Referral of young children by primary care nurses to dental personnel

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Abstract

Oral health promotion to young children is delivered by primary care nurses as part of general health promotion given to all children in Norway. *Objective:* The objective was to evaluate established routines for referral of children by primary care nurses to the dental services and to study whether referred children younger than 3 years required contact with dental personnel. *Methods:* All children referred by primary care nurses to the dental services in one county during one year were included. Primary care nurses referred children using criteria developed by dental personnel. At the dental clinic, anamnestic information, dental health and oral health behaviour of the referred children were registered. *Results:* Altogether, 181 children were referred; 53% were younger than 3 years. The most frequent reasons for referral of children younger than 3 years were caries or dental plaque, 34% had visible plaque accumulation and/or visible signs of caries. All referred children had at least one risk factor for caries. The referral reasons given by primary care nurses corresponded partly with findings at dental examination. The results indicated that 2% of the children in the studied population were referred to the dental services. *Conclusion:* The results indicated that by using established referral routines all children referred from well-baby clinics to the dental services were caries risk children who required early contact with dental personnel. However, the low proportion of children in the studied population referred by primary care personnel may indicate under-referral of children to the dental services.

Introduction

To prevent dental caries in children parents have to establish favourable oral health behaviour in children at an early age (1-3). Early professional involvement with provision of preventive advice to parents and oral examination of children has been proposed to counteract the onset of oral disease (4). Professional involvement may be with dental personnel or with primary health care personnel. Collaboration between primary care personnel and dental personnel about young children's oral health creates opportunity for joint ventures as children at risk of dental disease often have risk of other health problems. Multi-professional collaboration with integration of oral health messages into general health preventive care may be cost-effective in low caries populations and consistent with the common risk factor approach (5).

Early childhood caries is still a common disease in children with reported prevalence from 7% to 18% in 2-3 year old children (6-9). Caries prevalence is skewed, with a majority of children having no caries experience and a minority of children acquiring caries in early childhood, indicating need for early identification (10, 11). Tooth brushing twice daily from eruption of the first tooth has been recommended for decades, but studies have shown that only half of the children younger than 2 years had the teeth brushed twice daily (12, 13).

Dental caries is a multifactorial disease, and risk indicators for early childhood caries are often found within families, like parental national background and educational level, family situation and child rearing behaviour (11, 14, 15). Identification of characteristics associated with children's risk of developing caries should preferably be performed before clinical caries is visible so that preventive strategies may be put in place and early contact with the dental services established. Early identification of children at risk of acquiring caries can be performed by dental personnel as part of early dental visits or by trained primary care personnel combined with the regular delivery of general health care to parents in children's first years of life (16, 17).

In Norway, children are by law offered free dental care in the public dental services. The first regular contact with the public dental services is at age 3 years. Before the age of 3 years, preventive dental care is mainly given by primary care personnel, who provide information on dental advice to parents as part of the general care promotion given at well-baby clinics (18). The primary care nurses at well-baby clinics are encouraged to inspect the children's teeth at the age of 2 years and refer to the dental services when risk of dental caries is suspected (19).

The objective of the study was to evaluate established referral routines of children by primary care nurses at well-baby clinics to the dental services and to study whether the referred children younger than 3 years of age required contact with dental personnel.

Methods

All children referred from the 21 well-baby clinics to the 16 public dental clinics in the county of Vestfold during the year 2011 were included in the study. In the county, approximately 2400 children were born annually. The majority (95%) of children in Norway have regular check-ups at well-baby clinics during the first years of life (20). All well-baby clinics in Norway are since 2004 subjected to national guidelines requiring primary care nurses to evaluate children's dental health and to refer children at risk of caries to the dental services (19). The dental services in the studied county had since then collaborated with well-baby clinics, and established referral criteria for children. Primary care personnel received some education on oral health topics as part of their curriculum; the dental services organized regular meetings with well-baby clinics where information about oral health was delivered by dental personnel to primary care personnel. In total 192 children were referred from the well-baby clinics to the dental services, eight children did not show up for the dental examination,

and three children had recently had dental examination. The study population consisted of 181 children, 106 boys and 75 girls.

