but the same finding did not occur in relation to the mentoring of master's (KW = 6.9, p = 0.14) and undergraduate students (KW = 4.3, P = 0.37). Figure 1 illustrates the distribution of the doctoral students according to the category of research productivity grants. A significant

difference regarding doctoral students was found only between the level A of category 1 (1A) and category 2 (P < 0.001).

Scientific productivity: publications

During the whole period of their academic career, Neurosciences researchers published 6526 articles, with a median of 90 articles *per* researcher (IQ, 65.7 to 128.5), ranging from 32 to 443 articles. Of this total, 3,992 articles were indexed in the ISI database, approximately 61% of the total articles published (average *per* researcher of 69, SD = 56). A total of 5,061 articles were indexed in the Scopus database, (mean 87, SD = 67), corresponding to 77.5% of academic production.

Considering the number of articles adjusted by the time since receiving the doctoral degree, the median number of publications was 7.4 articles *per* year (IQ, 4.5 to 10.9). The adjusted median number of articles published in the ISI database was 4.4 *per* year (IQ, 2.5 – 7.6) and in the Scopus database was 5.6 *per* year (IQ, 3.2 – 8.7). There was no significant difference among the categories of CNPq research productivity grants when comparing the adjusted median number of papers published throughout their career (KW = 7.2, P = 0.12), as well as of articles indexed in the ISI (KW = 6.6, P = 0.16) and Scopus (KW = 8.1, P = 0.08) databases.

Considering the average number of articles published annually, the majority of researchers (54, 93%) increased their scientific output over the past five years. This increase ranged from 15% to 387% with a median increment of 77.4% in overall scientific production (IQ, 49.5 to 116.3). There was no significant difference between research productivity grants categories in relation to the increase of scientific publication during the last five years (KW = 5.08, P = 0.28), although the scientific output of researchers at level A of category 1 (1A) was nearly double (median 92.9%, IQ, 46% – 186%) that of category 2 researchers (median 57.8%, IQ, 37.3% – 82.9%).

Scientific production: impact

During their academic career, Neurosciences researchers published papers in 854 journals. The Impact Factor (IF) of 565 of these journals (66%) was identified in the JCR 2010 database. The median IF was 2.58 (IQ = 1.68 to 3.94), ranging from 0.061 to 47.05. Regarding the distribution of the impact factor, 55 journals (9.7%) had an IF of less than 1, 125 journals (22.1%) had an IF between 1 and 2, 160 journals (28.3%) an IF between 2 and 3, 1992 journals (16.3%) and IF between 3 and 4, 56 journals (10%) an IF between 4 and 5, and 77 journals (13.6%) an IF of 5 or more. Figure 2 illustrates the distribution of the IF of journals used by 58 researchers in the field of Neurosciences. In relation to scientific journals, Table 2 presents the 15 indexed journals most used by the researchers.

The median sum of the IF of the researchers was 187.7 (IQ, 104.2 to 340.5). There was a significant difference in the median sum of IF between the categories of the researchers (KW = 27.3, P < 0.001). However, there was only a difference between the levels A and B of category 1 and other grants levels. Moreover, there was no difference between categories when comparing the index of the IF adjusted by the number of articles indexed in ISI (KW = 8.0, P = 0.09). Figure 3 (Panel A and Panel B) shows the indexes derived from the IF according to the CNPq research productivity grants categories.

During their academic career, researchers in Neuroscience received a total of 50,669 citations in the database Web of Science, with a median of 384 citations *per* researcher (IQ, 205 to 1,173, ranging from 93 to 4,986). The average number of citations *per* article was 10.6 (SD = 7.3). In the Scopus database, 54,112 citations of articles

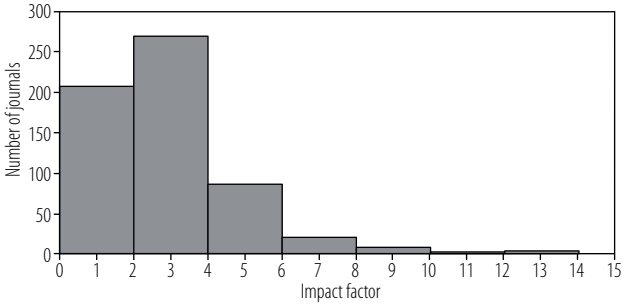

Figure 2. Distribution of impact factor of journals in which articles were published by researchers of CNPq whose area of interest is Neurosciences.

