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Trends in funding of original articles published in dentistry journals of three specialties between 2005 - 2009: A secondary research

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Abstract
Background: Funding helps in publication of articles since it is believed that funded researches are prestigious, more organized, and are of better quality. Aim was to assess the trends in funding of original articles based on geographic origin, research types and designs published in three specialty journals (2005-2009) and also to find association between funding, geographic origin and type of study.
Methods: This study is a secondary research done in library setting. Original Articles from Journals (Both National and International present between 2005 - 2009 of Public Health Dentistry, Pedodontics and Periodontics were systematically accessed from Bapuji Dental College library.
Results: Total of 2,090original articles (2005-2009) published in Public Health Dentistry (739), Periodontics (659) and Pedodontics (693) Journals were reviewed. More than half of the articles reported funding (51.9%) in Public Health Dentistry Journals, 42.5% of the published articles reported funding in Periodontics Journals, while only 26.6% of the articles reported funding in Pedodontics Journals. The most frequent source of funding was from government source in all the three journals. Most of the studies were from Europe in Public Health Dentistry Journals. Most of the funded studies were from Asia in Periodontics Journals while most of the funded studies were from Europe in Pedodontics Journals
Conclusions: Since majority of funding was from public sector this calls for collaboration of private scientific bodies and organizations to promote research publications.

Keywords: Funding, trends, research, dental

1. Introduction
In last few decades, there has been a tremendous increase in research, especially in biomedical field [1]. Conducting a research is an extensive process, requiring work force, time, material, money and so on. Procurement of these resources is an expensive business. It is mainly through funds obtained from institutions, public, or private companies that the requirements for conducting research are met. Funding helps in publication of articles since it is believed that funded researches are prestigious, more organized, and are of better quality. Since the Second World War, biomedical research has been the beneficiary of parallel advances in the physical, social, and information sciences. That momentum greatly expanded financial support for biological research, especially that related to human health. The public's imagination has been captured by the promises offered by biomedical research. Its commercial value has been readily recognized [2]. Literature search reveal that there has been a remarkable research output in last few decades. Increased contribution to biomedical research has come mainly from developed countries like USA and European countries [3]. Developed countries are different from developing countries in many aspects such as health care delivery system, health infrastructure, socio-cultural aspects, and economics. Biomedical research should occur in both developed and developing countries to improve the health of population globally [1]. Biomedical research uses many approaches to understand the etiology, prognosis, and underlying mechanism of topics of interest. Randomized controlled trials are considered as gold standard in clinical epidemiology. Apart from randomized controlled trials, there are other types of trials such as animal trials and *in vitro* trials. In order to conduct any type of trial, as mentioned before, it warrants funds and hence funding becomes important [1].
With this background, as a researcher it is our contractual obligation to find out if the money spent on different researches are truly warranted and what type of research trials are being

funded and contribution to research and funding from different geographic areas across the world. Hence, this study was planned with the aim of assessing the trends in funding, based on geographic origin, research types and designs published in the journals and also to find association among funding, geographic origin and type of study. This may aid us in understanding the variables which influence the likelihood of obtaining funds for health research.

2. Methods: Ethical clearance was obtained prior to study. A secondary research in library setting was conducted. All original articles of commonly accessed journals (Both National and International present between 2005 - 2009 of Public Health Dentistry, Pedodontics and Periodontics present in library were systematically assessed for trends in funding based on geographic origin and type of research in Bapuji Dental College library.

2.1 Journals Included

Public Health Dentistry Journals: Community Dentistry and Oral Epidemiology, Journal of Public Health Dentistry, Oral Health and Preventive Dentistry, Community Dental Health and Fluorides. Pedodontics Journals: Journal of Dentistry for Children, Journal of Indian Society of Pedodontics and Preventive Dentistry, International Journal of Pediatric Dentistry, Journal of Clinical Pediatric Dentistry and Journal of Pediatric Dentistry.

Periodontics Journals: International Journal of Periodontics and Restorative Dentistry, Journal of Clinical Periodontics, Journal of Periodontology, Journal of Periodontal Research and Periodontology 2000.

2.2 Inclusion criteria: Only original articles published in the selected dentistry journals present between 2005 and 2009 were included.

2.3 Exclusion criteria: Articles which were not original like Abstracts, letters to the editor, case reports, technical notes, editorials, errata, book reviews, commentaries, review articles and supplementary volumes.