The well-baby clinics had written instructions provided by the public dental services concerning reasons for referral of children to the dental clinics. The criteria for referral were high caries risk defined as visible plaque accumulation or visible signs of caries, children having unfavourable diet, children having general disease and/or using medications and children with parents of non-western background. In addition other reasons could be given for the referral (developmental disturbances, tooth emergence problems or dental trauma). Only one referral reason could be given for each child. When a child was considered to need consultation with dental personnel, a referral form was sent to the dental clinic and included information on child age, reason for referral and parental contact information.

When the dental clinic received the referral form from the well-baby clinic, the child was invited to dental examination by a dental hygienist. The dental examination was performed in a fully equipped dental clinic using mirror and probe after the teeth had been dried with air. Caries was registered as the sum of teeth recorded as decayed, filled or missing due to caries. Five caries grades (d₁-d₅) were recorded (21). In the analysis, all grades of caries were summed and categorized as visible caries. As the data showed that no children below 3 years of age had filled or missing teeth due to caries, the term visible caries is used. Dental plaque was categorized as no visible plaque and visible plaque accumulation (22). Visible dental caries and dental plaque accumulation were combined into one variable based on the assumption that both the presence of visible plaque and signs of caries indicated that the child was at risk of developing dental caries. The variable was dichotomized as not having visible plaque or caries and having visible plaque accumulation and/or visible signs of caries.

Child age was registered at the dental examination and dichotomized into younger than 3 years and 3 years or older, based on the assumption that children aged 3 years or older had established contact with the dental services.

As part of the dental examination the parents filled in a questionnaire with information regarding family characteristics and child oral health behaviour. The family characteristics included parental educational level, parental national background and family status. Parental educational level was reported as mother and father having short or long education. Educational level was defined as long; having more than 12 years of schooling, and short; 12 or fewer years at school. In the analyses mother's and father's educational level was combined into one variable and dichotomized as both parents with high education and one or both parents with low education. Parental national background was recorded based on mother's and father's country of birth. This information was combined to distinguish between both parents having western background and one or both parents having non-western background. Non-western background included parents born in Asia, Africa, South America, Central America and Eastern Europe. Family status was reported as the child living with both mother and father (two parent family) or living with mother or father (one parent family).

Information on the child's oral health behaviour was registered by questions about oral hygiene habits, use of fluoride, consumption of sugar containing drinks at night and the child's age when tooth brushing was introduced. Tooth brushing frequency was reported as twice daily, once daily, sometimes or never, and dichotomized as twice daily and less than twice daily. Child age when tooth brushing was introduced was reported as 1 year or younger, between 1 and 2 years of age and older than 2 years, and dichotomized as 1 year or younger and older than 1 year. Use of fluoridated tooth paste and fluoride lozenges was reported as daily, sometimes or never and dichotomized as daily and less than daily. Frequency of sugar containing drinks at night offered to children was reported as regularly, and not regularly. In

addition information about the child's medical condition was recorded. The parents reported if the child had a disease or used medications, and this information was combined and dichotomized as no disease or medication and having a disease and/or using medication.

The statistical analyses were performed using IBM SPSS, version 22. Association between referral reasons and findings at dental examination were tested using Chi square statistics. Association between child having visible dental plaque and/or caries and child oral health behaviour and family characteristics were explored using bivariable and multivariable logistic regression. Variables showing statistically significant associations with visible plaque accumulation and/or visible signs of caries in bivariable analyses were included in multivariable analysis. All variables were entered simultaneously. Children with missing data were excluded from multivariable analyses. Few children had incomplete data; only one variable had more than 10% missing data. Replacing missing data by multiple imputations did not change the results. Results were reported using frequencies, P-values and odds ratios (OR) with 95% confidence intervals (95% CI). The level of statistical significance was set at 5%.

The study was performed as part of the quality assurance system required by law in the public dental services. Quality assurance and evaluation as part of the health service does not require approval from ethical committees even if the projects are carried out for scientific purposes and generate knowledge that is published. Informed consent was given by all parents. Data analyses were conducted on anonymized data.