Table 2. Distribution of 15 journals indexed in JCR most used by CNPq Neurosciences researchers for publication

Indexed journals	Impact Factor 2010*	Articles	%
Arq Neuro-Psiquiat	0.574	588	9.0
Revista Brasileira de Psiquiatria	1.593	258	3.9
Braz J Med Biol Res	1.150	172	2.6
Prog Neuro-Psychoph	2.877	102	1.56
Epilepsia	3.955	89	1.36
Neurology	8.017	80	1.22
BMC Infectious Diseases	2.825	66	1.01
Eur Arch Psy Clin N	3.637	60	0.91
Psychiat Res	2.803	60	0.91
Epilepsy Behav	1.994	58	0.88
J Affect Disorders	3.740	56	0.85
Psychopharmacology	3.817	52	0.80
Epilepsy Research	2.302	50	0.76
Neuroscience Letters	2.055	50	0.76
Brain Research Bulletin	2.498	49	0.75

* Published by Journal Citation Report in 2011.

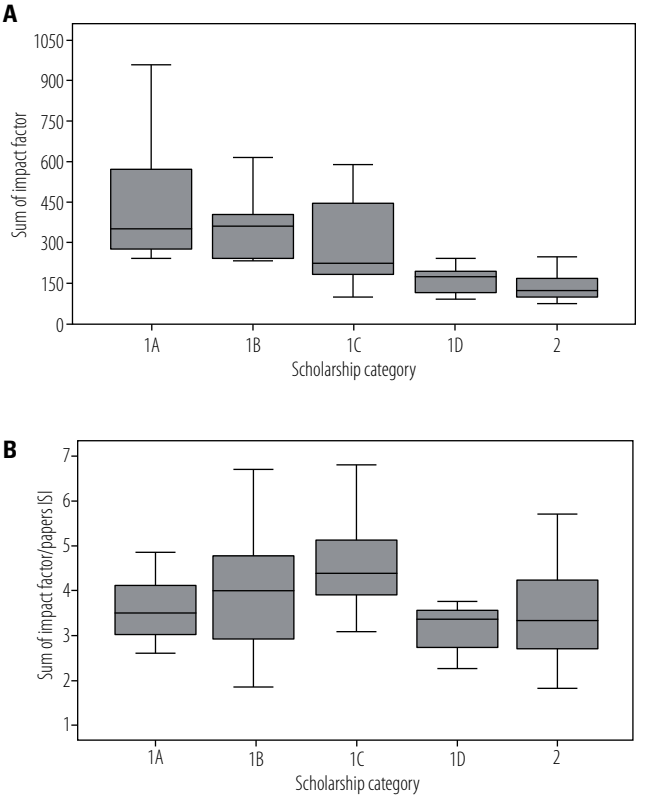

Figure 3. (**A**) Sum of impact factor according to scholarship category/level; (**B**) Index of the IF adjusted by the number of articles indexed in ISI according to grant category/level.

from researchers in Neuroscience were identified, with a median of 455 citations *per* researcher (IQ, 255 to 1,253, ranging from 35 to 4,756 citations). The average number of citations *per* article in the Scopus database was 9.7 (SD = 6.1). There were significant differences among the categories of grants considering the number of citations in both databases, i.e., ISI (KW = 24.2, P < 0.001) and Scopus (KW = 24.4, P < 0.001). Comparing the CNPq research productivity grants categories, researchers of level 1A had significantly more citations than researchers of levels 1C, 1D and 2. Researchers of level 1B also had significantly more citations than levels 1D and 2. There was no significant difference among other grants levels.

