

Trends in dental and medical research and relevance of randomized controlled trials to common activities in general dentistry

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The aim was to study publication trends in dental and medical research as well as the proportion of randomized controlled trials in dental research (RCT-Ds) of relevance to common activities in general dentistry. The study was based on Medline searches, 1969–99 (MeSH terms). Data from Public Dental Services (county of Östergötland, Sweden) were used to find the most common activities in the practice of general dentistry. In dental research the annual number of publications had decreased from 5,900 in 1969 to 4,400 in 1999, corresponding to 9,100 and 14,000, respectively, in medical research. Clinical trials in dental research had increased to 7% and RCT-Ds to 5% of all dental research during 1969–99. In medicine, clinical trials and randomized controlled trials had increased to 2% and 1%, respectively. In dental and medical research, meta-analyses (MAs) totalled 0.1–0.2% in 1994 and 1999. One out of 200 dental research publications in 1979–99 was an RCT-D of relevance to the most common activities in general dentistry. These activities contributed to more than 80% of the dental care of children and adolescents and to more than 60% of the dental care of adults in 1999. □ *Evidence-based dentistry; evidence-based medicine; oral surgery; periodontics; public health dentistry*

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Evidence-based medicine was established in the early 1990s and has been described as the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients (1). Collaboration groups within evidence-based dentistry and medicine have subsequently been developed around the world, initiated in Europe by the founding of the Cochrane Collaboration in Oxford and followed by Britain's Centre for Review and Dissemination in York, among others (1–3). These collaboration groups search for and review existing evidence, but also point out areas where evidence is absent or scarce and where there is a need of further research (2–4). However, the development and acceptance of evidence-based dentistry and medicine in general practice has been fairly limited so far (1). Tradition-based healthcare with adherence to old, well-known, generally accepted concepts and to individual intuition and knowledge is successively being replaced by a novel evidence-based approach to problem-based learning in clinical practice (4). When seeking evidence about methods of prevention or treatment effects, a randomized controlled trial (RCT) with relevant outcome measures is the preferred study design (5, 6). The strength of evidence has suggested an order of hierarchy, from the most to the least valuable (7). Results from several smaller, independent RCTs are sometimes insufficient for providing evidence for a clinical question. Correctly conducted systematic reviews, such as meta-analyses (MAs), may be helpful (3). The quality and value of an MA, however, is largely dependent on the criteria on which RCTs are included in the review and demand expertise (8–10). The

included RCTs may have been focused on different outcome measures, thus preventing conclusions from the MA from being drawn directly about individual patients in various clinical situations (8).

Evidence-based practice requires the integration of research evidence with clinical expertise, and patient values and demands. For this, new clinician skills are needed in finding and appraising the evidence in individual patient situations (1, 6). The dental research community is currently being accused of paying little attention to clinical care and for insufficiently supplying evidence to general dentistry (2). When evidence is to be found, Medline is one of the major biomedical bibliographic databases containing citations from approximately 3,900 current biomedical journals in the fields of dentistry, medicine, nursing, healthcare sciences, and the preclinical sciences, among others (6). This study was performed with the aim of elucidating the number and proportion of publications and secular trends in dental and medical research available on Medline related to most common clinical activities in general dentistry.

Material and methods

Medline searches

The Medline database (Entrez PubMed, www.ncbi.nlm.nih.gov) was searched for publications by one of the authors (PS) (during the period 27 March 2000 to 3 April 2000). Inclusion criteria in the searches were: (i) MeSH

Table 1. Number of clinical trials (CTs), randomized controlled trials (RCTs), meta-analyses (MAs), and publications in total in dental and medical research on Medline, 1969–99 (percentage within parentheses)

Year	CTs		RCTs		MAs		In total	
	Dental	Medical	Dental	Medical	Dental	Medical	Dental	Medical
1969	42 (0.7)	37 (0.4)	2 (<0.1)	3 (<0.1)	0 (0.0)	0 (0.0)	5911	9099
1974	95 (1.6)	43 (0.4)	2 (<0.1)	8 (0.1)	0 (0.0)	0 (0.0)	5950	9820
1979	69 (1.3)	40 (0.4)	13 (0.2)	12 (0.1)	0 (0.0)	0 (0.0)	5480	10099
1984	75 (1.1)	57 (0.8)	22 (0.3)	26 (0.3)	0 (0.0)	0 (0.0)	6531	7431
1989	156 (2.1)	93 (1.0)	63 (0.9)	51 (0.6)	0 (0.0)	0 (0.0)	7317	8920
1994	330 (6.3)	233 (2.0)	203 (3.9)	157 (1.4)	11 (0.2)	12 (0.1)	5221	11496
1999	317 (7.2)	283 (2.0)	224 (5.1)	169 (1.2)	8 (0.2)	28 (0.2)	4431	14069

