

Parental and family-related influences on dental caries in children of Dutch, Moroccan and Turkish origin

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Abstract – Objectives: The aim of this cross-sectional study was to investigate the relationship between parental and family-related factors and childhood dental caries in a sample of 5- to 6-year-old children of Dutch, Moroccan and Turkish origin. Furthermore, the relationship of parental and family-related factors with social class and ethnicity was examined. **Methods:** The study sample included 92 parent–child dyads (46 cases and 46 controls), which were recruited from a large paediatric dental centre in The Hague, the Netherlands. Cases were children with four or more decayed, missing or filled teeth, and controls were caries free. Validated questionnaires were used to collect data on sociodemographic characteristics, oral health behaviours, parents' dental self-efficacy and locus of control (LoC), parenting practices and family functioning. Parenting practices were also assessed using structured video observations of parent–child interactions. **Results:** Parents of controls had a more internal LoC, and they were more likely to show positive (observed) parenting in terms of positive involvement, encouragement and problem-solving, compared to cases ($P < 0.05$). Lower social class was significantly associated with a lower dental self-efficacy, a more external LoC and poorer parenting practices. Furthermore, LoC was more external in Moroccan and Turkish parents, compared to Dutch parents. **Conclusion:** Parents' internal LoC and observed positive parenting practices on the dimensions positive involvement, encouragement and problem-solving were important indicators of dental health in children of Dutch, Moroccan and Turkish origin. Findings suggest that these parental factors are potential mediators of socioeconomic inequalities in children's dental health.

Key words: behavioural science; caries; family; pediatric dentistry; social inequalities

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Although significant improvements in children's oral health have occurred in many Western countries over the last 30 years, oral health inequalities have emerged as a major public health challenge (1, 2). Higher levels of dental caries are found among children from lower socioeconomic backgrounds and certain ethnic minority groups (3, 4). In the Netherlands, the prevalence and severity of dental caries are highest among Dutch children

from lower social classes and children of Moroccan and Turkish origin (5, 6). These latter ethnic groups constitute 12–20% of the population in the larger cities in the Netherlands, and they are overrepresented in the lower socioeconomic strata (7).

High-risk populations apparently fail to sufficiently benefit from conventional approaches in caries prevention. These approaches often focus on achieving individual behaviour change through

dental health education and awareness raising programmes. The assumption of these approaches is that children and/or parents will alter their behaviour once they acquire the relevant knowledge and motivation (8). However, systematic reviews have reported on the limited effectiveness of educational interventions to produce sustained improvements in oral health outcomes, particularly in those from lower socioeconomic position and ethnic minority groups (9, 10). Therefore, a paradigm shift in caries prevention is needed towards innovative strategies that address the underlying determinants of childhood dental caries. The development of such strategies requires understanding of the full range of oral health determinants and the mechanisms by which socioeconomic conditions and ethnicity affect children's dental health.

One factor which plays an important role in the development of childhood dental caries is the family (11). The family provides the child's proximate home environment that promotes certain oral health-related behaviours, expectations, beliefs and social norms. Parental attributes, parenting practices and overall family functioning all capture components of the family system, yet they are distinct constructs that may differentially influence children's caries experience. Parental attributes are characteristics of the parents that may influence the quality of the home environment. Examples of parental attributes that were associated with higher levels of childhood dental caries include parental stress (12, 13), low sense of coherence (14, 15), maternal depression (16), low dental self-efficacy (17–19) and an external dental health-related locus of control (LoC) (17, 20). Parenting practices refer to parental behaviours specifically directed towards raising the child. A recent study reported a significant relationship between parenting practices and children's oral health outcomes (21), while two other studies did not (16, 22). Broader family functioning measures relate to the evaluation of interactions between family members at a systemic level, such as parent–child, parent–parent and sibling–sibling relationships, and how these relationships interact to influence overall family functioning (23). Two studies reported that good family functioning, that is in terms of responsiveness, involvement, communication and organization/structure, was significantly associated with lower levels of dental decay, better oral hygiene and less frequent consumption of sugary foods in children (24, 25).

