



## Pursuing efficiency: international visibility of the scientific production of Brazilian graduate programs in child and adolescent health from 1998 through 2003

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### Abstract

**Objective:** To assess the trend in the number of published articles by Brazilian graduate programs in child and adolescent health and the proportion of such publications cited in MEDLINE and Thomson Scientific's Journal Citation Reports (JCR), using the former database as a proxy for efficiency and the latter as an indicator of visibility.

**Methods:** We assessed the trends of 14 graduate programs concerning the number of theses, dissertations, and articles cited in MEDLINE and JCR, through secondary data from the latest two triennial evaluations carried out by the Brazilian Federal Agency for the Improvement of Higher Education (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES) between 1998 and 2000 and between 2001 and 2003).

**Results:** The number of published articles increased (1,520 to 1,917), as did the median number of articles cited both in MEDLINE (32.5 to 45) and in JCR (24.5 to 27). The median number of dissertations rose from 19.5 to 26.5; the median number of theses went up from 12 to 13.5. The median number of faculty advisors decreased (21.5 to 18.4).

**Conclusion:** Graduate programs in child and adolescent health became more efficient in producing knowledge through the publication of more articles with broader international visibility. Such trend was contradictorily accompanied by a diminishing number of advisors.

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### Introduction

Efficiency of academic research is a matter of pressing interest to practicing clinicians – pediatricians included – considering the growing tendency towards following evidence-based medicine, whose trait of orderly incorporating research evidence into medical practice is directly derived from the research and development concept. Under a broader public health focus, quality academic research is essential for devising national health policies, designing health actions, and delivering health services efficiently.<sup>1-4</sup>

On the other hand, most theoretical academics currently agree that a nation's research and development drive must

place society and the environment at the core of a research system based upon quality, transparency and value for money.<sup>2,5</sup> Such a concept is often translated by the equation that combines efficiency with the sum of proper utilization of financial supplies and knowledge output.<sup>6,7</sup>

Given that the so-called knowledge society has been increasingly viewed as knowledge economy in today's globalizing context, and as it has called for a production of knowledge with the widest possible reach, the notion of visibility has been definitely infused into the academic research lexicon.<sup>8-14</sup> According to many authors, as far as the mainstream peer-reviewed periodicals scene is dependable, publication acceptance equals quality, while the proportion of

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publications cited in prestigious databases such as MEDLINE and Thomson Scientific's Journal Citation Reports (JCR) can be viewed as a proxy for visibility.<sup>14-16</sup> Such combination of visibility and quality is embraced by most research funding agencies, such as Brazil's Federal Agency for the Improvement of Higher Education (CAPES), which bases its evaluation of graduate education programs on publication output, chiefly international visibility, and advisors' performance.<sup>17</sup>

Brazil is one of the few of the so-called middle-income countries having a consistent state program directed to financing projects of knowledge production in the health field, in spite of the small budget assigned to scientific research, considering the country's gross national income.<sup>15,18,19</sup>

Governmental policies of health research funding in Brazil are mainly operationalized through three agencies with countrywide reach (the already cited CAPES, the National Council for Scientific and Technological Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico, CNPq), and the Studies and Projects Funding Agency (Financiadora de Estudos e Projetos, FINEP), and through state foundations for research support. CAPES stands out among them, having a strong aim at organizing and planning the development of human resources at the graduate level. Its process of graduate program evaluation began in the late 1970s, but significant changes in methods and evaluation criteria were made from 1996 on, placing great emphasis on knowledge production, particularly on the number of published articles, international visibility, and researchers' individual performance.<sup>17,20</sup>

During that period, the overall participation of Brazilian scientific publications in the international indexing databases underwent a significant rise from 0.56% to 1.49%, so that Brazil now ranks 17th on the list of countries with greatest scientific output, and 9th on the list of those countries with largest increase in scientific production over a 10-year period.<sup>21</sup>

Recent studies show significant advances concerning the publication of Brazilian human health articles in international periodicals.<sup>22</sup> Amongst all knowledge fields that have been following such trend, that of child and adolescent health stands out, with a 213% increase in MEDLINE citations along the past 12 years.<sup>23</sup> Multiple health specialties contribute to this figure, particularly public health, internal medicine and surgery research centers. Although the contribution of pediatric academic institutes and departments is also significant, recent research suggests that they are slower in keeping up with the upward trend of other specialties.<sup>23</sup>

The objective of this study was to assess the trend in the number of published articles by Brazilian graduate programs in child and adolescent health and the proportion of such publications cited in MEDLINE and JCR, using the former database as a proxy for efficiency and the latter as an indicator of visibility.

