# Clinicians' preventive strategies for children and adolescents identified as at high risk of developing caries

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International Journal of Paediatric Dentistry 2011; 21: 167– 174

**Background.** Clinicians handle diagnosis and treatment planning of caries in different ways, and the underlying factors leading to management of risk and choice of treatment strategies are poorly understood.

**Aim.** The aim of this study was to investigate dentists' and dental hygienists' choices of preventive strategies for children and adolescents identified as at high risk of developing caries.

**Design.** A sample of dental records from 432 of a total of 3372 children in a Swedish county identified as at high risk of developing caries, aged 3–19 years, was randomly selected for analysis in the study. Information of importance for the therapists' choice of caries management strategies were obtained from the dental records.

# Introduction

Oral health is part of general health, and influences overall quality of life, self-esteem and social confidence<sup>1,2</sup>. Dental caries is considered one of the greatest global oral health burdens and is a major oral health problem in most industrialised countries<sup>3,4</sup>. Nevertheless, caries has been successfully prevented and caries prevalence has decreased in many countries in recent decades<sup>2</sup>. Current interventions available to prevent caries disease include use of fluoride, chlorhexidine, sealant and xylitol as well as behaviour modification to improve diet and oral hygiene<sup>5</sup>.

Correspondence to: Roxana Sarmadi, Department of Paediatric Dentistry, Vretgränd 9A,75322 Uppsala, Sweden. E-mail: roxana.sarmadi@lul.se **Results.** The results showed that therapists considered tooth brushing instruction and fluoride treatment at the clinic to be of primary importance as treatment given in 60% of the cases, respectively. Fluoride treatment at home and diet counselling were both chosen in half of the cases. Fissure sealant therapy was used in 21% of the cases, and 15% of the patients did not receive any preventive treatment at all. The results also showed that girls more often received fluoride treatment, tooth brushing instruction and oral hygiene information than boys.

**Conclusions.** In the majority of the children and adolescents, several preventive measures were given. The more background factors included in the risk assessment, the more preventive measures were given. The differences between the treatments given to girls and the boys need to be further investigated.

The evidence of the cariostatic effect of topical fluorides<sup>6-8</sup> and sealants<sup>9</sup> in children and adolescents is sufficient. Limited evidence supports the effectiveness of chlorhexidine in the process of prohibiting caries<sup>10–12</sup>. Concerning the preventive effects of fluoride tablets and sorbitol and xylitol in chewing gum and sweets, no clear conclusions can yet be drawn from available studies<sup>13</sup>. In addition, the evidence supporting the use of health promotion programmes with the purpose of reducing caries prevalence is very limited. In fact, several studies of preventive programmes for high-risk children have suggested that the interventions used were ineffective in reducing caries<sup>14–17</sup>.

The underlying factors of importance for clinicians when managing caries risk and choice of treatment strategies are poorly understood<sup>18,19</sup>. Not only knowledge about diseases and treatment options guide the

dental professionals in the process of making decisions, but also considerations beyond the concepts of health<sup>20</sup>. In a study of preventive strategies in the Nordic countries dental personnel through a questionnaire described caries-preventive methods used in the countries. Differences concerning choice of prevention method used for caries risk patients and implementation of prevention was found. Danish dental care providers chose oral hygiene training as their priority, and implemented it. Apart from fluoride varnish for some patients. most of them did not use or recommend fluoride additionally to fluoride toothpaste. The Norwegian and Icelandic dental care personnel chose both oral hygiene education and the use of fluoride as priorities, while most Swedish dental care providers preferred to provide dietary advice and oral hygiene training, as well as additional fluoride for risk patients. The authors stated that the results only could be explained by differences in the dental cultures in the four Nordic countries<sup>21</sup>.

In a systematic review, the Swedish Council on Technology Assessment in Health Care reported that the best risk indicator of dental caries in schoolchildren was past caries experience<sup>22</sup>. This is in line with the results of a study in a Swedish county showing that dentists mainly base their caries risk assessment on past caries experience, i.e., most children and adolescents identified as at high risk of developing caries had already been affected by caries<sup>23</sup>.

The aim of this study was to investigate dentists' and dental hygienists' choices of preventive strategies for children and adolescents identified as being at high risk of developing caries at the public dental service in Uppsala County.

# Material and method

In 2000, dentists and dental hygienists at the public dental service in Uppsala County examined 39,231 individuals aged 3–19 years. The dentists identified 27,739 (70%) of children and adolescents as being at low, 8.120 (21%) as uncertain and 3.372 (9%) as at high risk for developing caries. The caries risk assessment was noted in the dental records.

