

A map of Brazilian dental research in the last decade

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Abstract: The aim of the present study was to analyze dental research trends in Brazil over the past nine years. All abstracts presented at the 26th Annual Meeting of the Brazilian Society for Dental Research in 2009 (n = 2648) were classified based on field of knowledge, home institution and geographic region. Data were compared with those previously published based on abstracts presented at various meetings. Between 2001 and 2006, five fields of knowledge had a greater than 10% representation among the total number of studies. These fields included restorative dentistry/dental materials (RD/DM), periodontics, endodontics, pediatric dentistry and population-based oral health. In 2009, only RD/DM maintained a greater than 10% proportion of meeting abstracts, and basic fields comprised the second position among those fields with greater representation (9.8%). The majority of research studies were performed at public institutions, and the number of abstracts per state increased significantly in 2009 (Wilcoxon test, $p < 0.001$). The southeastern region of Brazil submitted the greatest number of abstracts; however, other regions also demonstrated increased participation in research (11%). The percentage distribution of abstracts between states remained constant (Wilcoxon test, $p = 0.255$; $r_s = 0.873$). The results of the present study suggest a slight shift in the scientific research profile in Brazilian dentistry: fields related to professional disciplines have declined in relative research participation, while increasing interest has been observed in basic fields and new specialties.

Descriptors: Dental Research; Bibliometrics; Evaluation Studies as Topic; Oral Medicine; Brazil.

Introduction

In 1970, a representative intellectual field emerged in Brazil that focused on the development of social sciences, education and health sciences.¹ The production of scientific papers in Brazil has increased at twice the mean global rate over the last two decades, and the proportion of Brazilian papers in the Web of Science index, which was approximately 0.5% of the global output twenty years ago, now approaches 1.5%.² Research in the field of dentistry has also increased both quantitatively and qualitatively. Research has become so representative and important in society that the number of professionals dedicated to research has increased considerably over the past several years.³ Moreover, there has been an increase in the number of references to Brazilian dental stud-

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ies indexed in international databases (ISI Web of Science).⁴ This fact is of considerable importance, as scientific production establishes a link between dental students and professionals, thereby uniting the national perspective of Brazilian dentistry.⁵

Brazilian dental research is currently one of the most respected areas of dental research in the international scientific community.⁶ Therefore, it is important to describe the unique characteristics of this work. The Brazilian Society for Dental Research, which is comprised of the Brazilian Division of the International Association for Dental Research, holds an annual meeting to discuss research in Brazilian dentistry. This meeting is the most prestigious dental conference in Brazil, and it is a venue for the presentation and discussion of scientific findings.⁷ One study reports that Brazil is among the 10 most prolific dental research countries in the world.⁸

The aim of the present study was to analyze scientific production in Brazil over the past nine years based on the annals of the Brazilian Society for Dental Research.

Methodology

A retrospective study was carried out analyzing abstracts presented at the 26th Annual Meeting of the Brazilian Society for Dental Research. All abstracts (n = 2648) were classified based on registration category and field of knowledge using the method proposed by Amorim *et al.*⁵ This classification scheme discriminates topics by dividing fields of knowledge into 25 categories based on the most frequently addressed topics in Brazilian dental literature over the past 15 years. This method was adopted in the present investigation to facilitate comparisons between the current study and previous studies. The following abstract characteristics were also determined: number of authors, name and type of home institution (public or private) and geographic region of origin (southern, southeastern, central western, northern or northeastern Brazil). Moreover, all statistical parameters of the studies were evaluated, including sample size, methodology, inferences, statistical tests employed and confidence levels (data on statistical parameters will be presented in an upcoming study).

Data were collected by a group of five trained researchers working in pairs who classified abstracts based on previously defined characteristics. Information was collected independently by each examiner in each pair and then compared between the two researchers. A third researcher was consulted in the event of differing analyses. All information was codified, and databases were constructed using the Statistical Package for the Social Sciences (version 15.0; SPSS Inc. Chicago, IL, USA).

The collected data were then compared with data published by Dias *et al.*, who evaluated half of the abstracts presented at meetings of the Brazilian Society for Dental Research between 2001 and 2006, and by Cavalcanti *et al.*, who analyzed abstracts presented in 2003 at the 20th Annual Meeting of Brazilian Society for Dental Research.^{1,7} For these analyses, descriptive statistics (frequencies), the Wilcoxon test and Spearman's correlation coefficient were used with the significance level set at 5%.