Considering all 58 researchers in Neuroscience, the median h-index at the Web of Science database was 10.5 (IQ, 7.75 to 18.25), ranging from 4 to 39. The corresponding values for the h-index of Scopus was a median of 12 (IQ, 9 – 21), ranging from 4 to 36. There were significant differences in the median h-indexes in the ISI (KW = 19.6, P = 0.001) and Scopus (KW = 20.9, P < 0.001) databases, according to the grants scholarship category. As shown in Figure 4A, the median h-index significantly differed only between category 2 and levels A and B of category 1 (1A/1B) in the ISI database.

In the ISI database, the median m-index, i.e., the h-index adjusted by the time of the researcher's academic career, was 0.77 (IQ, 0.54 to 1.02), ranging from 0.19 to 2.1. The corresponding values for the m-index in Scopus was a median of 0.82 (IQ, 0.54 to 1.13), ranging from 0.25 to 2.0. However, there was no significant difference in m- index among all CNPq research productivity grants categories in either database, i.e., ISI (KW = 4.3, P = 0.36) and Scopus (KW = 4.03, P = 0.40). Figure 4B illustrates the distribution of the m-index in the ISI database according to the grants category.

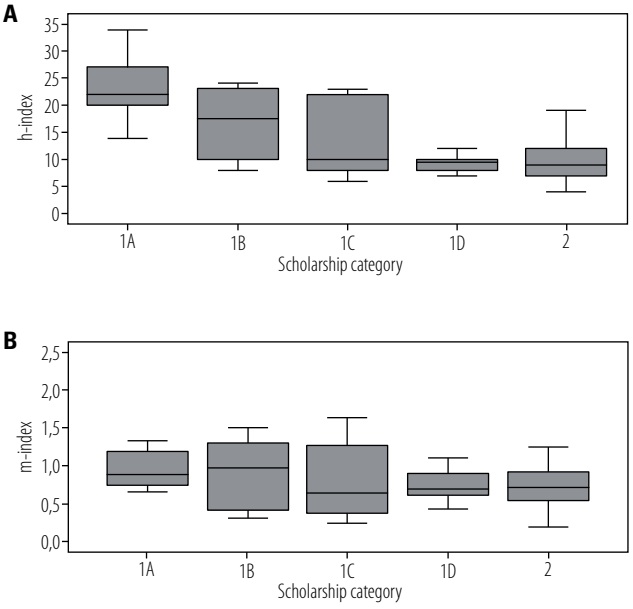

Figure 4. (**A**) h-index in the ISI database according to scholarship category/level; (**B**) m-index in the ISI database according to grant category/level.

Discussion

This cross-sectional study on CNPq researchers in the field of Neurosciences showed a group with high scientific productivity in terms of quality. Some data are relevant to this statement, such as the high percentage of articles published in major databases in the scenario of current scientific production, 61% of articles indexed in the ISI database and 77.5% in Scopus. In a previous study, considering all 411 researchers of CNPq in Clinical Medicine, we showed that the respective percentages were 51% and 68%. Regarding this aspect, researchers of Neurosciences showed the highest percentage of indexed articles when compared with researchers from other medical specialties[6]. This fact is even more significant considering the scenario highlighted in the study by Mari *et al.*[24], in which it was reported that of 222 journals devoted to the theme of mental health indexed in Medline and/or in the ISI database, only nine (4.1%) were from countries of low to medium income. Possibly, this qualitative improvement has occurred during the last decade. In an analysis of Brazilian production in Psychiatry, Figueira *et al.*[12] evaluated articles published between 1981 and 1995 in national and international journals. These authors showed that, during the studied period, 87.2% of articles were published in Brazil and 56.8% were review articles or opinion papers.

Another important finding that emerges from our analysis is the concentration of scientific output in Neurosciences in few Brazilian states, three of which account for approximately 80% of the researchers: São Paulo, Rio Grande do Sul and Rio de Janeiro. Therefore, it is not surprising that Rocha *et al.*[10], in a study that evaluated the Brazilian scientific production in the 40 psychiatry journals with highest impact factor, showed that 83 (86.4%) of 96 articles were by researchers in the States of São Paulo (46 articles, 47.9%), Rio Grande do Sul (27 publications, 28.12%), and Rio de Janeiro (10 publications, 10.41%). Our analysis showed no gender difference among grants scholarship categories. However, only one female researcher was identified at the highest levels (1A/1B) compared with 14 male researchers. Recently, Mendlowicz *et al.*[15] showed that, in 2001, women represented only 40% of the authors of the four major Brazilian journals in the field of Psychiatry. However, due to continued growth in the proportion of female authorship of review articles, a near gender parity was achieved[25].