From the individuals who were identified as being at high caries risk in 2000, a random sample of dental records from 678 children and adolescents aged 6–19 years was chosen from all public dental clinics in Uppsala County by selecting every fifth child from the group. The children and their parents were informed by letter and could agree or refuse to participate in the study. A total of 432 individuals (64%) agreed to participate. In addition, all 22 dental clinics in the public dental service were informed, and agreed to take part in the study.

From the dental records, data were collected retrospectively from 1998 to 2000. Data were collected from all documented information in the records such as written notes, status and medical history during these 3 years. Data were registered in a protocol designed for the study (Fig. 1). In the protocol, the child's age, sex, and caries risk assessment in 1998, 1999, and 2000 were noted. Information from the dental records that could support the risk

Name	Census registration number					
Address	Postal code			Locality		
Clinic						
Therapist (initials)	Dentist	Dentist Hygienist De		Dental nur	Dental nurse	
Age						
Sex						
Risk assessment	1998	Yes	No	Risk group		
	1999	Yes	No	Risk group		
	2000	Yes	No	Risk group		
Number of fillings in primary teeth			1998	1999	2000	
Number of fillings in permanent teeth			1998	1999	2000	
Fluoride therapy (self	oride therapy (self-care)			No		
Fluoride therapy (at dental clinic)		Yes	No			
Diet information			Yes	No		
Diet counselling			Yes	No		
Oral hygiene informa	tion		Yes	No		
Tooth brushing instru	uction		Yes	No		
Use of chlorhexidine			Yes	No		
Fissure sealant theraj	ру		Yes	No		
Other preventive interventions		Yes	No			

Fig. 1. The protocol designed for the study.

assessment were gathered; a history describing medical, dental and social background, dental status, oral hygiene, dietary habits, and saliva data. It was noted if bitewing radiographs were taken in 1998, 1999 or 2000. The method has been described in detail in a previous study $^{23}$ . Information describing the therapists' choices of preventive measures such as use of fluoride. diet information, diet counselling, tooth brushing instruction, use of chlorhexidine, and fissure sealants was obtained from the dental records. It was noted if the therapists had chosen fluoride treatment at the clinic, such as fluoride varnish, or if the patient was recommended fluoride treatment at home. The intensity of the preventive measures was not registered in the protocol. The number of fillings in primary and permanent teeth was recorded for each year.

Diet information was considered to be given when the therapist gave general diet information to the patient, while diet counselling was considered to be fulfilled if the therapist analysed the patient's diet history and gave the patient specific advice. Oral hygiene information and tooth brushing instruction were considered to be given if any notes in the records showed that the therapists had used these preventive measures. Chlorhexidine therapy was considered to be performed if the therapist had used chlorhexidine as a caries preventive treatment, and fissure sealant therapy was considered to be performed if the therapist had used fissure sealant therapy either with glass ionomer or with resin based materials. Preventive measures such as dental floss instruction were recorded as "other preventive measures" in the protocol. The profession as (dentist, dental hygienist, and dental nurse) who had chosen and carried out the preventive treatments was noted.

Two experienced dental therapists, one dentist and one dental hygienist, collected the data. Both inter-examiner and intra-examiner reliability tests were performed. For the interexamination test the investigators' registrations of twenty randomly selected dental records were compared. In the intra-examiner test the same dental records were re-investigated by the same therapist and the concordance was analysed. The ethics committee, Faculty of Medicine, Uppsala University, Sweden, approved the study.

## Statistical analyses

Assessment of intra-examiner and interexaminer agreement was analysed by calculating the kappa coefficient. Frequency tables performed descriptive analyses, and Fisher's exact test was used for statistical analyses of the variation of frequency. The Fisher's exact test procedure calculates an exact probability value for the relationship between two dichotomous variables in small Sample sizes. When equality of population medians among groups were compared, a Kruskal-Wallis test was used since this test does not make assumptions about normality and homoscedasticity. Regression analysis was used to describe and evaluate the relationship between continuous variables. A P-value <0.05 was considered statistically significant.

### Results

#### Inter- and intra-examiner reliability test

The test included 20 randomised-selected study protocols with 25 variables as shown in Fig. 1. Kappa coefficients were calculated as a measure of assessment agreement regarding the variables. The inter-reliability test showed an overall kappa coefficient of 0.85 for 24 variables. Kappa calculation for one variable could not be performed. The intra-reliability test showed an overall kappa coefficient of 0.86 for 24 variables. Kappa calculation for one variable could not be performed.