terms: ‘dentistry’, ‘endodontics’, ‘orthodontics’, ‘periodontics’, ‘prosthodontics’, ‘public health dentistry’, ‘surgery, oral’, ‘medicine’, ‘specialties, medical’, ‘specialties, surgical’, (ii) publication years 1969–99 (5-year intervals), and (iii) publication types ‘clinical trial’ (CT), ‘meta-analysis (MA)’, or ‘randomized controlled trial (RCT)’.

Number and proportion of publications

The total number of publications as well as the number and proportion of published CTs, MAs, and RCTs in every search (MeSH term) were calculated. To test the search validity, the proportion of false inclusions was calculated for the search results of randomized controlled trials in dental research (RCT-Ds) during the period 1979–99 (MeSH-term ‘dentistry’). Of these 1.9% hits were false, belonging to fields other than dental research.

Activities in general dental care

To find the most common activities in general dentistry for children and adolescents, as well as for adults, data were obtained from the Public Dental Services in the county of Östergötland, Sweden, 1999. The statistics included 66,031 children and adolescents with a mean age of 11 years (median 12 years, range 0–19 years) and 88,398 adults with a mean age of 45 years (median 50 years, range 20–100 years).

For children and adolescents, the activities were calculated as percentages of total treatment time (289,000 h), whereas for adults the activities were calculated as percentages of the total economic value (132×10^6 Swedish crowns) of all registrations. The three highest percentages in both categories were considered in this study.

Published RCT-Ds of relevance to the most common activities in dental care. Abstracts of all RCT-Ds (MeSH-term dentistry) from 1979–99 (5-year intervals) were examined for relevance and located to the following domains; examinations, prevention, or restorative treatments in general dental care. Published RCT-Ds of relevance within each

domain were calculated in proportion to the total number of RCT-D search hits in dentistry (MeSH term).

Results

Number and proportion of publications in dental and medical research

Medline searches revealed that a 25% decrease occurred in the number of annual publications in dental research between 1969 and 1999, although a peak was seen in 1989. In contrast, in medical research the annual number of publications had increased by 55%, but a transient decrease was seen in 1984 (Table 1).

The number and proportion of clinical trials in both dental (CT-Ds) and medical research (CT-Ms) had increased between 1969 and 1999. Also, RCT-Ds and randomized controlled trials in medical research (RCT-Ms) had increased in the same period (Table 1).

The different fields of dental research, except oral surgery, had an overall similar proportional increase of published CT-Ds and RCT-Ds (Table 2) as dental research in total (Table 1).

The largest proportion of published CT-Ds (21%) and RCT-Ds (16%) was seen in periodontology in 1999 (Table 2), with about threefold larger proportions than in dental research in total (Table 1).

No MAs were found in the searches before 1994. In dental research the proportion of MAs was 0.2% in 1994 and 1999 and, in medical research, 0.1% in 1994 and 0.2% in 1999 (Table 1).

RCT-Ds of relevance to the most common activities in general dental care. General dental care statistics revealed that examinations, prevention, and restorative treatments were the most common activities in child and adolescent dental care. Examinations and restorative treatments were the most common activities in adult dental care (Table 3).

Examination of published RCT-Ds 1979–99 revealed that 28% of the RCT-Ds (i.e. about 0.5% of all publications in dental research) were of relevance to examinations, prevention, or restorative treatments in

Table 5. Major subcategories* covered by randomized controlled trials in dental research (RCT-Ds) on Medline, 1979–99, within the domains examination, prevention, and restorative treatment in general dentistry

Examination	(n = 5)	Prevention	(n = 147)	Restorative treatment	(n = 45)
Periodontal probing	3	Caries prevention	29	Composite restorations	20
Plaque index	1	Gingivitis prevention	33	Glass ionomer restorations	12
Risk assessment	1	Plaque control	64	Amalgam restorations	5
		Instruction and promotion	11	Others	8
		Others	10		

* Some publications covered more than one subcategory why the total number of RCT-Ds in each domain does not equal the number of RCT-Ds (Table 6).

of the RCT-Ds, which was beyond the scope of this study, will subsequently be elucidated.