Our analysis showed that researchers in Neurosciences published a significant number of scientific papers in journals of medium to high impact factor. During their academic career, researchers published a median number of 90 articles, similar to a median number of 87 articles by 411 researchers from the field of Clinical Medicine as a whole[6]. However, when comparing the values adjusted by the time since receiving the doctoral degree, researchers in Neuroscience showed higher values than those obtained by researchers from clinical medicine in general. In Neuroscience, the median number of publications was 7.4 articles *per* year, while papers indexed in the Scopus and ISI databases were 4.4 *per* year and 5.6 *per* year, respectively. The corresponding values for researchers in Clinical Medicine was 4.13 *per* year, 2.23 *per* year and 2.90 *per* year in the ISI and Scopus databases, respectively[6].

Another point to be emphasized in our study is the assessment of the quality and impact of scientific publications by researchers in Neurosciences through the analysis of bibliometric indicators. Among several indicators for assessing the performance of researchers, the h-index, proposed by Hirsch, is intended to simultaneously measure the quality and consistency of scientific production[22]. Thus, the h-index provides a summary of the production and impact of a particular author[23]. In our analysis, the median h-index for researchers in Neuroscience was 10.5 and 12 in the ISI and Scopus databases, respectively. In addition eight researchers (13.8%) with a h-index greater than 20 were identified in the ISI database. The paucity of national and international data on h-index makes these results difficult to compare with other fields of knowledge. For example, Hermes-Lima *et al.*[26] compared indicators of impact of two samples randomly selected from 20 researchers in Comparative Biochemistry and Physiology, one originating from Latin America and the other from developed countries. This study showed that the average h-index was 10.4 for Latin American researchers and 12.4 for researchers from developed countries, which is close to that found in our study for researchers in Neurosciences. On the other hand, Mugnaini *et al.*[27] compared the h-index of scientists members of the Brazilian Academy of Sciences and of the USA National Academy of Sciences and showed that the median h- index for members of the areas of Biomedical and Health Sciences were significantly lower in Brazil (median of 20 and 22, respectively) than in the U.S. (median of 82.5 and 66, respectively). However, the comparison of these values should be viewed with caution, because

the h-index is highly biased towards "older" researchers with long careers and also towards researchers working in areas with high frequency of citations[28]. Thus, despite its undeniable advantages, this index provides an incomplete picture of the real impact of the scientific production of a particular group of researchers[29]. In this context, it is interesting to note that, in our analysis, the m-index, which corrects this time-span bias of the h-index, was quite similar for the various CNPq grants categories, with no significant difference among researchers. These data based on h-index and m-index can also be used to predict the future of a scientific career, i.e., if anything significant will change over time[26]. Thus, our findings suggest that the younger researchers in Neuroscience might achieve considerable levels of citations and impact during future years. Consequently, it would be of interest if the committees of evaluation of CNPq research productivity grants considered the introduction of many bibliometric parameters, such as h- and m-indexes, for the ranking of researchers.

Another relevant point that should be emphasized in this study is that 16% of the articles of the leading researchers in the field of Neurosciences were published in three indexed Brazilian journals, demonstrating the importance of these journals for the dissemination of knowledge and scientific production in our country[30]. Of note, three Brazilian psychiatric journals are currently indexed at Journal Citation Report, with an impact factor ranging from 0.574 to 1.593 and publishing innovative research[31,32]. In an evaluation of the Brazilian scientific productivity in the field of Mental Health, Gonçalves *et al.*[16] showed that the average IF of 105 journals increased significantly when comparing two periods 1998-2002 (average 1.9) and 2004-2006 (average 2.8)[7]. Thus, the 90th percentile for the IF of journals in which the Brazilian researchers in the field of mental health have published during the first period was 4, while the IF for the journals best ranked (top 10%) during the last three years was 5.1, representing an increase of 25%[7]. In our analysis, we found a similar profile of journals used by neuroscientists. The median IF was 2.58 for the 565 journals indexed in the JCR 2010 database and 90% of the journals had an IF greater than 1. It also should be pointed out that the 90th percentile for the IF of 565 journals was 5.5. It is noteworthy that approximately 14% of the journals used by researchers in Neurosciences have an IF greater than 5. A total of 8,073 journals are currently registered in the JCR database and only 494 (6%) have an impact factor of 5 or more, and the majority of these journals are from basic science areas. The same database shows that among 128 journals indexed in the field of Psychiatry and 239 in the field of Neurosciences, only 14 (11%) and 39 (16.3%) had an IF greater than 5, respectively. These data further emphasize the quality of the scientific output of this group of researchers.