## Methods

This is an ecological study on a time trend of secondary data derived from reports of the continuing evaluation of graduate programs in child and adolescent health. We included all programs belonging to the referred field, credentialed by CAPES, and evaluated during the latest two triennia (1998 through 2000, 2001 through 2003).

We examined the following variables: number of term papers (both dissertations and theses), number of advisors, number of advisees, and number of published articles. These data were assessed in the annual reports issued by each graduate program according to the criteria prescribed by CAPES. Since the top rating of the CAPES Qualis system – a process that ranks the journals and other types of publications used by graduate programs to publicize the intellectual output of their faculty and students – adopts JCR as the reference for classifying periodicals of international circulation (Qualis International A and B), and MEDLINE indexing as the prime database for the second rank (Qualis International C), we chose these two criteria as proxy measures for visibility.<sup>24</sup> The overall visibility of each program was inferred from the ratio between the number of articles cited in MEDLINE and/or JCR and the total number of articles published in the same period. It is important to point out that those two databases show some degree of overlap, since the same article can be indexed in both.

The data analysis was descriptive through measures of frequency and central tendency. We used the Wilcoxon test to assess significant differences between medians of dependent samples and linear regression to find the trend of medians of advisors and articles per year during the study period. The level of significance was  $p < 0.05$  for all calculations.

## Results

Fourteen graduate programs in mother-infant health, pediatrics and child and adolescent health were included in the analysis, 10 of which were credentialed by CAPES to issue doctorate degrees and four to issue master's degrees only.

All evaluated indices of knowledge production, i.e. dissertations, theses and published papers, showed an overall upward trend, as seen by the analysis of medians of papers issued by all 14 programs. The total number of dissertations underwent a 35.9% increase from the first to the second triennium, while the number of theses had a 12.5% increase (Table 1). The total number of published articles was 1,520 during the first triennium and 1,917 during the second one, corresponding to a 26% increase. When separately considering the medians of articles per program cited in MEDLINE and JCR, there was an increase of 38.5% and 10.2%, respectively. In contrast, there was an overall 14.7% decrease in the number of advisors from 1998 through 2003 ( $p < 0.01$ ) (Figure 1).

**Table 1** - Knowledge output by Brazilian graduate programs in child and adolescent health: medians of dissertations and theses issued by 14 programs per triennium

	First triennium*	Second triennium†	Increase (%)	p
Dissertations	19.5	26.5	35.9	< 0.05
Theses	12	13.5	12.5	> 0.05

\* 1998 through 2000.

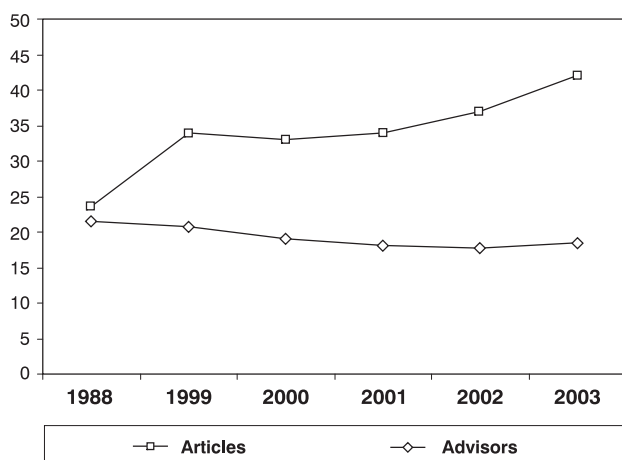
† 2001 through 2003.

The increase in the number of MEDLINE indexed articles was higher compared with JCR rates, although there was a noticeable increment in the visibility of the articles published along the study period, as inferred by citation both in MEDLINE and JCR (Table 2).

## Discussion

The results of this study indicate a moderate positive increment in the scientific production of graduate programs in child and adolescent health, in accordance with studies that assessed other areas of knowledge.<sup>25</sup> However, one of our main findings is the contrasting decrease in the number of advisors, while the number of both term papers and published articles went up.

Some issues can be raised when trying to explain such results. First, has the continuing evaluation process carried out by CAPES been having a positive impact on the performance of graduate programs? The new method of evaluation that was implemented by CAPES in 1998 considers both the



Linear regression was used to assess the significance of trends:  $p = 0.014$  for articles,  $p = 0.013$  for advisors.