2.4 Search strategy

A systematic search of selected journals and journal issues between 2005 and 2009 was performed manually by a single investigator. All the original articles of the journals were analyzed and the following information was collected.

a. Source of Extramural funding: Articles were classified by the source of funding as foundation, industry, research institute/ university, government, multiple sources or no funding/not reported according to Barao VA *et al*. [1]

b. Geographic origin: The geographic origin of the international articles were categorized by continent wise into North America, Europe, Asia, South America, or Others (Central America, Africa and Oceania) according to Barao VA *et al*. [1] National articles were accessed. Article which had more than one geographic origin listed, the continent of the corresponding author was selected.

c. Type of study: The articles were classified into four categories: clinical study, animal study, *in vitro* study and others (descriptive, analytical, cadaver, mathematical and multiple types). An article was classified as a multiple type when two or more research types were documented in the same manuscript.

2.5 Statistical considerations: Descriptive statistics were generated and data was presented in frequencies and percentages. Chi-square test was employed for testing the association between funding, geographic location and types of study.

3. Results

A total of 2090 original articles published in commonly accessed journals of Public Health Dentistry, Periodontics and Pedodontics Journals were reviewed between the year 2005 and 2009 present in the library of Bapuji Dental College and Hospital, Davangere.

3.1 Public Health Dentistry Journals

A total of 738 original articles were published from the year 2005 to 2009 (Table 1). More than half of the articles reported funding (51.9%). The most frequent source of funding was from government (19%) when compared to other funding sources. Most of the funded articles (14.8%) and most of the published articles (28.6%) in the 5 different journals were from Europe. There was highly significant association found between the type of funding and geographic origin. ($p = 0.000$). Descriptive and analytical studies (Table 2) were most commonly funded (44%) followed by clinical studies (4.9%). All the study types were most commonly supported by the funding from the governmental source. Significant association was found between type of studies and source of funding. ($p = 0.004$)

Out of 738 articles, most of the articles with clinical type of study (Table 3) were from Europe (3.9%). Most of the animal studies were from Asia (2.6%) while most of the in-vitro studies were from South America. Highly significant association was found between type of studies and geographic origin of the articles published. ($p = 0.000$)

3.2 Periodontics Journals

A total of 659 original articles were published from the year 2005 to 2009 (Table 4). Less than half of the articles reported funding (42.5%). The most frequent source of funding was from government (15.5%) when compared to other funding source. Most of the funded articles (16.5%) were from Asia and most of the published articles (37.3%) were from Europe in the 5 different journals. There was highly significant association found between the type of funding and geographic origin. ($p = 0.000$). With respect to the types of studies that received funding (Table 5), clinical studies were most commonly funded (15.7%) followed by others (10.5%). All the study types were most commonly supported by the funding from the governmental source except for the clinical studies which were supported by funding from foundations. Significant association was found between type of studies and source of funding. ($p = 0.004$)Out of 738 articles (Table 6), most of the articles with clinical type of study were from Europe (21.9%). Most of the animal studies (6.8%) and in-vitro studies (7.0%) were from Asia. Highly significant association was found between type of studies and geographic origin of the articles published. ($p = 0.000$).

3.3 Pedodontics Journals

In selected Pedodontics journals (Table 7), only 26.6% of the articles reported funding. The most frequent source of funding was from government (7.5%) followed by foundations (7.2%) when compared to other funding sources. Most of the funded articles (7.3%) were from Europe and most of the published articles (37.5%) were from Asia in the 5 different journals.

There was highly significant association between the type of funding and geographic origin. (p = 0.000). With respect to the types of studies that received funding (Table 8), other type of studies (descriptive, analytical, cadaver, mathematical and multiple types) were most commonly funded (18.5%). All the study types were most commonly supported by the funding from the foundation source except for the others which was supported mostly by funding from government. Highly significant association was found between type of studies and source of funding. (p = 0.000.Out of 693 articles, most of the articles with clinical type of study (Table 9) were from Asia (11.1%). Most of the animal studies (0.3%) were from South and North America and in-vitro studies (8.4%) were from Asia. Highly significant association was found between type of studies and geographic origin of the articles published. (p = 0.000).

