

Children's dental healthcare quality using several outcome measures

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The aim of this study was to measure the quality of children's dental healthcare from the oral health records of 10-year-olds and from the numbers of children in risk groups. The focus was on dental healthcare and markers of dental records. A representative sample of women expecting their first child was selected in southwestern Finland. Children's dental health, $dmft/DMFT = 0$, was recorded in 45% of cases with a mean DMFT index of 0.5, and $dmft/DMFT \geq 5$ in 15% of the children. Late-appearing caries (caries-free at the age of 5 years but caries-existing thereafter) was present in 31% (258/828) of the children. The focus on restorative dental healthcare was appropriate. The use of sweets was documented in 23% of cases and tooth-brushing in 28%. A total of 26% of the children had gingivitis in every segment. The study illustrates that only one of the targets has been fully reached. □ *Children's caries; children's dental health; health counseling; health education; quality of dental healthcare*

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Since 1972, when the Primary Health Act (1) was introduced, Finnish children have had the opportunity to attend regular high-quality dental healthcare as part of public dental healthcare services. In the last quarter of the century, children's dental health reached an acceptable level, but in recent years this development may have reversed (2, 3). The number of individual dental check-ups has diminished and remaining resources are now focused on children at high risk of developing caries. In Sweden, Wendt et al. have observed a similar trend of fewer check-ups than previously (4). The objective of healthcare is to achieve a fixed benefit or health effect by the most technically efficient and cost-effective methods (5). A marginal product of dental health is the benefit that may be obtained from the least input, and an increase in this marginal product through check-ups has been the principle to follow. Sometimes the consequences can be zero or even decreased dental health (diminishing marginal product), in which case an improvement in quality will not be achieved unless certain critical factors are taken into account. Finland was the only industrialized pilot country to participate in the WHO Health for All by the Year 2000 program. The Finnish dental health goals established 0.3 as the DMFT index for children at 10 years of age (6) without any speculation as to whether or not the goals would be achievable by the year 2000. Similar critical factors and standards of dental healthcare have recently been stated for children and adolescents in Sweden (7). Legal, psychological, and technical (professional) factors, principles for the documentation of patient records, cost-effectiveness and initiatives towards appropriate dental healthcare all form the basis of children's dental care, and this includes children with long-term illnesses as a special group.

Professional know-how, patient satisfaction, and eco-

nomics effectiveness in relation to outcome—factors considered to comprise quality in healthcare (8)—are defined as having three parts: structure, function, and outcome analysis (9). Outcome analysis has been regarded as the most useful of the three when measurable (8). Quality can be measured: with tools such as the notation used for evaluation (10) of dental health in the study described here; with an illustration of the $dmft/DMFT$ index; or with a focus on dental healthcare or patient satisfaction (7).

The research group set up targets for dental healthcare based on clinical experience, pedodontic expertise, and the scientific literature on technical (professional) quality. The aim of the present study was to examine how the technical (professional) quality of children's dental healthcare has been carried out, and to accomplish this using the following outcome measures: 1) number of children with healthy (or carious) teeth measured with the $dmft/DMFT$ index, the target being 60% and $DMFT < 0.3$; 2) sizes of 2 risk groups in terms of (a) dental health ($dmft/DMFT \geq 5$), the target being $<10\%$ and (b) dental health with caries first appearing after 5 years of age, the target being $<20\%$; 3) a focus on dental healthcare with visits of caries risk groups (children in most need of repair treatment will receive the most care); 4) presence of markers on the dental health status regarding frequency of tooth-brushing habits and eating of sweets, the target being 90%, and 5) presence/absence of gingivitis for counted segments ($CPITN = 0$), the target of not having gingivitis or gingivitis only in 1 or 2 segments.

This present study utilized the Finnish Family Competence (FFC) study (11) established in the Department of Public Health, University of Turku, in 1985. The maternity healthcare clinic (MHCC) staff in the (then)

Province of Turku and Pori collaborated and a representative sample of women expecting their first child was formed in southwestern Finland. There were 101 dental healthcare clinics (DHCCs) in the study. A total of 1,582 women and/or families expecting their first child were contacted during 1986, when these women first visited their own maternity healthcare center. Altogether 1,443 gave informed consent. The details of the project have been explained elsewhere (11).

A total of 1,294 deliveries resulted in 1,292 potential participant children, with 7 sets of twins and 1 set of triplets. There were 3 stillbirths and 8 newborns died. In this study, 4 clinical dental check-ups were completed when the children were 3, 5, 7, and 10 years of age, and 1,059, 828, 1070, and 1,074 children, respectively, participated during these ages.

The dentists in the DHCCs, including two of the present authors (M-LM and PP), completed the dental examinations during the regular routine visits when the children were 3, 5, 7, and 10 years. Mirror, probe, and, on occasion, fiber optic light were used to assess the extent of caries for every surface. The interobserver kappa coefficient (0.64), which had been obtained earlier (12), indicated satisfactory agreement between observers.

The following 2 indicators were the determinants of the dental health status: the dmft/DMFT index (13) and the number of children with healthy teeth/children with dental caries. Gingival status was determined from dental health records using the Community Periodontal Index of Treatment Needs (CPITN) (14).