## Choice of preventive strategies

The results showed that therapists chose fluoride therapy (professional care at the clinic), tooth brushing instruction and oral hygiene information as preventive measures, in approximately 60% of the cases, respectively. Fluoride as home care treatment and diet information were chosen in half of the cases, diet counselling and fissure sealant therapy in every fifth case, while chlorhexidine was rarely used (Fig. 2).



Fig. 2. The distribution of preventive measures chosen by clinicians (percent).



Fig. 3. The distribution of preventive treatments for boys and girls, respectively, chosen by clinicians (percent). Analysed using Fisher's exact test. \*P < 0.05, \*\*P < 0.001.

The therapists performed a total of 412, 534, and 815 fillings in primary and permanent teeth for the years 1998, 1999, and 2000. The number of fillings increased when the number of children with high caries risk increased. No statistically significant differences between boys and girls or between children who had undergone caries risk assessment model and the others were found as regards to the number of fillings. Children who had previously been subject to a caries risk assessment model, however, received preventive measures to a greater extent than the rest of the sample (data not shown). A caries risk assessment model was considered to have been used when a minimum set of criteria were fulfilled: a documented medical history, dental status, dietary analysis and, in addition, either information about the child's oral hygiene or social history<sup>23</sup>.

The results showed that girls more often received fluoride treatment, toothbrush

instruction and oral hygiene information than boys. There was a tendency, although not statistically significant, for the boys to receive more diet information (Fig. 3).

The dentists both planned and carried out preventive measures to a greater extent than the dental hygienists and dental nurses. Dentists, dental hygienists and dental nurses planned the choice of preventive measures in 73%, 21%, and 20% of cases and carried out the preventive treatments in 61%, 32%, and 35% of the cases, respectively. This means that for some patients, several professions planned and carried out treatment, also the sum of percentage exceeds 100%.

The result showed that almost 15% of patients did not receive any preventive measures at all, while 54% of patients received between 3 and 8 preventive measures. Fig. 4 shows the distribution of preventive measures performed by therapists.



Fig. 4. The distribution of the number of preventive measures per individual chosen by clinicians (percent).

Table 1. Impact of factors included in the caries risk assessment on the choice of preventive measures (multiple regression analysis).

Factors included in the caries risk assessment	<i>F</i> -value	95% CI	<i>P</i> -value
Medical history	0.00	-0.33 to 0.30	NS
Social history	1.09	-0.35 to 1.16	NS
Dental history	2.09	-0.11 to 0.70	NS
Bw radiographs	0.99	-0.23 to 0.70	NS
Dental status	4.03	0.02 to 2.18	<0.005
Oral hygiene	51.22	0.94 to 1.66	<0.0001
Analysis of diet diary	4.08	0.03 to 2.10	<0.005
Analysis of dietary habits	59.00	1.26 to 2.12	<0.0001
Salivary secretion test	0.77	-2.19 to 5.72	NS
Buffering capacity	0.33	-4.23 to 2.31	NS
Mutans streptococci	0.63	-0.66 to 1.56	NS
Lactobacilli	0.00	-1.86 to 1.85	NS
Cariogram	0.37	-4.32 to 2.28	NS



**Fig. 5.** Relation between the number of documented factors used for risk assessment and the number of performed preventive measures (multiple regression analysis).

Factors documented by the therapists for risk assessment were reported in a previous study<sup>23</sup>, but these factors are also reported in

Table 1. The relationship between factors documented for the risk assessment, and use of preventive measures can be seen in Fig. 5. A multiple regression analysis showed that the more background factors that were included in the caries risk assessment, the more preventive measures were used ( $r^2 =$ 0.383). Information about the patients' oral hygiene and analysis of dietary habits had the strongest impact on the choice of preventive measures, but dental status and analysis of diet diary also impacted on the choice (Table 1).

#### Discussion

The results of the study show that therapists at the public dental service in Uppsala County invested primarily in fluoride treatment performed at the clinic, oral hygiene information and tooth brushing instruction. Home care fluoride treatment and diet information were offered to half of the individuals, although the conclusions concerning the prevalence of home care fluoride treatment have to be interpreted with caution since the agreement in the intra-reliability test regarding this factor was poor.

According to the report from The Swedish Council on Technology Assessment in Health Care, there is strong evidence for daily use of fluoride toothpaste in preventing caries in the permanent teeth of children and adolescents<sup>13</sup>. The report supports the therapist's focus on tooth brushing instruction since such instruction involves the use of fluoridated toothpaste. The plaque reduction obtained by brushing is, however, not strongly related to prevention of caries. According to the same report, professional treatment with fluoride varnish at least twice per year has a caries preventive effect on young permanent teeth. Thus, the same report also supports the therapists' frequent choice of fluoride treatment performed at the clinic.