Results

In 2009, a total of 2648 abstracts were presented at the 26th Annual Meeting of the Brazilian Society for Dental Research. Table 1 displays the distribution of registration category between submitted abstracts. The number of authors ranged from one to eight (mean: 5.4 ± 1.7), and the mean number of authors also varied according to registration category, with the lowest number occurring in the field of

Table 1 - Frequency of abstracts according to registration category at the 26th Annual Meeting of the Brazilian Society for Dental Research, Brazil, 2009.

Abstract categories	n	%
Scientific Forum	16	0.6%
Dental Research for Collective Action	17	0.6%
Hatton*	32	1.2%
Research in Dental Education	46	1.7%
Scientific Initiation	925	34.9%
Studies carried out by postgraduate students and professors	1612	60.9%
Total	2648	100.0%

*Hatton is a category for highly prolific researchers. The winner of this category presents their study at the next IADR meeting.

public health and the highest in the Hatton category.

Figure 1 displays the distribution of abstracts according to field of knowledge presented from 2001-2006, 2003 and 2009. Among the 5203 ab-

stracts assessed between 2001 and 2006, five fields of knowledge were represented by greater than 10% frequency among the total number of studies: restorative dentistry/dental materials (RD/DM),

	(1): BSDR 2001 to 2006 (Dias et al., 2008)	(2): BSDR 2003 (Cavalcanti et al., 2004)	(3): BSDR 2009
A	Restorative Dentistry (12.8%)	Clinic / Dental Materials (7.1%)	Restorative Dentistry / Dental Materials (23.11%)
B	Periodontics (11.7%)	Periodontics (7.8%)	Periodontics (5.43%)
C	Endodontics (11.4%)	Endodontics (6.0%)	Endodontics (8.49%)
D	Pediatric Dentistry (10.8%)	Pediatric Dentistry (34.4%)	Pediatric Dentistry (5.62%)
E	Public Health (10.5%)	Epidemiology / Public Health (14.8%)	Public Health / Preventive Dentistry / Policies / Economy (13.29%)
F	Pathology / Stomatology (14.5%)	–	Pathology / Stomatology (0.26%)
G	Oral Dental Prosthesis (7.4%)	–	Prosthesis / Dental Materials / TMJ ¹ / TMD ² / Occlusion / Orofacial pain (8.87%)
H	Surgery (6.1%)	Surgery (4.3%)	Surgery / Traumatology (6.68%)
I	Orthodontics (5.2%)	Orthodontics (3.8%)	Orthodontics / Jaw Orthopedics (2.49%)
J	–	–	General Health / Patients with special needs (9.51%)
K	Other areas (9.6%)	Other areas (4.9%)	Other areas (4.68%)
L	–	–	Profession / Labor Dentistry (5.77%)
M	–	Radiology (16.8%)	Radiology / Imaging (1.32%)
N	–	–	Pharmacology (0.33%)
O	–	–	Research / Teaching (0.64%)
P	–	–	Implantology (0.03%)
Q	–	–	Ethics / Forensic Dentistry (0.075%)
R	–	–	Biosecurity (1.58%)
S	–	–	Basic Areas (0.64%)
T	–	–	New Technologies (1.01%)
U	–	–	Geriatric Dentistry (0.07%)
Total	(100%)	(100%)	(100%)

BSDR: Brazilian Society for Dental Research, ¹Temporomandibular Joint (TMJ), ²Temporomandibular Disorders (TMD).