Results

Children's age at dental examination in the dental clinic varied from 4 months to 16.6 years. Half of the children (53%) were younger than 3 years of age. Mean age in children younger than 3 years was 1.9 (SD 0.6) years, and in children aged 3 years or older 6.9 (SD 3.6) years.

Table 1 shows children younger than 3 years and children 3 years of age and older referred from well-baby clinics to the dental services according to referral reasons. The most frequent reasons for referral were visible plaque accumulation or visible signs of caries and non-western background. For children younger than 3 years of age, half of the children (48%) were referred because of visible plaque accumulation or visible signs of caries, and 13 of the 96 children were referred because of other reasons than the established referral criteria; parents request, newly immigrated, dental trauma, dental anomalies or tooth eruption.

In Table 2 findings at the dental examination related to reasons for referral from well-baby clinics to the dental services for children younger than 3 years of age are presented. The results showed that more than half (52%) of children referred because of visible plaque accumulation or visible signs of caries had plaque and/or caries at the dental examination ($P < 0.01$). In children referred because of unfavourable diet, 31% reported at the dental examination that they offered the child sugar containing drinks at night regularly ($P > 0.05$). In children referred because of medical disease and/or medications, 92% reported the child to have a disease and/or used medication at the dental examination ($P < 0.01$). In children referred because of non-western background, all parents reported the child to have non-western background at the dental examination ($P < 0.01$).

The results showed that all children referred from well-baby clinics to the dental services had more than one caries risk indicator diagnosed at the dental examination (Table 2). Of children referred because of visible plaque accumulation or visible signs of caries, 31% were also offered sugar containing drinks at night regularly and 54% had non-western background. Of children referred because of unfavourable diet, 44% were also diagnosed with caries and/or plaque at the dental examination and 75% had non-western background.

In Table 3, the findings in children younger than 3 years referred to the dental services are shown. Tooth brushing less than twice daily was performed in 39% of the children, and

tooth brushing was initiated when the child was older than 1 year in 22% of the children.

Sugar containing drinks at night were offered regularly to 25% of the children. Of the children, 57% had non-western background and 73% had one or both parents with low education. Visible plaque accumulation and/or visible signs of caries were diagnosed in 34% of the children. Caries was present in 24% of the children, 16% had caries lesions extending to dentin and 14% of the children had visible plaque accumulation.

Of the referred children that had visible plaque accumulation and/or visible signs of caries at the dental examination, 54% had the teeth brushed less than twice daily and 55% were offered sugar containing drinks at night (Table 3). The results from bivariable regression showed that children with visible plaque accumulation and/or visible signs of caries at the dental examination were more likely to having the teeth brushed less than twice daily (OR 3.8, 95% CI 1.5-9.3), being offered sugar containing drinks at night regularly (OR 3.0, CI 1.1-8.0), having parents with non-western background (OR 3.5, 95% CI 1.3-9.3) and having parents with low education (OR 4.0, 95% CI 1.1-15.4) than other referred children. The results from multivariable analysis showed that children with visible plaque accumulation and/or visible signs of caries at the dental examination were more likely to brush the teeth less than twice daily (OR 3.2, 95% CI 1.0-9.8) than other referred children when adjusted for parental background, parental educational level and being offered sugar containing drinks at night.

Discussion

This objective of this study was to evaluate routines for referring children from well-baby clinics to the dental services. The main finding was that all children referred by primary care nurses were caries risk children who required early contact with dental personnel.

The study included data from well-baby clinics and dental clinics in one county in Norway. Caries prevalence among infants and toddlers in Norway is low (24), this may be one explanation for the limited number of referred children. The results describe the situation when the dental services had focused on collaboration with well-baby clinics for several years. The results may be generalized to countries where primary care personnel have responsibility for oral health promotion for young children, and children do not meet dental personnel during the first years of life. Calibration of dental personnel was not performed as part of this study, but caries registrations in the dental clinics are regulated by guidelines and regular calibrations are performed.