The statistical significance of differences between the observed and the targeted measures of dental healthcare quality was tested with one sample test for the proportion or one sample test for the mean. One-tailed *P*-values were calculated to test whether the observed measures differed significantly from the targeted value in a negative direction. In addition to the *P*-values, one-sided 95% confidence limits (95% CL) were calculated, and statistical computations were performed with the SAS system for Windows, release 8.2/2001.

The study design was approved by the Joint Committee of Ethics of Turku University and Turku University Central Hospital.

Caries status at the age of 10 years

About 45% (481/1,074) of the study children had dmft/DMFT = 0, 72% (774/1,074) had DMFT = 0 (permanent teeth), and 56% (604/1,074) had dmft = 0 (deciduous teeth). The mean DMFT (permanent teeth) was 0.5. The mean dmft/DMFT index was 1.8, while mean dmft was 1.3.

Value of dmft/DMFT ≥ 5 at the age 10 years

A dmft/DMFT ≥ 5 occurred among 15% (163/1,074) of the children.

Late-appearing caries: caries-free at the age of 5 years but caries-existing thereafter. Altogether 258/828 children (31%) were

caries-free at the age of 5 years but had caries again thereafter.

Gingival status

Dentists had recorded gingival status in the case of 935 children. Good gingival status (CPITN = 0) was found in 42% of the children and occasional gingivitis (in some segments) in 32% when using the Community Periodontal Index of Treatment Needs. Gingivitis (for every counted segment) was recorded for 26% of the children. Of the children who had CPITN = 0, only 11% had dmft/DMFT ≥ 5 , while 22% of those who had gingivitis in every counted segment had caries (dmft/DMFT ≥ 5).

Focusing dental healthcare

By the age of 10 years, an average of 15.7 visits had been made ($n = 620$) to a dentist. Of those, 1 visit per year was for a routine preventive check-up (about 10 visits in all); the rest were restorative visits. It was thus estimated that each child had visited a dentist for restorative dental healthcare purposes about once every other year.

When looking at the dmft/DMFT index, the visits were divided as follows:

- dmft/DMFT = 0, an average of 12.9 visits, range 1–45
- dmft/DMFT = 1–4, an average of 17 visits, range 1–63
- dmft/DMFT ≥ 5 , an average of 22 visits, range 5–47

By the age of 10 years, an average of 2.5 visits had been made ($n = 615$) to a dental hygienist, while 178/615 children paid no visits to a dental hygienist.

Markers of dental records

Dentists had recorded eating of sweets for 244/1,074 (23%) children at the age of 10 years, while markers were missing for 830 children. According to the dental records of the 10-year-olds, teeth were reportedly brushed by 298/1,074 children. Notations were thus fully documented in 28% of the tooth-brushing records. The children with dmft/DMFT = 0 more frequently had appropriate markers in their dental records concerning eating sweets ($P = 0.045$) and tooth-brushing ($P = 0.016$). Observed and targeted measures of dental healthcare quality are given in Table 1.

Although children have been receiving intensive dental healthcare for nearly 30 years, the quality of their dental health is under challenge when several outcome measures are used. Fewer than half of the 10-year-olds (the criterion of 6 of 10 children having healthy teeth, according to our target) had healthy teeth. The mean of the DMFT index was 0.5 (compared with the pre-set national criterion of <0.3). Altogether, 15% of the children had dmft/DMFT ≥ 5 (versus 1 of 10), and about one-third of 10-year-olds had late-appearing caries (our target, <2 of 10). Over a quarter of the children had gingivitis in every segment. It was expected that some gingivitis would be

acceptable but not in every segment counted. Those who had the greatest need for restorative care also had the highest level of gingivitis. Nearly 25% of the markers pertaining to the use of sweets and over 25% pertaining to tooth-brushing were documented in the files, while 90% of the markers had been the target. The children who had these markers had the highest frequency of dmft/DMFT = 0. However, children who have dmft/DMFT > 0 have to be referred for dental health counseling the most. Their habits should be the subject of discussion and naturally they should have markers in the records.

The sample was representative of the study population and provided valuable knowledge about these children up to the age of 10 years. In Finland, a 10-year follow-up period of children is possible with assistance from the staff of the public well-baby clinics and dental health clinics and from cooperative parents. The participation rate of the study remained at an acceptable level. Generalizations from the unselected Finnish-speaking population of the southwestern area may be made to cover the whole country. A good coverage of the services will count for good quality. In this follow-up study with a cohort design, it was not possible to illustrate the ratio of all the children who used the available public dental health services or to compare these children with the whole child population of the country. Another element of quality is in successfully halting children's caries, but this aspect of quality has been reported elsewhere (15). Patient satisfaction with dental healthcare has been dealt with in a clinical study by the present authors (16).