Information about the patient's oral hygiene and diet counselling had the strongest impact on the choice of preventive measures in this study. This is in line with a previous report describing the differences between dental cultures in Denmark, Iceland, Norway and Sweden<sup>21</sup>. According to this report, a majority of Swedish dental care providers preferred to provide dietary advice and oral hygiene education and additional fluoride for risk patients. The frequent use of dietary and oral hygiene measure in this study could be an indicator of that these actions were a matter of routine rather than the result of an individual assessment of needs.

The study showed that 15% of the children and adolescents did not receive any preventive measures at all. One explanation may be that they belonged to the caries risk group in 2000 only and thus were in need of preventive treatments only one of the years studied. Still, they were identified as at caries risk, during at least 1 year and would reasonably be in need of preventive measures. A weakness of the study design, however, is that most of the data were collected over a 3-year period without specification for each year which means that we cannot restrict the analysis to the year 2000 when all children certainly belonged to the high-risk group. The study was retrospective which has the disadvantage that the outcome of interest has already occurred when the study is performed and it is not possible to collect the missing data in subsequent. The reliability of data is depending on the quality of the records and it cannot be excluded that the therapists forgot to note all measures in the records. In this study, however, when strategies were supposed to be studied, a prospective design could have been biased because the therapists may have adapted their decisions to an optimal way of treating high-risk group children.

Pit and fissure sealant therapy is a recommended procedure to prevent caries of the occlusal surfaces of permanent molars, especially in children with high caries risk<sup>24,25</sup>. Longitudinal studies have shown that pit and fissure sealants applied during childhood have a long-lasting caries preventive effect and are effective treatments with low failure rates<sup>26,27</sup>. This study shows that fissure sealants were used by the therapists in only 21% of the cases, despite the scientific support for the treatment. In the age group of 6–11 years, however, 35% of the children had at least one tooth treated with fissure sealant. One explanation to the

low use of sealants may be that the dentists at the public dental service in Uppsala County mainly base their caries risk assessment on past caries experience<sup>23</sup>, which leads to late detection of children with high caries risk. If the children already have cavities when they are identified as risk individuals, the period for fissure sealant therapy has already been passed, and fillings will be the therapy of choice. Earlier identification of children at high risk for caries, using other risk factors or indicators such as social history and dietary habits, could potentially lead to more frequent use of fissure sealant therapy. In addition, and in contrast to some other parts of Sweden, fissure sealant therapy in the area studied is not used as a population strategy, i.e., when children get the measure irrespective of caries risk. This may be attributable to the fact that dental staff are unfamiliar with the method and thus are less inclined to use this therapy. The technique is exacting, requires good saliva control and is difficult for the therapist to perform alone. Since the technique is so demanding, the cost effectiveness is unclear<sup>22</sup>.

The study shows that girls more often received preventive treatments than boys. Several studies report that men have poorer oral hygiene and more gingivitis compared with women<sup>28,29</sup>. According to a report from the National Board of Health and Welfare, there were no significant differences in dental health between boys and girls in Sweden<sup>30</sup>. Consequently, there are no explanations from the point of view of prevalence of disease for girls to have been received more preventive treatments than boys. Could the fact that a majority of the dental staff is female result in routines and ways of communicating that appeal more to girls than boys?

The results show that dentists both planned and carried out preventive measures to a much greater extent than dental hygienists and dental nurses. The reason may be that dentists take more responsibility for treatment of children at high caries risk. In the case of children at low and moderate caries risk, dental hygienists and dental nurses play a key role in examination and planning of preventive measures. In Sweden, the tendency is that occupational groups other than dentists, such as dental hygienists and nurses, become the primary health carers for children and adolescents.

Professional fluoride therapy at the clinic, oral hygiene information and practical instruction dominate in this study. Most children at caries risk had several preventive interventions, but 15% had none. The more background factors that were included in the caries risk assessment, the more preventive measures were used. The fact that girls had more preventive treatments than boys was surprising, and the reasons need to be further investigated.

#### What this paper adds

- Insight into the panorama of preventive measures that are used in general dentistry.
- Knowledge about a positive relation between the number of factors included in risk assessment and the repertoire of preventive measures.

#### Why this paper is important to paediatric dentists

- Information about preventive strategies used by general dental therapists can help the paediatric dentist develop effective guidelines for dental care for children with a high risk of developing dental caries.
- The knowledge about choice of preventive measures by general dental therapist can also be helpful for the paediatric dentists own risk assessment and choice of preventive strategy in patients referred for specialist treatment.

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