In summary, the literature acknowledges a range of parental and family factors as possible

mediators of caries development in children, yet the evidence relies on few empirical studies. Furthermore, it remains unclear whether these factors could explain socioeconomic and ethnic inequalities in the prevalence of childhood dental caries. Therefore, the aim of this study was to explore the relationship between parental and family-related factors (parents' dental self-efficacy and LoC, parenting practices and family functioning) and childhood dental caries in a sample of 5- to 6-year-old children of Dutch, Moroccan and Turkish origin. A further objective was to explore the relationship of parental and family-related factors with social class and ethnicity. The hypothesis of this study was that parents of caries-free children (controls) had a higher dental self-efficacy, a more internal LoC and more positive parenting practices and family functioning, compared to children with dental caries (cases). Furthermore, it was hypothesized that these parental and family-related factors were more favourable in parents from higher social classes and those of Dutch origin, compared to parents from lower social classes and those of Moroccan or Turkish origin, respectively.

Materials and methods

Ethical approval for this study was obtained from The Central Committee on Research Involving Human Subjects, the Netherlands (CCMO). Prior to data collection, all participating parents provided written informed consent.

Study sample

Data for this study were collected between September 2013 and March 2014. Participants were recruited from a large paediatric dental care centre in The Hague, the Netherlands. The centre works in partnership with elementary schools and has clinics in different geographical regions in the city that vary in terms of socioeconomic level and immigrant population.

All 5- and 6-year-old children that were of Dutch, Moroccan and Turkish origin were selected. Children were considered of Dutch origin if both their parents were born in the Netherlands. Children were classified as Moroccan or Turkish if (i) both their parents were first-generation immigrants or (ii) if one parent was a first-generation immigrant and one parent was a second-generation immigrant. Subsequently, children were selected and allocated according to their dental condition into

two groups: cases and controls. Cases were defined as children with at least four decayed, missing or filled primary teeth (dmft score ≥ 4), irrespective of the condition of the permanent teeth, because the number of erupted permanent teeth varied among children. Controls had no decayed, missing or filled teeth in both their primary and permanent dentition (dmft/DMFT = 0, referred to as 'caries free'). A dmft-value of 4 was chosen to define cases, because it corresponds with the mean and median dmft of 5-year-old children with dental caries in the 2006 Dutch National Oral Health Survey (26). Children diagnosed with emotional and behavioural disorders (e.g. autism spectrum disorders), children with special needs and children with tooth enamel defects were excluded from study selection. Only one child per family was included. The sample size was determined on the basis of a previously conducted study by de Jong-Lenters et al. (21). This study found statistically significant differences in parenting practices between cases and controls with an effect size of $d = 0.90$ or higher. Given this effect size, a power calculation indicated that a minimum sample of 50 children would be sufficient to detect differences in parenting variables between cases and controls, based on 90% of power and 5% level of significance. However, the sample size of this study was increased further to ensure enough participants in the socioeconomic and ethnic subgroups to be compared.

An information letter about the study was sent to the home address of all eligible children ($n = 271$; 165 cases and 106 controls). The parents of the children were subsequently contacted by telephone and kindly requested to participate. A total of 92 parent-child dyads participated in the study, including 46 cases and 46 controls (response rate = 34%). The response rate varied from 13% in Turkish cases to 57% in Dutch controls. Common reasons for non-participation in the ethnic minority groups were the language barrier and difficulties with transportation to the dental care centre, while the Dutch group reported no interest and/or no time as main reasons for non-participation. Participation involved a 90-min visit of the child and a parent to the paediatric dental care centre. Incentives for the study included a monetary voucher for the parent (20 euro's) and a small gift and oral hygiene kit for the child.

Data collection

Dental health data. Children's dmft(/DMFT) scores were obtained from personal dental health

records from the paediatric dental centre. The diagnosis of dental caries was based on clinical examinations (supported by dental X-rays), which were performed by dentists working at the centre. The centre registers data in a protocolled manner to ensure that records are up-to-date and complete. The dental status of children's primary dentition was extracted using data from the last dental visit, which had been no more than 6 months before the time of data collection of this study. The dmft(/DMFT) score was calculated by adding the number of decayed (at the dentine level), missing (due to caries) and filled teeth. Data extraction was performed by one researcher (DD), who holds a Bachelor of Science degree in Dentistry.

