A bibliometric analysis of the pediatric dental literature in MEDLINE

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Abstract

Purpose: *The purpose of this study was to estimate the availability of dental literature between 1989 and 1998 in seven disciplines within pediatric dentistry by using a bibliometric analysis on MEDLINE and to compare the results to that for adolescents and adults.*

Methods: *A search strategy was developed for each discipline incorporating dental vocabulary obtained from the MEDLINE Medical Subject Heading (MeSH) index. The number of articles retrieved from MEDLINE for adolescents and adults (> 13 yo) was compared to those for children (< 12 yo) in seven dental disciplines: dental implants, endodontics, oral medicine/radiology, oral surgery, orthodontics, periodontics, and restorative dentistry.*

Results: *There was an average of 8,097 dental articles published each year for the combined seven disciplines studied with an eight-fold range from 327 articles/year for endodontics to 2,765 articles/year for oral medicine/radiology. Of the mean number of articles published each year, 1,273 (16%) were limited to children, while the remaining 6,824 (84%) were on adolescents and adults. The number and percentage of children articles relative to the total number of publications on children ranged from 7 articles/year (1%) for dental implants to 528 articles/year (42%) for oral medicine/radiology. Implant dentistry publications increased the fastest, growing at an average yearly rate of 25%, followed by restorative dentistry (9%), endodontics (9%), oral surgery (6%), orthodontics (6%), periodontics (3%), and oral medicine/radiology (2%).*

Conclusions: *There is a substantial amount of literature in pediatric dentistry upon which to base clinical decisions. Within this large body of literature, there is a significant amount of variation between the various dental disciplines examined. To stay current, one would need to read and absorb approximately 24 articles each week over 52 weeks per year in more than 75 different journals. Furthermore, the volume of literature is increasing each year, making access even more difficult. These trends suggest the need for computer systems that will facilitate access and retrieval of clinically useful literature.(Pediatr Dent 23: 415-418, 2001)*

The rise of technology in dentistry is making it increasingly difficult for clinicians to keep current with recent technological advances.[1] So now, more than ever, clinicians are turning to the literature to help them sift through what works and what does not work. With increasing emphasis on the need for evidence-based clinical decision making in pediatrics, attention is being placed on the availability of high quality clinical trials.[2] The reason for this is that access to computer-based communication networks and online-critically-appraised medical information can potentially improve clinical decision making by increasing information availability.[3,4]

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One method for assessing information availability is bibliometric analysis, the use of statistical methods to analyze a body of literature to reveal historical development.[5] Assessment of the scientific literature consists of three steps: 1) retrieval and assessment of the availability of evidence; 2) evaluation of the quality of the evidence; and 3) synthesis of the combined evidence from multiple studies to draw inferences about the evidence on a particular topic.[6,7]

Similar methods of bibliometric assessment are currently being used by the U.S. National Academy of Science for evaluating research programs.[8] Bibliometric methods also have been used for evaluating medical progress in cardiology,[9] audiology,[10] mental health,[11] epilepsy,[12] emergency medicine,[13] medical diagnosis,[14] allied health,[15] arthritis,[16] endodontics,[17] orthodontics,[18] and pediatric surgery.[19]

This study focuses on the first step: retrieval and estimation of the availability of literature in pediatric dentistry that one can potentially use to make clinical decisions. This is a very important step because if either no literature is available or one cannot gather the literature, the clinician will not have the evidence necessary to improve clinical treatments and decisions in pediatric dentistry.

The purpose of this study was to estimate the availability of dental literature between 1989 and 1998 in seven disciplines within pediatric dentistry by using a bibliometric analysis on MEDLINE and comparing the results to that for adolescents and adults.

Methods

Literature search

A MEDLINE search strategy was developed for seven dental disciplines: endodontics, implant dentistry, oral surgery, oral medicine/radiology, orthodontics, periodontics, and restorative dentistry. Medical Subject Headings (MeSH) were used to

Table 1. The Mean Number of Articles Published Each Year Cited in MEDLINE for Seven Dental Disciplines, Published in English About Humans, From 1989 Through 1998

	Children	Adolescents and adults	Total articles
Oral medicine	528	2,237	2,765
Orthodontics	307	868	1,175
Oral surgery	151	689	839
Periodontics	139	1,094	1,233
Restorative dentistry	107	1,246	1,353
Endodontics	35	293	327
Implant dentistry	7	397	404
Total	1,273	6,824	8,097

Table 2. The Percentage of Articles Published and Corresponding Rank Order Within Each Discipline For Each Age Category

	Children (N=1,273)		Adolescents and adults (N= 6,824)		*p* value	Total (N=8,097)	
	%	Rank order	%	Rank order		%	Rank order
Oral medicine	42	1	33	1	< 0.01	34	1
Orthodontics	24	2	13	4	< 0.01	15	4
Oral surgery	12	3	10	5	< 0.01	10	5
Periodontics	11	4	16	3	< 0.01	15	3
Restorative dentistry	8	5	18	2	< 0.01	17	2
Endodontics	3	6	4	7	< 0.01	4	7
Dental implants	1	7	6	6	< 0.01	5	6

For each discipline, percentages were calculated by dividing the mean number of articles published each year for that discipline by the mean number of articles published each year for all disciplines

capture each discipline. A MeSH is the current authority list for the subject biomedical literature at the National Library of Medicine.[20] Literature searches were performed using the Ovid Web Gateway (Ovid Technologies, Inc, NY, NY) Internet interface for MEDLINE (http://gateway.ovid.com).