4. Discussion

The present study showed that most of the original articles were from Europe and Asia published in five different journals of Public Health Dentistry, Periodontics and Pedodontics. The increased number of published articles in these two continents can be attributed to increased demand for publishing due to increased production of research data. However, to our best knowledge present study is first of its kind done among these three subject journals, hence comparisons could not be done. Funding mechanisms vary in different continents. The majority of the articles from Asia and North America received funding from governmental sources. Studies from Asia and North America were represented most frequently by Japan and USA, respectively. In these two countries governments have taken action to provide financial support for research in efforts to encourage economic growth [6, 7]. While most of the articles from South America and Europe received funding from the source of foundations where these research support foundations aim to support the research and innovation, encourages in particular proposals, pioneering ideas that address new and emerging fields and applications that introduce unconventional, innovative approaches [8, 9]. In Public Health and Pediatric dentistry journals, studies like descriptive, analytical, cadaver, mathematical and multiple types were funded more commonly compared to Periodontology journals where clinical studies were more funded. Subjects of Periodontics has more clinical ramifications compared to Public Health Dentistry and Pedodontics perhaps that is the reason why other type of studies are funded more in Public Health and Pedodontics journals compared to Periodontology journals where clinical studies are more funded. The other possible reason could be that the monetary investment is lower for other types of studies than it would be for animal, clinical or in-vitro studies. The limitation of the present study is that it reviewed only original articles of journals from three specialties over a period of only 5 years This may not truly represent all the characteristics of these journals to the utmost accuracy. Therefore, the findings of this study may limit generalization of these results to other journals, specialties, and the dental literature as a whole. Hence, further studies including current journals which help in understanding the patterns of funding across different geographic regions of world are needed. This may aid us in understanding the factors which influence the likelihood of obtaining funds for health research and proper utilization of funds in health research.

Table 1: Distribution of articles based on place and funding source in Public Health Dentistry Journals.

Place	Source of Funding (Percentage of articles)						
	Foundation	**Industry**	**Government**	**University**	**Multiple**	**No Funding**	**Total**
North America	0.7%	0.8%	6%	1.5%	5.4%	11.2%	25.6%
Europe	3.7%	0.8%	4.5%	2.4%	3.4%	13.8%	28.6%
Asia	1.2%	0.5%	4.6%	4.3%	1.8%	11.7%	24.2%
South America	1.2%	0%	3%	0.5%	0.5%	7.0%	12.3%
Others	1.1%	0.1%	0.9%	1.2%	1.6%	4.3%	9.3%
Total	7.9%	2.3%	19%	10%	12.7%	48.1%	100%
Total articles = 738 degrees of freedom = 20 X^2 = 68.742 p = 0.000* X^2 = Chi-square value, df = degree of freedom, p = probability value, * Highly Significant							

Table 2: Distribution of articles based on type of study and source of funding, in Public Health Dentistry Journals

Type of study	Funding source (Percentage of articles)						
	Foundation	**Industry**	**Government**	**University**	**Multiple**	**No Funding**	**Total**
Clinical	0.9%	0.7%	1.2%	0.9%	1.2%	4.3%	9.3%
Animal	0.0%	0.0%	0.7%	1.2%	0.0%	2.2%	4.1%
In-vitro	0.3%	0.1%	0.3%	0.1%	0.1%	1.6%	2.6%
Others	6.6%	1.5%	16.8%	7.7%	11.4%	40%	84%
Total	7.9%	2.3%	19%	10%	12.7%	48.1%	100%
Total articles assessed = 738 df = 15 X^2 = 33.818 p = 0.004* X^2 = Chi-square value, df = degree of freedom, p = probability value, *Significant							

Table 3: Distribution of articles based on place of funding and study type in Public Health Dentistry Journals

Place of funding	Type of study (Percentage of articles)				
	Clinical	**Animal**	***In vitro***	**Others**	**Total**
North America	0.8%	0.3%	0%	24.5%	25.6%
Europe	3.9%	0.9%	0.7%	23.0%	28.6%
Asia	2.2%	2.6%	0.8%	18.6%	24.1%
South America	1.9%	0.1%	0.9%	9.3%	12.3%
Others	0.5%	0.1%	0.1%	8.5%	9.3%
Total	9.3%	4.1%	2.6%	84.0%	100.0%
Total articles assessed = 738 df = 12 X^2 = 63.876 p = 0.000* X^2 = Chi-square value, df = degree of freedom, p = probability value,*Highly significant					

Table 4: Distribution of articles based on place of funding and funding source in Periodontics Journals

Place of funding	Funding source (Percentage of articles)						
	Foundation	Industry	Government	University	Multiple	No Funding	Total
North America	0.9%	0.8%	2.6%	1.5%	0.9%	5.8%	12.4%
Europe	3.6%	2.7%	1.8%	3.3%	0.8%	25.0%	37.3%
Asia	2.4%	.9%	9.1%	2.7%	1.4%	15.8%	32.3%
South America	3.6%	0%	1.7%	0%	0.6%	3.9%	9.9%
Others	0.5%	0.2%	0.3%	0%	0.2%	7.0%	8.0%
Total	11.1%	4.6%	15.5%	7.6%	3.8%	57.5%	100.0%
Total articles assessed = 659 df = 20 X^2 = 138.664 p = 0.000 * X^2 = Chi-square value, df = degree of freedom, p = probability value, * Highly significant							

Table 5: Distribution of articles based on type of study and funding source in Periodontics Journals.