The dental health of 12-year-old children has been documented in various countries during the 1990s. At 12 years of age, the mean of the DMFT was 1.2 in Finland in 1994 (17), 0.7 in The Netherlands in 1996, 0.9 in Sweden in 1999, and 1.0 in Denmark in 2000 (18). In the WHO recommendations, the Finnish dental health goal for the year 2000 was set as DMFT < 0.3 at the age of 10 years (6). The mean index of the 10-year-olds in our study was 0.5. When taking both permanent and deciduous teeth into account, the mean index increased to 1.8. Tala (6) had set the goals for the year 2000 in 1989, but according to our study the target was nowhere near being reached as late as 1997. The limit may have been much too strict. It is no use sticking to the indices in mechanical terms only, although some limit values must be set in order to achieve quality (7). In Finland, discussions and consensus are needed to find the best level of cost-effectiveness and future costs of dental healthcare.

Fifteen percent of the children had the dmft/DMFT ≥ 0.5 at the age of 10 years. Among some children, however, cariogenic factors and harmful dental behavior may be so extreme that even extraordinary preventive efforts could not help (19). By the age of 10 years, our study children had paid an average of 3 visits to a dentist per 2 years. Those children with dmft/DMFT ≥ 0.5 had visits ranging from 5 to 47 during 10 years, which suggests that there have been difficulties in halting caries. This means that some routine check-ups and preventive visits have been neglected, which does not

Table 1. Observed and targeted measures of dental healthcare quality (according to the targets of the study) for 10-year old children

Criterion	P-value	Observed	95%CL* targeted
dmft/DMFT = 0	<0.001	45%	(47%) 60%
DMFT (mean)	<0.001	0.53	(0.48) <0.3
dmft/DMFT ≥ 5	<0.001	15%	(13%) <10%
dmft/DMFT = 0 at 5 and caries appears thereafter	<0.001	31%	(29%) <20%
CPITN index			
= 0 for every segment	<0.001	42%	(45%) 70%
= Gingivitis for 1–2 segments	0.134	32%	(29%) 30%
= Gingivitis for every segment	<0.001	26%	(24%) none
Given care in relation to needs of dental healthcare		Appropriate	Appropriate
Markers of the frequencies of:			
Use of sweets	<0.001	23%	(25%) 90%
Tooth brushing	<0.001	28%	(30%) 90%

* 95% upper or lower confidence limit. Which one will depend on which direction an indication of deviation in the worse direction from target will take.

signify effectiveness, especially when we are aiming for high quality.

More than a quarter of the children in this study had gingivitis in every segment counted. Traditional prevention of dental caries has not resulted in appropriate outcomes appropriate to our targets. Dentists should take this situation into account when meeting with the child at the clinic for the purposes of dental health promotion and maintenance. They should also consider the family when offering knowledge, support, and advice and when they aim at high-quality work. Although there is an abundance of general information, dental health information has been reduced, and there is less time for health education. Old practices no longer seem effective and yet intensifying prevention has produced practically no additional benefit (20). New viewpoints and means and methods of oral health are needed. The individual needs of different families must be considered where the level of knowledge is concerned (11). Oral health care should be integrated into the general healthcare practices of the professionals. Despite increased dental health education offered to children, few changes have been observed overall. In a study by Kuusela et al. (21), as few as one-third of 11-year-old Finnish boys brushed their teeth more than once a day. It was uncommon in Finland to brush one's own teeth more than once a day during the 1993–1994 school year, which is comparable to the rates of the eastern bloc countries in Europe, whereas brushing teeth was more frequent in the other Scandinavian countries.

Based on Finnish health legislation (1) and instructions by the National Board of Health, Finland (22), several criteria of dental healthcare quality (such as patient identification) have been established in the records of patients in this study now that the use of computers is more readily available than before. The markers of preventive issues, such as the use of sweets or tooth-brushing habits,

could be documented more carefully than had been recorded in the past. Dentists may have discussed these issues with children and their families more often than the markers truly revealed. Verbal assessments should also have been recorded. In the present study, those who had markers on the frequency of the use of sweets and tooth-brushing were significantly more likely to have healthy teeth. Adequate markers are necessary for quality assurance. Local directives require that dental healthcare is documented in a way that the data will be available for research and investigation purposes thereafter (23).

Theoretically, anyone and everyone could have dmft/DMFT = 0, but this is unlikely in practice. The goals must be set in such a way that they are relevant and aim for the best results. The message should be that family issues, habits, and routines must be discussed with all concerned during every dental visit (24, 25). Standards of dental healthcare for children and adolescents have been presented in Sweden (7). These may be even stricter and more far-reaching than the criteria of the present study. These have been suggested to include legal, psychological, and technical aspects, principles in documentation of patient records and cost-effectiveness as well as efforts for appropriate dental healthcare, and children with long-term illnesses as a special group.

In this study, the criteria were established in a selective way consisting of technical, (professional) aspects of quality. With no set criteria for goals, the quality of dental healthcare could slip to an undesirable level. Our criteria may have been strict, but there is still room for improvement. It may not be reasonable to assume that all of the criteria should be met. Established measurable quality criteria could contribute to the future dental health of children.

This study pertains to quality outcomes, while to explain reasons further investigations of structure and processes of the care are necessary. The professional care keepers should consider a much more comprehensive practice than before. Quality issues need to be investigated further.

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