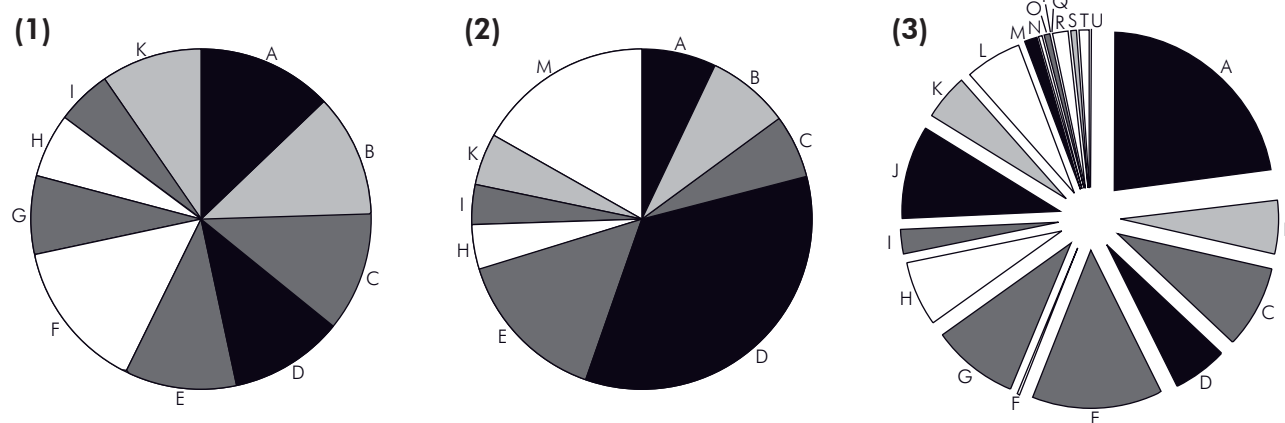


Figure 1 - Absolute and relative frequencies of abstracts at meetings of the Brazilian Society for Dental Research according to year of presentation and field of knowledge.

periodontics, endodontics, pediatric dentistry and population-based oral health. In 2003, the fields of pediatric dentistry and radiology accounted for a greater portion of the total abstracts. In 2009, only RD/DM maintained a greater than 10% proportion (23.1%) of the total number of abstracts, with basic fields taking second position among those with greater participation (9.8%). Additionally, new fields of knowledge emerged at the 2009 meeting, and novel specialties such as dental care to disabled and elderly patients became more prevalent. Fields with the lowest frequency representation were labor dentistry, occupational dentistry and forensic dentistry.

Regarding institutional affiliations of manuscripts, papers published in 2009 came from 142 different institutions, and the majority of studies from the last decade were performed at public institutions (75.2% in 2003; 71.3% in 2009). Papers presented in 2009 demonstrated the following institutional percentage distribution: 26.6% originated from federal institutions; 43.2% from state institutions; 1.5% from municipal institutions; 27.9% from private institutions; 0.3% from research institutions; 0.2% from dental associations; and 0.03% (one paper) from a manufacturer of dental materials.

Although the largest number of abstracts originated from southeastern Brazil (76.4% in 2003; 68.6% in 2009), with the state of São Paulo accounting for more than 50% of the national scientific production (59.4% in 2003; 51.5% in 2009), other regions of the country have increased their participation in research by approximately 11% in recent years. Table 2 displays the number of papers from each state in both 2003 and 2009. The median difference in the number of abstracts by state between 2003 and 2009 was 10.5 (interquartile range = 34.0). The number of abstracts per state was statistically higher in 2009 than in 2003 (Wilcoxon test, $p < 0.001$), with the exception of the state of Pernambuco and the Federal District, which demonstrated a decrease in absolute research numbers. However, despite the increase in number of abstracts, the percentage distribution of abstracts between states remained the same between 2003 and 2009 (Wilcoxon test, $p = 0.255$, Spearman's correla-

tion coefficient = 0.873, $p < 0.001$).

Table 3 displays the top ten institutions according to number of abstracts at the 26th Annual Meeting of the Brazilian Society for Dental Research. The universities with the greatest number of studies at the last meeting were the Universidade Estadual de Campinas, followed by the Universidade de São Paulo and the Universidade Estadual Paulista, which accounted for 34.7% of the total presented abstracts.

Discussion

Despite the limitations inherent to using material from the records of the annual meeting of the Brazilian Society for Dental Research, this study may be useful in helping to identify the main topics and trends of dental scientific research in Brazil. At the previous Society for Dental Research meeting, Brazilian studies were more concentrated on research conducted by post-graduate students and professors; this finding was quite expected, as the majority of meeting participants were affiliated with postgraduate programs. However, the growing number of entries in the category of Scientific Initiation (34.93%) demonstrates an increasing trend in Brazilian dental research.

The greatest number of authors per paper was found in the Hatton category. This observation was expected, as studies in this category are typically more complex and often involve multidisciplinary teams and even the participation of foreign researchers.

It was furthermore observed that it is difficult to define fields of knowledge in scientific dental research. A number of different research classifications have been proposed in the literature; however, a lack of standardization hinders the establishment of comparisons between studies and impedes the use of in-depth analyses.