Type of study	Funding source (Percentage of articles)						
	Foundation	Industry	Government	University	Multiple	No Funding	Total
Clinical	4.2%	3.3%	3.3%	3.5%	1.4%	24.1%	39.9%
Animal	3.0%	.3%	3.3%	0.9%	0.3%	7.3%	15.2%
In-vitro	2.4%	0.6%	3.2%	1.4%	0.8%	5.3%	13.7%
Others	1.4%	.3%	5.6%	1.8%	1.4%	20.8%	31.3%
Total	11.1%	4.6%	15.5%	7.6%	3.8%	57.5%	100.0%
Total articles assessed = 659 df = 15 X^2 = 65.121 p = 0.000* X^2 = Chi-square value, df = degree of freedom, p = probability value, *Highly significant							

Table 6: Distribution of articles based on place of funding and study type in Periodontics Journals

Place of funding	Clinical	Animal	*In vitro*	Others	Total
North America	5.0%	2.1%	2.0%	3.3%	12.4%
Europe	21.9%	3.6%	3.6%	8.2%	37.3%
Asia	9.7%	6.8%	7.0%	8.8%	32.3%
South America	2.9%	2.6%	0.9%	3.5%	9.9%
Others	0.5%	0%	0.2%	7.4%	8.0%
Total	39.9%	15.2%	13.7%	31.3%	100.0%
Total articles assessed = 659 df = 12X^2 = 158.603p = 0.000 * X^2 = Chi-square value, df = degree of freedom, p = probability value, *Highly significant					

Table 7: Distribution of articles based on place of funding and funding source in Pedodontics Journals.

Place of funding	Funding source (Percentage of articles)						
	Foundation	Industry	Government	University	Multiple	No Funding	Total
North America	1.0%	0.3%	1.6%	0.7%	2.6%	14.9%	21.1%
Europe	2.6%	0%	2.0%	1.4%	1.3%	12.0%	19.3%
Asia	0.7%	0.3%	1.0%	3.0%	0%	32.5%	37.5%
South America	2.5%	0.1%	2.5%	0.7%	0.4%	12.7%	18.9%
Others	0.4%	0%	0.4%	0.6%	0.3%	1.4%	3.2%
Total	7.2%	0.7%	7.5%	6.5%	4.6%	73.4%	100.0%
Total articles assessed = 693 df = 20 X^2 = 99.295 p = 0.000* X^2 = Chi-square value, df = degree of freedom, p = probability value, * Highly significant							

Table 8: Distribution of articles based on type of study and funding source in Pedodontics Journals.

Type of study	Funding source(Percentage of articles)						
	Foundation	Industry	Government	University	Multiple	No Funding	Total
Clinical	1.4%	0.4%	1.0%	1.2%	.3%	19.2%	23.5%
Animal	0.3%	0.1%	0%	0%	0%	0.3%	.7%
In-vitro	1.4%	0%	0.7%	1.0%	0%	15.3%	18.5%
Others	4.0%	0.1%	5.8%	4.3%	4.3%	38.7%	57.3%
Total	7.2%	0.7%	7.5%	6.5%	4.6%	73.4%	100.0%
Total articles assessed = 693 df = 15 X^2 = 71.983 p = 0.000* X^2 = Chi-square value, df = degree of freedom, p = probability value, *Highly significant							

Table 9: Distribution of articles based on place of funding and study type, in Pedodontic Journals

Place of funding	Type of study (Percentage of articles)				
	Clinical	Animal	*In vitro*	Others	Total
North America	2.3%	0.3%	2.2%	16.3%	21.1%
Europe	3.9%	0.1%	1.7%	13.6%	19.3%
Asia	11.1%	0%	8.4%	18%	37.5%
South America	4.8%	0.3%	5.6%	8.2%	18.9%
Others	1.4%	0%	0.6%	1.2%	3.2%
Total	23.5%	0.7%	18.5%	57.3%	100%
Total articles assessed = 693 df = 12 , X^2 = 70.324 p = 0.000 * X^2 = Chi-square value, p = probability value, *Highly significant					

5. Conclusions

In Public Health Dentistry Journals more than half of the articles reported funding. The most frequent source of funding was from government. Most of the published articles were from Europe. Most of the articles with clinical type of study were from Europe. In Journals of Periodontics less than half of the articles reported funding. The most frequent source of funding was from government. Most of the funded articles were from Asia. Majority of the clinical studies were from Europe. In Journals of Pedodontics most frequent source of funding was from government. Most of the funded studies were from Europe and majority of the published articles were from Asia. Majority of the clinical studies were from Asia.

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