The results of the present study showed that half of the referred children were 3 years or older, children that in Norway according to law should be called regularly to the dental services. Referral of older children may be a result of the referral routines introduced to identify children before the first visit to the dental services at the age of 3 years. This showed that primary care nurses had contact with older children mainly non-western not reached by the dental services. This may indicate that the dental services lack appropriate routines to reach newly immigrated children.

The results indicated that children referred by primary care nurses were at risk of developing caries in early childhood. All referred children had more than one risk indicator for caries, indicating that all children were caries risk children who required contact with dental personnel before the first scheduled examination at age 3 years. The referral reasons related to anamnestic information; medical condition and family background were in agreement with findings at dental examination. Primary care nurses collect routinely this information from the families as part of daily work with general health promotion for children and families. The referral reasons related to oral health and oral health behaviour were partly in agreement with findings at dental examination. Lack of agreement may be due to limited

knowledge about oral health among primary care nurses (24, 25). Another explanation may be that the referral criteria unfavorable diet may have included more than sugar containing drinks at night on which dental personnel focused, and the parents may have stopped offering the child sugar containing drinks at night because of information given by primary care nurses before the child was referred to dental personnel.

The result from multivariable analysis showed that children who developed caries early had a higher probability of not yet having established tooth brushing routines than other children. This shows that tooth brushing twice daily in early childhood were strongly associated with caries development. This is in accordance with findings from other studies (1, 3, 7, 8, 11, 14). Dental personnel recommend tooth brushing twice daily from eruption of the first tooth, but studies have shown that this is often not performed (12, 26). The association between tooth brushing frequency and having visible plaque accumulation and/or visible signs of caries may imply that problems with establishing tooth brushing in early childhood should be included as criteria for referring children from well-baby clinics to the dental services.

Delivering oral health promotion to infants and toddlers can be performed either by early contact with dental personnel or by integrating preventive oral care in the services primary care personnel perform at well-baby clinics (16, 17, 27). Including oral health in general health promotion may give parents a better understanding of oral health being an integral part of general health and facilitates a common risk approach (5).

In low caries populations where few children need contact with dental personnel in the first years of life collaboration with primary care personnel may be cost-effective. Scheduled visits at well-baby clinics for infants and toddlers are established in Norway. Studies have shown that repeated information about oral care during infancy from primary care personnel, and collaboration between well-baby clinics and the dental services in identifying caries risk children reduce caries development and the need for dental treatment during preschool age

(28-30). If oral health information and inspection of young children's teeth was included routinely at visits to the well-baby clinics, dental visits before the age of 3 years would be required only for caries risk children.

Based on the number of referred children below age 3 years and the number of children in this age group in the studied county, 2% of the children were referred to the dental services. In the studied county, 6% of children had caries lesions at the first dental visit at age 3 years. This may indicate that more than half of children being at risk of developing caries were not referred from well-baby clinics to the dental services, and that primary care nurses need more competence and motivation to be able to identify a larger proportion children in need of early oral health prevention. This is in line with results from one study from the US which have indicated under-referral of young children from primary care personnel to dental personnel (16). Training of primary care personnel in oral health should be given higher priority in educational programs. In addition, collaboration between well-baby clinics and the dental service create opportunities for maintenance and improvement of primary care personnel's oral competence.

In conclusion, the results indicated that by using established referral routines all children referred by primary care nurses to dental personnel were correctly diagnosed as risk children who required early contact with dental personnel. However, the low proportion of children in the studied population referred by primary care nurses may indicate under-referral of children to the dental services.

Clinical relevance

Scientific rationale for study

Oral health promotion to young children is delivered by primary care nurses as part of general health promotion. Collaboration between primary care nurses and dental personnel creates opportunity to reach young caries risk children.

Principal findings

Children referred by primary care nurses to the dental services were caries risk children who required contact with dental personnel. The low proportion of children in the studied population referred by primary care nurses may indicate under-referral of children to the dental services.