Brazilian dental research has undergone an important transformation in recent years. Until 2001, scientific research was devoted mainly to dental materials studies as well as clinical and surgical technique analyses, as observed by Dias *et al.*, who also emphasized the focus on restorative dentistry and dental materials from 2001 to 2006.¹ However, the

Table 2 - Distribution of abstracts according to geographic region and year of presentation at meetings of the Brazilian Society for Dental Research, Brazil.

State	Abstracts				Difference ¹ (2009-2003)	Difference ² (2009-2003)
	2003 ⁷		2009			
	n	%	n	%	n	%
Alagoas	0	0.0	1	0.0	1	0.0
Amapá	0	0.0	1	0.0	1	0.0
Amazonas	1	0.1	12	0.5	11	0.4
Bahia	36	1.9	38	1.4	2	-0.5
Ceará	7	0.4	29	1.1	22	0.7
Distrito Federal	11	0.6	4	0.2	-7	-0.4
Espírito Santo	3	0.2	24	0.9	21	0.7
Goiás	6	0.3	47	1.8	41	1.5
Maranhão	4	0.2	11	0.4	7	0.2
Mato Grosso	6	0.3	11	0.4	5	0.1
Mato Grosso do Sul	2	0.1	11	0.4	9	0.3
Minas Gerais	150	7.9	239	9.0	89	1.1
Pará	6	0.3	13	0.5	7	0.2
Paraíba	21	1.1	64	2.4	43	1.3
Paraná	84	4.4	218	8.2	134	3.8
Pernambuco	46	2.4	34	1.3	-12	-1.1
Piauí	0	0.0	6	0.2	6	0.2
Rio de Janeiro	172	9.0	191	7.2	19	-1.8
Rio Grande do Norte	21	1.1	55	2.1	34	1.0
Rio Grande do Sul	150	7.9	199	7.5	49	-0.4
Rondônia	0	0.0	10	0.4	10	0.4
Santa Catarina	44	2.3	57	2.2	13	-0.1
São Paulo	1132	59.4	1361	51.4	229	-8.0
Sergipe	3	0.2	9	0.3	6	0.1
Total	1905	100.0	2645	99.8*	740	-0.2*

*Among the 2648 studies presented at the 2009 meeting of the Brazilian Society for Dental Research, three abstracts originated from other countries (Italy, Paraguay and Peru); ¹statistically significant difference (Wilcoxon test, $p < 0.001$); ²non-significant difference (Wilcoxon test, $p = 0.255$, Spearman's correlation coefficient = 0.873, $p < 0.001$).

same authors also reported that the previously unrecognized category of public health had climbed to fifth place in terms of the number of manuscripts in dental research. These results are in agreement with another study analyzing the different fields of dentistry research in three Brazilian scientific journals between 1990 and 2004; this previous study found that the greatest number of published papers focused on restorative dentistry/dental materials and public health.⁵ Narvai states that the increase

in publications on public health is not sufficient to classify this field as one of the most productive in dental research, but a growing interest in this field seems to be a current trend.⁸

There are several interesting findings in the results for 2009. In this year there was an increase in the production of manuscripts related to the care of patients with special needs. This specialty was first registered by the Federal Council of Dentistry in 2002. Recently, this field has undergone consider-

Table 3 - Top ten institutions by number of abstracts at the 26th Annual Meeting of the Brazilian Society for Dental Research, Brazil, 2009.

Institution	Percentage of abstracts
Universidade Estadual de Campinas – Campinas ^{Pu/SE}	8.4
Universidade de São Paulo – São Paulo ^{Pu/SE}	6.0
Universidade Paulista – Araraquara ^{Pu/SE}	5.4
Universidade Paulista – Araçatuba ^{Pu/SE}	4.6
Universidade Paulista – São José dos Campos ^{Pu/SE}	4.0
Universidade de São Paulo – Ribeirão Preto ^{Pu/SE}	4.0
Faculdade de Odontologia São Leopoldo Mandic – São Paulo ^{Pri/SE}	3.9
Universidade de São Paulo – Bauru ^{Pu/SE}	2.3
Pontifícia Universidade Católica do Paraná – Curitiba ^{Pri/S}	2.2
Universidade Federal do Pelotas – Pelotas ^{Pu/S}	2.1