**Figure 1** - Published articles and advisors from Brazilian graduate programs in child and adolescent health: medians per year, 1998 through 2003**Table 2** - Articles published by Brazilian graduate programs in child and adolescent health: Medians of the total number of published articles issued by 14 programs, and of those cited in MEDLINE and Thomson Scientific's Journal Citation Reports (JCR) per triennium\*

	First triennium†	Second triennium*	Increase (%)	p
Articles cited in MEDLINE	32.5	45	38.5	< 0.01
Articles cited in JCR	24.5	27	10.2	< 0.05
All published articles	84.5	107	26.6	< 0.05

\* The total absolute number of articles published by all programs was 1,500 in the first triennium and 1,917 in the second triennium;

† 1998 through 2000.

‡ 2001 through 2003.

production and the higher quality of scientific articles as performance indicators. Thus, the impact factor of the periodicals in which papers get published is one of the chief quality criteria, whose top excellence goal is the publication in journals with impact factor equal to or above the median for periodicals in a given specialty. In a study that assessed performance indicators for cancer, cardiovascular and malaria research in Brazil in the late 1980s and early 1990s, the findings already showed continuous growth of the scientific community and foresaw a positive impact of scientific activity on biomedical education.<sup>26,27</sup> A recent study that looked into knowledge production in pediatrics showed a rise in the number of published articles since 1993, even though this started before the implementation of the new process of evaluation by CAPES and the study did not focus specifically on graduate program output.<sup>23</sup> On the other hand, the diminishing number of advisors along the period of the present study may indicate a reaction to the new evaluation criteria, which tend to drive away faculty members with low academic output. This current scenario may hinder the aggregation of new researchers and advisors to the graduate programs, with the ensuing limitation of their production capacity.

Second, does a greater financial investment in research projects in the area of human health correlate with a significant increase in knowledge production in mother-infant health? In general, there has not been any remarkable rise in the human health research funding in Brazil along the past 20 years. The competition dynamics within the knowledge production arena is not yet fully understood; there are no theoretical references that may adequately explain the behavior and relations among the various actors in such a highly rivaled field. Science is certainly involved with the production of well-being, but it does not follow such basic market principles as consumer pressure, nor is it sensitive to investments in areas

that are adjacent to science and technology.<sup>28</sup> However, as King points out, scientific production in Brazil is quite small when compared to the gross national income, indicating that investments in science and technology are yet to be viewed as a strategic priority of the country.<sup>15</sup> Moreover, according to CAPES, in spite of a 205% increase in graduate degrees issued along the past 10 years, there has only been a 30% raise in the financing budget for graduate programs, with a marked resulting reduction of scholarships granted to new students during this period.<sup>29</sup> Therefore, these findings allow us to suggest that the growth of scientific production in Brazil has occurred as a reaction of the institutions to a policy of excellence pursuit, in which the evaluation process played a fundamental role.

Some limitations of the present study may hamper a deeper analysis of the quality of graduate program publications. First, the study lacks a longer time trend series that would allow a more proper definition of the correlation between the new evaluation method and the scientific production trend. Second, we could not assess the impact factor of the periodicals in which the involved papers could get published. Third, we could not assess the number of citations that those papers elicited. In this regard, the improvement of evaluation criteria should permit access to that information in the future.

In conclusion, scientific production of graduate programs in child and adolescent health underwent a striking increase in international visibility advanced by a growing number of published articles of higher quality. The attainment of such efficiency level was accompanied by a reduction in the number of advisors and an increase in the number of students, in a scenario of financial constraint. The implementation of the new continuing evaluation process by CAPES in 1998 brought about new efficiency parameters that seem to have fostered, at least partially, the referred noticeable increase in the scientific output of graduate programs.

However, by comparing the results, there was an overall increase of 95.6% in the number of articles related to child health published by general Brazilian scientific institutions cited in MEDLINE from 1998 to 2003, while pediatric institutions presented a lesser performance, having increased their output by only 38.5%.<sup>23,30</sup> These results suggest, even in face of a significant increase, that pediatric institutions did not respond equally to the general inputs for increased performance in Brazilian science production. The reasons for this scenario must be evaluated promptly, among other reasons to investigate the total budget allocated to research in pediatric institutions and the administrative performance of programs through new criteria, such as scales of difficulties, opportunities and administrative pressure.

Finally, if we view such scenario in the light of the report by de Meis et al.,<sup>29</sup> who described the great level of stress of

graduate students and faculty members caused by the conflict between growing competition and dwindling resources, and taking into account all limitations imposed by sparse investment, we must still question the further growth of graduate programs.

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