Practical implications

Collaboration between primary care nurses and dental personnel meeting children during infancy and in early childhood may increase the possibility of initiating caries preventive oral care early.

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Declaration of interest

The authors report no conflict of interests. The authors alone are responsible for the content and writing of the paper.

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Table 1. Children younger than 3 years of age and children 3 years of age and older referred from well-baby clinics to the dental services according to referral reasons.

	< 3 years (n = 96)	≥ 3 years (n = 85)
	% (n)	
Visible plaque or caries	48 (46)	21 (18)
Unfavourable diet	17 (16)	5 (4)
Disease and/or medications	13 (12)	6 (5)
Non-western background	9 (9)	34 (29)
Parents request	1 (1)	7 (6)
Newly immigrated	2 (2)	18 (15)
Other reasons	10 (10)	9 (8)

Table 2. Anamnestic information and clinical findings at the dental clinic related to referral reasons. Children younger than 3 years of age (n = 96).

Well-baby clinic <i>Referral reason</i>	Dental clinic			
	Plaque and/or caries (n = 33)	Sugar containing drinks usually (n = 22)	Disease and/or medication (n = 18)	Non- western background (n = 51)
	% (n)	% (n)	% (n)	% (n)
Visible plaque or caries (n = 46)	52 (24)	31 (13)	11 (5)	54 (25)
Unfavourable diet (n = 16)	44 (7)	31 (5)	13 (2)	75 (12)
Disease and/or medications (n = 12)	17 (2)	18 (2)	92 (11)	17 (2)
Non-western background (n = 9)	(0)	13 (1)	(0)	100 (9)
Not examined (n = 3)	(0)	(0)	(0)	(1)
Other (n = 10)	(0)	(1)	(0)	(2)

Table 3. Proportion and number of referred children and children with visible plaque accumulation and/or visible caries according to child and family characteristics. Bivariable and multivariable logistic regression showing the probability of a referred child having visible plaque accumulation and/or visible signs of caries (OR, 95% CI). Children younger than 3 years of age.

	All children (n = 96) % (n)	Children with plaque and/or caries (n = 33) % (n)	Bivariable logistic regression (n = 96) OR (95% CI)	Multivariable logistic regression (n = 73*) OR (95% CI)
Child				
Child tooth brushing frequency*				
Twice daily	61 (54)	24 (13)		
Less than twice daily	39 (35)	54 (19)	3.8 (1.5 – 9.3)	3.2 (1.04 – 9.8)
Tooth brushing start*				
1 year or younger	78 (69)	32 (22)		
Older than 1 year	22 (19)	47 (9)	1.9 (0.7 – 5.4)	#
Fluoridated tooth paste*				
Daily	88 (77)	33 (25)		
Less than daily	12 (11)	55 (6)	2.5 (0.7 – 9.0)	#
Fluoride lozenges*				
Daily	40 (35)	43 (15)		
Less than daily	60 (53)	30 (16)	0.6 (0.3 – 1.4)	#
Sugar containing drinks at night *				
Not regularly	75 (66)	29 (19)		
Regularly	25 (22)	55 (12)	3.0 (1.1 – 8.0)	2.1 (0.6 – 7.7)
Disease and/or medications*				
No	80 (71)	35 (25)		
Yes	20 (18)	39 (7)	1.2 (0.4 – 3.4)	#
Clinical findings				
Plaque and/or caries				
No	66 (63)	(0)		
Yes	34 (33)	100 (33)	#	#
Family				
Parental background*				
Both western	43 (39)	18 (7)		
One or both non-western	57 (51)	43 (22)	3.5 (1.3 – 9.3)	3.0 (0.9 – 10.4)
Parental educational level*				
Both parents high	27 (20)	15 (3)		
One or both parents low	73 (53)	42 (22)	4.0 (1.1 – 15.4)	3.0 (0.7 – 13.1)
Family status*				
Two parent family	80 (71)	34 (24)		
One parent family	20 (18)	39 (7)	1.3 (0.4 – 3.6)	#

*Number of children reduced because of internal drop-out

#Variable not included in the analysis

P < 0.05 marked in bold