Literature stratification

For each MEDLINE search strategy, the identified literature was limited to humans, with articles written in English and published between the years 1989 to 1998 (inclusive). The identified literature was then divided into articles on either children (< 12 years old) or adolescents and adults (>13 years old). The articles were then stratified by year. This stratification yielded the annual number of articles published each year by discipline. After obtaining the annual number of articles published in each year for all seven disciplines, the average annual publication rate was calculated over the 10-year period. In order to determine the dynamics of annual publication rate within each discipline, the time courses (number of publications/year) over 10 years for each discipline were calculated.

Statistical analysis

The data obtained was analyzed using Instat 2.01 for Macintosh (Graphpad Software, Inc, San Diego, CA). Paired t-test was used to compare the number of articles published for adolescents + adults versus children for each dental discipline. An analysis of variance (ANOVA) was performed to compare the means for children between each discipline. Spearman rank correlation and linear regression were used to determine differences over time. Graphics were prepared using Delta Graph Pro 4.0.1 for Macintosh (SPSS Inc., Chicago IL).

Results

Table 1 presents the mean number of articles published each year cited in MEDLINE by discipline. There was an average of 8,097 articles published per year for the combined seven disciplines studied. When this annual publication rate was broken down by discipline, there was approximately an eight-fold range: from 327 articles/year for endodontics to 2,765 articles/year for oral medicine/radiology.

Sixteen percent (1,273/8,097) of the articles were limited to children (< 12 years old), while the remaining 84% (6,824/8,097) were limited to adolescents and adults (>13 years old). The mean number of articles/year on adolescents and adults was significantly larger than the mean number of articles/year on children for all disciplines ($p < 0.001$).

A mean number of 1,273 articles were published each year for children in the combined seven disciplines. There was approximately a 75-fold range in the number of articles published each year by discipline from 7 articles/year for implant dentistry to 528 for oral medicine/radiology.

A mean number of 6,824 articles/year was published for adolescents and adults in the combined seven dental disciplines. There was approximately a seven-fold range in the number of articles published each year by discipline from 293 articles/year for endodontics to 2,237 for oral medicine/radiology.

Table 2 depicts the mean number of articles/year for both children and that of adolescents and adults in a particular discipline as a percentage of the mean number of all articles/year, along with the corresponding rank order. The discipline with the greatest percentage of children articles/year was oral medicine/radiology (42%), and the discipline with the lowest percentage was dental implants (1%).

The greatest percentage of articles/year on adolescents and adults was also oral medicine/radiology (33%), and the discipline with the lowest percentage was endodontics (4%). For all disciplines, the mean percentage of articles/year for children was significantly less than that for adolescents and adults ($p < 0.01$).

Table 3 displays the average percentage increase in published articles/year for both children and adolescents and adults along with the corresponding rank order. The total number of

articles on children increased at an average rate of 4%, while the total number of articles on adolescents and adults only increased at 3%. The difference in these rates was not statistically significant (p>0.36).

When the articles published on children were analyzed, implant dentistry publications increased the fastest, growing at an average yearly rate of 25%, while the publication rate for oral medicine/radiology increased the slowest (2%).

For articles on adolescents and adults, implant dentistry publications also grew at the fastest rate (9%), while the publication rate for restorative dentistry increased the slowest (1%). For each discipline, when these percentage increases for children were compared to that for adolescents and adults, the percentage increases were not statistically significantly different.

Discussion

This is the first study to estimate the quantity of pediatric dental literature available on MEDLINE for potential evidence-based clinical decision making from 1989 to 1998 and compare that to those published during the same period for both children and adolescents and adults.

The total number of articles on children increased at an average rate of 4% while the total number of articles on adolescents and adults only increased at 3%, but this difference was not statistically significant. This means that compared to general dentistry, pediatric dentistry has a volume of evidence that is growing at a rate comparable to that for general dentistry. Nevertheless, saying that the seven disciplines studied are representative of all of pediatric dentistry and general dentistry is probably an oversimplification. Thus, additional studies are needed to determine if these seven disciplines are truly representative of all pediatric and general dentistry.

The discrepancies in publication growth rates could be due to new advances or techniques leading to more growth and research in some disciplines in pediatric dentistry compared to others. Large growth rates such as 25% for dental implants also may be due to its low baseline starting point Thus, any increase would result in a relatively larger percentage increase.

