

# Parental influences on dental caries development in preschool children. An overview with emphasis on recent Norwegian research

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## ABSTRACT

The proportion of Norwegian preschool children with dental caries experience has decreased during the last decades and the caries distribution has become skewed. Some children develop caries in early life, and caries may affect body weight, growth and quality of life in children. The social environment influences child development, including the risk for developing dental caries. The purpose of this paper was to summarize knowledge from the literature regarding parental influence on caries development in preschool children with focus on recent Norwegian research based on the Norwegian Mother and Child Cohort study. The results from the literature review showed that characteristics of the family and parental oral health behaviours and lifestyle may be associated with caries development in preschool children. These associations were recently confirmed in the Norwegian setting with low caries prevalence in children, high educational level in the population, and comprehensive dental service free of charge for children. In conclusion, the literature establishes associations between parental factors that are known during pregnancy and early parenthood and caries development in early childhood. These risk indicators may be used by health care personnel to identify risk children and target preventive care at children before dental caries has developed.

## INTRODUCTION

Dental caries is a common disease in children (1,2). Untreated dental caries can affect body weight, growth and quality of life in preschool children (3). Caries experience in early childhood has been linked to caries experience in the permanent dentition in several studies (4-7). The burden of dental caries lasts a lifetime because once the tooth structure is destroyed it will usually require restoration and on-going maintenance throughout life.

The proportion of Norwegian 5-year-old children with caries experience has decreased from 50% in 1985 to 20% in 2010 (8). In addition to a decrease in caries prevalence the distribution has become skewed with 6% of the 5-year-olds having caries experience in 5 or more teeth (8). It has been proposed that individualized care to prevent caries development should be targeted at children at high risk of developing caries, instead of offering standardized caries preventive measures to the whole population (9). Offering individualised preventive care to risk children depends on the possibility to identify individuals at risk of developing caries before clinical caries is evident (10,11).

It is well accepted that environmental factors influence caries development (12-16). The mother and the family are part of the child's environment influencing child development and establishment of oral health behaviours. The literature is growing on the association between caries experience in children and characteristics of the family, parental oral health behaviours and

lifestyle. In Norway, several environmental factors differ from other countries; the population is well educated, the dental care system offers comprehensive dental care free of charge from an early age, and the prevalence of dental caries is relatively low.

The purpose of this paper was to summarize knowledge from the literature regarding parental influence, more specifically family characteristics, oral health behaviours and lifestyle, on caries development in preschool children with focus on recent Norwegian research.

## CHARACTERISTICS OF THE FAMILY

The social environment influences child development (17) including the development of dental caries. The association between social conditions and dental health has, in one study, been shown to be stronger for preschool children than older children (18). Parental educational level and non-western background are well established as indicators associated with caries in preschool children (19-35). Low family income and father's occupational status at child birth has been related to preschool child oral health (36-38). Mother-child interaction (39) and family function (13) have, in some studies, been related to caries development in children. Studies of association between maternal age at child birth and caries experience in the child have shown conflicting results (40-42). Living in a family with few children has been reported to be associated with less caries in children (18). Change in family status from a

traditional two parent family to single parent families may influence the parents' ability to give the child appropriate oral care. Children living in families with complicated relationships have been reported to have higher risk of caries experience at the age of five than other children (40).

### PARENTAL ORAL HEALTH BEHAVIOURS

Parental tooth brushing habits have been associated with caries experience in children (40,43,44). The age of the child when the parents' start to brush the child's teeth (45-47) and parents' own dental health (48), have been shown to be associated with caries development in children. Parental attitudes towards oral health related behaviours may influence whether the behaviours will occur in children (49). In some studies, parental beliefs and attitudes towards oral health have been associated with caries development in children (50-53). Several conditions such as knowledge in the field of interest and social and cultural background can influence the establishment and maintenance of beliefs and attitudes (54,55). Beliefs and attitudes are modifiable and differ between individuals with the same background (55).

Mother's dental anxiety and dental attendance pattern have been proposed as predictors of dental health in preschool children and whether she takes the child to the dentist (56). When preschool children do not show up for scheduled dental appointments, it is usually due to the parents not bringing the children to the dental service. This behaviour may reflect parents' negative beliefs and attitudes toward dental care (57). It may also be due to lack of knowledge of the dental care system for children or to a parent's fear of consequences when missing work. Missed dental appointments have been related to caries prevalence in older children (58,59) and have been reported to be associated with dental treatments due to toothache in children (60).