Our results should be considered in light of several methodological limitations. In this respect, the possible major weakness was the difficulty of manually checking all journals used by each investigator through consultation of the Lattes Curriculum database. This task required a major effort in certifying the results obtained and, undoubtedly, is error-prone, in spite of the mechanisms used by our team to avoid these problems. For example, the database was compiled by four researchers and consolidated at the end by a single investigator who systematically checked for errors and inconsistencies. Nevertheless, partially due to these difficulties, we were not able to address some important issues, such as the questions of co-authorship, collaboration among research groups, and postgraduate programs productivity. Moreover, another limitation of our study is related with the selection of our sample. Our analysis was limited to the Medical Committee of CNPq, which covers the vast majority of clinical researchers. Consequently, we did not verify committees related to basic areas of knowledge such as Physiology, Immunology, Genetics and others that might probably include neuroscientists. However, some characteristics of the study may increase the strength of our results, such as the strategies mentioned above and also the systematic search of the ISI and Scopus databases according to a well-established protocol.

Conclusion

In this study, we found that researchers in the field of Neuroscience have relevant quantitative and qualitative scientific output. This scientific production has increased significantly in recent years and, in most parameters examined, the researchers in the field of Neurosciences outweigh the CNPq researchers from other areas of knowledge in Clinical Medicine. Further studies addressing some important issues like research groups' productivity, collaborative efforts, and specific postgraduate programs might contribute to our better understanding of this dynamic area of research.

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Conflits of interest

None.

References

1. Santos NCF, Candido LFO, Kuppens CL. Produtividade em pesquisa do CNPq: análise do perfil dos pesquisadores da química. Quimica Nova. 2010;33:489-95.
2. Barata RB, Goldbaum M. [A profile of researchers in public health with productivity grants from the Brazilian National Research Council (CNPq)]. Cad Saude Publica. 2003;19:1863-76.
3. Mendes PHC, Martelli DR, Souza WP, Filho SQ, Martelli Junior H. Perfil dos pesquisadores bolsistas de produtividade científica na Medicina no CNPq, Brasil. Rev Bras Educ Méd. 2010;34:535-41.
4. Santos SMC, Lima LS, Martelli DRB, Martelli Junior H. Perfil dos pesquisadores da Saúde Coletiva no Conselho Nacional de Desenvolvimento Científico e Tecnológico. Physis. 2009;19:761-75.
5. Oliveira EA, Colosimo EA, Martelli DR, Quirino IG, Oliveira MC, Lima LS, et al. Comparison of Brazilian researchers in clinical medicine: are criteria for ranking well-adjusted? Scientometrics. 2012;90:429-43.
6. Martelli-Junior H, Martelli DR, Quirino IG, Oliveira MC, Lima LS, Oliveira EA. [CNPq researchers in medicine: a comparative study of research areas.]. Rev Assoc Med Bras. 2010;56:478-83.
7. Bressan RA, Gerolin J, Mari JJ. The modest but growing Brazilian presence in psychiatric, psychobiological and mental health research: assessment of the 1998-2002 period. Braz J Med Biol Res. 2005;38:649-59.
8. Fiestas F, Gallo C, Poletti G, Bustamante I, Alarcón RD, Mari JJ, et al. Improving mental and neurological health research in Latin America: a qualitative study. BMC Public Health. 2009;9:334.
9. Nitrini R. The scientific production of Brazilian neurologists: 1995-2004. Arq Neuropsiquiatr. 2006;64:538-42.
10. Rocha FF, Fuscaldi T, Castro V, Carmo W, Amaral D, Correa H. [Brazilian scientific production in the 40 psychiatric journals with high impact factor in 2006]. Rev Assoc Med Bras. 2007;53:543-6.
11. Spina-França A. Estado atual das neurociências no Brasil. Neuro-Press. 1997;1:3-5.
12. Figueira I, Jacques R, Leta J. A comparison between domestic and international publications in Brazilian psychiatry. Scientometrics. 2003;56: 317-27.
13. Leta J, Jacques R, Figueira I, Meis L. Central international visibility of Brazilian psychiatric publications from 1981 to 1995. Scientometrics. 2001;50:241-54.