Though the average percentage increases for children versus adolescents and adults is not significant, it is still interesting to note discrepancies in rank order. For example, the average percentage increase for restorative dentistry is ranked second for children and seventh for adolescents and adults. This discrepancy suggests that publications of restorative dentistry in children may be growing due to the recent interest in new techniques and materials being used in pediatric dentistry such as glass ionomers, compomers, resin-reinforced glass ionomers, sealants, etc. Also of interest to note is that for orthodontics, the average percentage increase in number of articles published/year was ranked fifth in children, but ranked second for adolescents and adults. This suggests a growing interest in treating malocclusion among adults.

In determining which of the large number of topics within pediatric dentistry that should be studied, the selected seven disciplines were chosen because they are common disciplines within the specialty of dentistry. The disciplines were also chosen because they were relatively easy to define and search. Other disciplines such as preventive dentistry, community dentistry, and dental public health were much more difficult to define and find specific subject headings for. In the future, articles available in other disciplines and topics, such as preventive dentistry, trauma, etiology, prognosis, and dental public health, should also be considered.

Table 3. Yearly Average Percentage Increase in Number of Articles Published/Year for Each Discipline

	Children (n=1,273)		Adults and adolescents (n=6,824)		*p* value	Total (n=8,097)	
	%	Rank order	%	Rank order		%	Rank order
Dental implants	25	1	9	1	0.36	9	1
Restorative dentistry	9	2	1	7	0.36	2	7
Endodontics	9	3	4	3	0.59	4	3
Oral surgery	6	4	3	5	0.53	3	5
Orthodontics	6	5	5	2	0.69	5	2
Periodontics	3	6	3	4	0.88	3	4
Oral medicine	2	7	2	6	0.92	2	6
All 7 disciplines	4		3			3	

For each discipline, percentages were calculated by dividing the difference between number of articles for 1989 and 1990 by the number of articles for 1989. This calculation was then repeated for years 1990 to 1998 and the percentages then averaged over a 10-year period.

It should be noted that this study had several limitations. First, in developing the search strategy, the MEDLINE MeSH index was used to determine appropriate subject headings to use to search each discipline. Mostly, subject headings were unique to each discipline. However, some subject headings were not. For example, the topic "dental bonding" is relevant to the discipline of restorative dentistry. However, articles pertaining to orthodontic bracket bonding also appeared as a result. In this case, the keyword "orthodontic brackets" was applied to eliminate these articles from the restorative dental bonding articles. Nevertheless, this method of filtering is somewhat subjective and does not guarantee absolute elimination of irrelevant articles.

Thus, certain relevant studies may have been omitted, while other irrelevant articles may have been included. Second, the subject headings used in the MEDLINE search were limited to MeSH vocabulary. The word selection was meant to be inclusive, but it may have excluded some relevant articles. Third, the classification of articles under different keywords and subject headings is a subjective process. That is, many people contribute in the classifying of articles in MEDLINE, and their views of classification may vary. For instance, what might be "temporomandibular joint disorders" to one person may be "temporomandibular joint dysfunction syndrome." The former is a MeSH under Oral Surgery while the latter is a MeSH under Orthodontics.

It should also be noted that the age categorization was arbitrary. The American Academy of Pediatric Dentistry defines pediatric dentistry as oral health care "…for infants and children through adolescence…,"[21] whereas the Heinemann Dental Dictionary defines pediatric dentistry as "care and treatment of teeth and oral conditions in children" (i.e. not including adolescents).[22] It was a difficult decision whether or not to include adolescents in the "pediatric" age category. The decision was made not to include adolescents in the child age group since children enter the permanent dentition by approximately age 13.[23] If studies included both subjects under 13 and over 13, the study would be classified into either children group or adolescent group according to the individuals working for MEDLINE. It is important for the reader to keep in mind that the data presented here represents estimates only.

The importance of this study was to assess the availability of pediatric dental literature that one can potentially use to make clinical decisions. Further, given the growing body of pediatric dental literature, one can expect this number to continually increase. Further assessments are needed to critically appraise the quality of the identified articles. This can be done by categorizing the evidence by quality levels using guidelines from the Agency Health Care Policy (Acute Pain Management, 1992) and the Centre for Evidence-based Medicine (http://cebm.jr2.ox.ac.uk/docs/levels.html). With access to these methodological filters, the clinician could quickly narrow his search down from an overwhelming number of articles that contain both low and high-quality evidence to a more manageable number of high-quality articles resulting in a more easily made, well-informed clinical decision.

Conclusions

If all of the publications on children are of high clinical applicability, then pediatric dentists would need to read, digest, and implement into clinical practice approximately 24 articles each week during their careers to keep current. Thus, by providing unbiased access and quick retrieval of publications, structured search strategies and the associated benchmarking applications can be useful in answering specific clinical questions.

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