Pu = public institution; Pri = private institution; SE = southeastern region; S = southern region.

able development, which may be explained by the public policy of deinstitutionalization and the inclusion of individuals with special needs as well as the greater involvement of dentists in this process. Moreover, at the same time, there has also been a reduction in the relative proportion of traditional dentistry research areas in the national survey, and there are signs of a progressive increase in studies published in different disciplinary fields. These innovative fields include biosecurity and the development of new technologies and basic science such as pharmacology, biochemistry, microbiology and physiology. This increase in production in basic fields may be related to the governmental assessment of postgraduate courses and an emphasis on both the quantity and quality of scientific publications. Periodicals in basic fields generally have higher impact factors than publications in dentistry, and this discrepancy may have contributed to a drive to publish in basic areas. Simultaneously, there was also a significant increase in the number of scholarships for doctoral degrees in basic fields over the past decade. According to GEOCAPES, sandwich scholarships granted to health fields (n = 206) were more numerous than those for biological fields (n = 182) in 1999. In 2009, the number of scholarships granted for sandwich core fields (n = 495) exceeded the number of grants for health fields (n = 374).⁹ Thus, a new profile of dentistry was identified that focuses on the appreciation of science and biological foundations.

For decades, there have been disparities in devel-

opment between macro-regions in Brazil, and these discrepancies have also manifested in the distribution of scientific, technological and human resources as well as scientific production.⁴ In the present study, a greater proportion of scientific publications was found in the state of São Paulo, which contains seven of the 10 most productive Brazilian universities. Moreover, other states from southeastern and southern regions have experienced a significant increase in scientific research, with specific emphasis on the states of Paraná and Minas Gerais. This increase may be related to the high concentration (80%) of postgraduate programs in these regions.¹⁰ The federal government is responsible for policies aimed at diminishing the polarization of scientific production, and some official programs such as the National Academic Cooperation Program – New Frontiers aim to enable exchange experiences between universities in order to strengthen institutions in the northern, northeastern and central western regions.¹¹ Moreover, the National Council for Scientific and Technological Development (CNPq) has designated considerable financial resources (at least 30% in 2010, for example) for research projects coordinated by individuals affiliated with institutions in northeastern Brazil. The number of scholarships for postgraduate studies in these regions has also increased between 2002 and 2009.⁹ These policies have contributed to an increase in research production in most states, especially in Goiás, Paraíba, Rio Grande do Norte and Ceará. However, scientific

production in these regions remains low in comparison to the southeastern and southern regions. Notably, scientific publications have decreased in the Federal District and the states of Pernambuco and Bahia despite the government incentive programs.

As observed in the present study, scientific production is almost completely dependent upon the existence of universities and postgraduate programs. Approximately 70% of Brazilian research production is performed at public institutions. There are 92 postgraduate programs in dentistry in Brazil, and 34 of these programs are affiliated with private institutions, whereas the remaining 58 (63%) belong to public institutions and primarily state universities (35), followed by federal (22) and municipal (1) institutions. Among the programs at private institutions, 61.8% received a “weak” rating in the government assessment for the year 2009, indicating that the academic courses were new and not yet developed. None of the programs at private institutions received a rating of “excellent”. Among programs at public institutions, only 27.6% received a “weak” rating, while 34.5% were classified as “very good”; four programs were hailed as “excellent”. These results are likely related to the history of postgraduate education in Brazil, which has a predominance of *stricto sensu* courses in public institutions and *lato sensu* courses in private institutions. Moreover, differences between the degree of education and work culture at public institutions may influence these outcomes. This situation reflects a con-

siderably more significant scientific production from public institutions, which suggests that political actions are necessary to reduce the aforementioned disparities. The Coordination for the Improvement of Higher Education Personnel, which fosters the expansion and consolidation of postgraduate programs in all Brazilian states, has directed resources toward courses in Brazilian public and private institutions to promote the growth of scientific cooperation and integration.

Conclusions

The results of the present study suggest that a change in the profile of scientific research production may be occurring in Brazilian dentistry. With the exception of restorative dentistry/dental materials, research in fields focusing on technical and traditional professional dentistry disciplines has decreased, while increasing interest has been observed in basic fields and new specialties. Although inter-regional and inter-state discrepancies exist in Brazilian research production, this difference has tended to decrease over time. Moreover, public institutions are still responsible for the majority of dental research performed in Brazil.

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