### PARENTAL LIFESTYLE

A growing interest in exploring parental lifestyle and caries development in children has been observed (61-72). Lifestyle has been associated with oral health behaviours, and maternal health and lifestyle in pregnancy and early motherhood may influence the mother's ability to take appropriate care of the child's oral health. Sugar is important in caries development (66), and children's sugar consumption has been related to caries development (67-69). Mothers are likely to introduce their dietary habits to the children (70), and the children's own dietary habits have been shown to develop early in life (71,72). Other parental factors that have been shown to be associated with caries experience and caries increment in their offspring include maternal weight early in pregnancy (61) and parental tobacco smoking (62-64). Maternal obesity during pregnancy has been considered to influence

appetite control in children (65). Lack of appetite control in children may influence dietary habits, leading to increased numbers of meals which again is associated with development of dental caries.

### RECENT NORWEGIAN STUDIES

Until recently there have been few studies in Norway exploring associations between maternal influence on caries development in preschool children, and previous studies have mainly used cross-sectional data. By using data from the Norwegian Mother and Child Cohort study (MoBa) and link data from the Public Dental Services to the MoBa-database, children and their mothers may be followed from pregnancy into preschool age. These data have given the possibility to explore maternal influence on caries development in preschool children using a prospective design.

Studies based on the MoBa study and data from dental examination of 5-year-old children in the Public Dental Services have recently been published (73,74). Extensive information about parents and children have been collected in the MoBa study which is a prospective population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health (75,76). Pregnant women were recruited from all over Norway from 1999 to 2009, and 39% of the invited women participated. The cohort includes 108 000 children. The questionnaires in the MoBa study covers a variety of issues regarding parents and children, with detailed questions on health, socioeconomic status, nutrition, environmental exposures, and familial and psychological factors, before, during, and after pregnancy.

The studies were based on MoBa quality-assured data files (version 3) released for research in 2007, and were restricted to consider children born in 2002 in the county of Akershus. Altogether, 1607 children were included, that was 27% of the children born in Akershus in 2002 (77). Clinical data collected from dental examination in 2007 and 2008 in the Public Dental Services was obtained from 1366 children. Eighteen children were excluded from the analyses because of incomplete data. The final study population consisted of 1348 children (73).

The clinical dental examination of the children was performed by 44 dental hygienists as part of the regular dental recall examination in the Public Dental Service. In the analyses, caries lesions extending into dentine were defined as caries and the children classified as having or not having caries lesions. The caries experience in the studied 5-year-old children was low, 11% of the children had caries experience (73). Exposure data was obtained from questionnaires in the MoBa study and from a questionnaire completed by the accompanying parent at the dental examination.

The purpose of these studies was to explore aspects contributing to early identification of children at risk of developing caries: to study associations between caries experience in 5-year old children, and charac-

teristics of the family and maternal health and lifestyle during pregnancy and early motherhood.

The results from the analyses exploring associations between characteristics of the family and caries development in children showed that having caries experience at 5 years of age was associated with: having one or both parents of non-western origin, having had a change in family status from two parents to one parent before 5 years of age, and having mother with low education (Table 1), when controlled for family income, older siblings, child gender and age at dental examination (73). The results exploring association between caries experience in 5-year-old children and maternal health and lifestyle showed that maternal obesity and maternal high intake of sugar and fat during pregnancy were statistically significantly related to caries experience in the child at 5 years of age (Table 1), when controlled for maternal health, smoking and physical activity, and child birth weight, prematurity and age at dental examination (74).

In addition to the studies with a prospective design a random sample, 523 5-year-old children, was drawn from the same birth cohort in the Public Dental Services and used in studies with a cross-sectional design. The purpose of these studies was to describe in detail the caries situation in 5-year-old children in Norway, and to study associations between caries experience in children and characteristics of the family such as parental education and national background, and parental oral health behaviours including dental attitudes, dental anxiety, and dental attendance. The results showed associations between caries experience in children and parental education, national origin, tooth brushing habits, frequent sugar consumption, and attitudes to tooth brushing (Table 2), when controlled for parental access to dental care, previous tooth problems, satisfaction with own teeth and attitudes to sweet consumption, and child age at tooth brushing start (78). Dental attendance and behavioural management problems in children were associated with caries experience in children (Table 2), when controlled for parental national background and education, parents having a dentist to go to, and child dental anxiety (79). Children having parents with both non-western background and low education were shown to have a 12 times higher probability of developing caries before 5 years of age than other children in the Norwegian setting (78).

### THE NORWEGIAN SETTING – DISCUSSION

In the Norwegian setting, several factors could be expected to influence the association between characteristics of the family and development of caries in children. These factors include low caries prevalence in children, high educational level in the Norwegian population and the dental service which offers comprehensive and free dental care to children from an early age.