14. Luz MP, Marques-Portella C, Mendlowicz MV, Gleiser S, Coutinho EFS, Figueira I. Institutional h-index: the performance of a new metric in the evaluation of Brazilian Psychiatric Post-graduation Programs. Scientometrics. 2008;77:361-8.
15. Mendlowicz MV, Coutinho EFS, Laks J, Fontenelle LF, Valença AM, Berger W, et al. Is there a 'gender gap' in authorship of the main Brazilian psychiatric journals at the beginning of the 21st century? Scientometrics. 2011;86:27-37.
16. Gonçalves RR, Kieling C, Bressan RA, Mari JJ, Rhode LA. The evaluation of scientific productivity in Brazil: an assessment of the mental health field. Scientometrics. 2009;80:529-37.
17. Leite P, Mugnaini R, Leta J. A new indicator for international visibility: exploring Brazilian scientific community. Scientometrics. 2011;88:311-9.
18. Lane J. Let's make science metrics more scientific. Nature. 2010;464:488-9.
19. Lehmann S, Jackson AD, Lautrup BE. Measures for measures. Nature. 2006;444:1003-4.
20. Bornmann L, Wallon G, Ledin A. Is the h index related to (standard) bibliometric measures and to the assessments by peers? An investigation of the h index by using molecular life sciences data. Research Evaluation. 2008;17:149-56.
21. Haeffner-Cavaillon N, Graillot-Gak C. The use of bibliometric indicators to help peer-review assessment. Arch Immunol Ther Exp (Warsz). 2009;57:33-8.
22. Hirsch JE. An index to quantify an individual's scientific research output. Proc Natl Acad Sci U S A. 2005;102:16569-72.
23. Panaretos J, Malesios C. Assessing scientific research performance and impact with single indices. Scientometrics. 2009;81:635-70.
24. Mari JJ, Patel V, Kieling C, Razzouk D, Tyrer P, Herrman H. The 5/95 gap in the indexation of psychiatric journals of low- and middle-income countries. Acta Psychiatr Scand. 2010;121:152-6.
25. Gomes MM. Women neurologist: a worldwide and Brazilian struggle. Arq Neuropsiquiatr. 2011;69:838-40.
26. Hermes-Lima M, Alencastro AC, Santos NC, Navas CA, Beleboni RO. The relevance and recognition of Latin American science. Introduction to the fourth issue of CBP-Latin America. Comp Biochem Physiol C Toxicol Pharmacol. 2007;146:1-9.
27. Mugnaini R, Packer AL, Meneghini R. Comparison of scientists of the Brazilian Academy of Sciences and of the National Academy of Sciences of the USA on the basis of the h-index. Braz J Med Biol Res. 2008;41:258-62.
28. Moed HF. New developments in the use of citation analysis in research evaluation. Arch Immunol Ther Exp (Warsz). 2009;57:13-8.
29. Abt HA. A publication index that is independent of age. Scientometrics. 2011.
30. Machado Ldos R, Livramento JA. The 70 years of Arquivos de Neuro--Psiquiatria. Arq Neuropsiquiatr. 2012;70:1.
31. Gattaz WF. Revista de Psiquiatria Clínica indexada no ISI. Rev Psiq Clín. 2008;35.
32. Moreira-Almeida A. The growing impact of publications in spirituality and health and the role of Revista de Psiquiatria Clínica. Rev Psiq Clín. 2010;37:41-2.