Although, the total number of annual publications in dental research decreased in the period 1969 to 1999, there was a proportional increase of CT-Ds and RCT-Ds. On the contrary, in medical research the annual number of publications increased in the same period, but the proportional increase of RCT-Ms was of a smaller magnitude than in dental research. The relative effect of the increased number of published CT-Ms and RCT-Ms was lowered by a simultaneous increase in the total number of publications, but may also partly be explained by a larger proportion of non-clinical fields in medical research.

We used a local database at PDS, which showed that examinations, prevention, and restorative treatments were the most common of all activities in general dental care of children and adolescents. Thus, data from the same individual may have been registered several times. Examinations and restorative treatments were the most common activities in general dental care of adults. We included prevention in the study as well, since in the

current payment and registration system, a large part of the preventive interventions for adults during the examination visit are not registered separately and cannot be isolated in statistics (12). This is also supported by earlier studies that have shown prevention to be one of the three most common activities in Swedish general dentistry, although minor variations occur (13–15).

Results from high quality RCTs and well-performed systematic reviews, such as MAs, are considered strong evidence in evidence-based medicine and dentistry (1, 2, 6). In both dental and medical research, MAs contributed to 0.1–0.2% of all publications during 1994 to 1999, in line with earlier observations (4, 16). MAs may be conducted, for example, in order to answer clinically relevant questions when the results from several available RCTs are insufficient to provide a clear answer (2–4). However, this approach has been a matter of controversy (8–10). It is also suggested that, due to a small proportion of RCT-Ds, difficulties may arise when systematic reviews in dentistry are to be made (2).

Recently, Källestål et al. (17) showed that, despite different caries-preventive strategies for children and

Table 6. Major journals from which the randomized controlled trials in dental research (RCT-Ds), of relevance to examination, prevention, and restorative treatment in general dentistry, were derived, 1979–99

Journal*	RCT-Ds			
	Examination	Prevention	Restorative treatment	Total
J Clin Periodontol	3	22		25
Caries Res		13	3	16
J Periodontol	1	11		12
Am J Dent		4	5	9
Community Dent Oral Epidemiol		5	3	8
J Clin Dent		6		6
J Prosthet Dent			6	6
Scand J Dent Res / Eur J Oral Sci	1	5		6
Am J Orthodont Dentofacial Orthop		4		4
Int Dent J		4		4
J Dent			4	4
Acta Odontol Scand		2	1	3
Br Dent J			3	3
Int J Paediatr Dent	1	2		3
J Oral Rehabil			3	3
Pediatr Dent		3		3
Quintessence Int		2	1	3

* Journals with 3 or more cited RCT-Ds in total within the domains examination, prevention, and restorative treatment.

adolescents in four Nordic countries, the dental health of the children varied very little. Limited economic resources in dentistry and in healthcare may lead politicians and healthcare managers to consider reducing the costs when priorities have to be set, for example, by eliminating non-evidence-based preventive activities in dentistry (17–19).

Studies that shed light on areas where research priorities should be set are needed, and there is a strong need to identify the gaps in our knowledge. The fact that the number of publications in dental research had decreased during the period 1969–99, but also, that CT-Ds, RCT-Ds, and MA-Ds were not well represented are alarm signals which cannot be ignored if we are to practice evidence-based dentistry in the future. Thus, strategies for improving this record are urgently needed. This may be achieved by a holistic, international approach, with collaborations among dental researchers and practitioners aiming towards the practice of evidence-based dentistry and towards high qualitative dental research. The ultimate objective of such an approach should be to improve public oral health. However, it cannot be sufficiently emphasized that studies with inappropriate study design will contribute rather with further confusion than with evidence (5, 6). We propose that future clinical research should prioritize properly designed trials of relevance to common activities in general dental care, where they are most needed and where the largest impact on public oral health may be achieved. Individual outcomes as well as outcomes on population level remain to be evaluated for interventions in general dentistry (2). Furthermore, the effectiveness and efficiency of current methods need to be appraised critically. Thus, efforts should be made to seek evidence-based grounds for every-day practice of general dentistry.

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