Caries prevalence among children in Norway is low and skewed (8,78), and the majority of preschool child-

**Table 1.** Multivariate logistic regression analyses of associations between caries experience in children and structural characteristics of the family and maternal health and lifestyle. Prospective studies based on data from the MoBa study and the Public Dental Services (n = 1348) (73,74).

	OR	95% CI
Family status from pregnancy to age 5		
No change (ref)		
Change	2.0	1.1–3.4
Maternal education		
High (ref)		
Low	1.9	1.3–2.8
Parental origin		
Both western (ref)		
One or both non-western	3.4	1.6–7.3
Maternal dietary sugar (% of energy intake)		
< 10 (ref)		
≥ 10	1.5	1.1–2.3
Maternal dietary fat (% of energy intake)		
< 35 (ref)		
≥ 35	1.6	1.1–2.5
Maternal BMI		
Normal (ref)		
Overweight	1.6	1.0–2.5
Obese	2.3	1.3–4.1
Maternal education		
High (ref)		
Low	1.5	1.1–2.3
Parental origin		
Both western (ref)		
One or both non-western	5.4	2.8–10.6

ref = reference category

**Table 2.** Multivariate logistic regression analyses of associations between caries experience in children and family characteristics, parental oral health behaviours and attitudes. Cross-sectional studies at child age 5 years (n= 523) (78, 79).

	OR	95% CI
Parental origin		
Both western (ref)		
One or both non-western	4.8	2.5–9.2
Parental education		
Both high (ref)		
One high, one low	2.1	1.1–4.0
Both Low	3.0	1.6–5.6
Parental tooth brushing frequency		
Twice a day or more (ref)		
Once a day or less	2.2	1.0–4.6
Parental sugar containing soft drink		
Once a week or less (ref)		
Several times a week	1.8	1.1–3.1
“It is worth battling the child for tooth brushing”		
Agree (ref)		
Disagree	2.8	1.1–6.9
Missed dental appointments in children		
No (ref)		
Yes	4.0	1.8–8.6
Behaviour management problems		
No (ref)		
Yes	2.4	1.0–5.7
Parental education		
High (ref)		
Low	2.8	1.6–4.8
Parental origin		
Both western (ref)		
One or both non-western	4.8	2.6–9.0

ref = reference category

ren have no caries experience at all. This may give the impression that preschool children are not at risk of acquiring dental caries, and that spending resources to prevent dental caries is wasted. However, still some children develop caries in early life and these children may be identified using the characteristics of the mother and the family. The caries risk indicators documented in the literature may be used to identify the minority of the children at risk of developing dental caries before caries is visible clinically. Identification of risk indicators for dental caries and use of a risk strategy in caries prevention among preschool children may be more cost-effective in Norway than in other countries because of the highly skewed distribution of caries experience in preschool children in Norway.

The education level in Norway is higher than average in the OECD countries (80). The proportion of adults in Norway with high education is increasing, especially among women. This may reduce the need for preventive dental advice given to parents. The studies showed that in Norway, with a high educational level, the proportion of the population with short education which could be expected to benefit from special support from the dental services, was low.

In Norway all children are by law offered free regular and comprehensive dental care from birth. The aim of the dental care system is to reduce inequalities in dental health between children and to compensate for factors in the children's surroundings that are associated with poor dental health (81). The recall intervals are individualised and give opportunity to deliver intensified caries preventive efforts to families with children identified as being at risk of developing caries. The first regular contact with the Public Dental Services is at 3 years of age. Before age 3 years, the main preventive oral care is delivered by health care personnel in mother and child clinics. Health care personnel are instructed to refer children in need of intensified caries preventive efforts to the dental services. The health care personnel get at the time when the mother has become pregnant, knowledge of several family characteristics such as family status, education, national back-

ground and maternal weight, the major risk indicators associated with caries development in preschool children. Pregnant women with unfavourable oral health behaviours or with one or several of the family characteristics identified as risk indicators for caries may be referred to the dental services, to enable oral health promoting activities to be instigated. The identified caries risk indicators are part of the information the health care personnel usually collect about the families, and are information that can be used in health promotion. Further development of the collaboration between the dental services and health care personnel in mother and child clinics may be ensured by establishing procedures for referring children to the dental services based on the risk indicators that have been documented in the literature.

## CONCLUSION

The aim of this narrative review was to summarize knowledge from the literature regarding parental influence on caries development in preschool children. The results from the review and from the recent Norwegian studies showed that characteristics of the family such as change in family status, education and national background, and parental lifestyle such as maternal weight and diet during pregnancy and early motherhood were consistently associated with caries development in preschool children. These caries risk indicators are known by health care personnel at the time when the mother has become pregnant, and may be used to identify risk children and target preventive care at children before dental caries has developed.

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