Sociodemographic and behavioural data. A parental self-report questionnaire was used to collect data on sociodemographic characteristics and oral health behaviours. Sociodemographic variables included the mother's highest completed level of education, family income and family structure. The mother's education level was used as an indicator for social class and was categorized into (i) lower education (no education, elementary school and secondary school at lower level), (ii) medium education (secondary school at higher level and further education at lower level) and (iii) higher education (further education at higher level and university). The oral health behaviours measured were tooth brushing frequency, the age tooth brushing was started, parental involvement with tooth brushing and the frequency of consuming sugary foods and drinks between meals. Fluoride toothpaste is the only source of fluoride in the Netherlands. As 99% of children in the Netherlands are brushing with fluoride toothpaste, tooth brushing frequency also reflects fluoride use.

Parental and family-related variables. Table 1 presents an overview of parental and family-related variables measured in this study. For each variable, a definition is described.

Parental oral health-related attributes—Parents' dental self-efficacy and dental health LoC were measured using a validated questionnaire developed by Pine et al. (27). This questionnaire assesses parental beliefs and attitudes associated with children's oral health behaviours, including sugar snacking and tooth brushing with fluoride toothpaste.

Parenting practices—Different approaches to measuring parenting practices have been devised,

Table 1. Definition, number of items (score range), direction of scores and internal consistency for parental and family-related variables

Variables	Definition	No. of items (score range)	Direction ^a	Cronbach's α
Oral health-related attributes				
Dental self-efficacy	Parents' confidence in their ability to engage in healthy oral health practices for their child	9 (9–45)	+	0.67
Locus of control	Parents' belief towards their ability to control the dental health of their child: health-external persons interpret health as dependent on outside forces (e.g. luck, responsibility of the dentist or genetics), whereas health-internal persons believe that health is determined by one's own behaviour	9 (9–45)	+	0.83
Parenting practices (APQ)				
Involvement	Parents' interest in the child's activities and positive interactions with the child	10 (10–50)	+	0.65
Positive parenting	The frequency of praise and positive reinforcement for prosocial child behaviour	6 (6–30)	+	0.69
Inconsistent discipline	Parents' irregular and unpredictable use of discipline practices and child punishment	6 (6–30)	–	0.52
Parenting practices (SIT)				
Positive involvement	The degree to which family interactions are characterized by warmth, empathy and positive affect and whether parents show an active interest in their child's experiences	12 (12–60)	+	0.77
Encouragement	The extent to which parents stimulate their child's independence through positive endorsement, reinforcement and offering help when necessary	20 (20–100)	+	0.87
Problem-solving	Parents' ability to generate solutions that are feasible for the child, and the extent to which the parent and child are both involved in the decision-making process and are open to each other's viewpoints	27 (27–135)	+	0.91
Discipline	Parents' adequacy of setting appropriate limits for their child and their efficiency in responding to their child's unacceptable behaviours in terms of timing, consistency, intensity and clear use of instructions/commands	26 (26–130)	+	0.80
Coercion	The degree to which parents have the tendency to criticize their children, be overly strict and demanding and use harsh and inconsistent disciplinary actions	16 (16–80)	–	0.61
Interpersonal atmosphere	The extent to which parent-child interactions are pleasant, comfortable and free of conflict and frustration	24 (24–95)	+	0.70
Family functioning				
Organization	The degree of structure, routines and assignment of roles in the family, as well as the family's ability to resolve problems	9 (9–45)	+	0.64
Social network	The extent to which the family can rely on support from people in their social environment	9 (9–45)	+	0.84

APQ, Alabama Parenting Questionnaire; SIT, structured interaction tasks.

^a+' = higher scores reflect positive outcomes, '- = higher scores reflect negative outcomes.

which include self-report questionnaires ('insider's view') and observational methods that rely on ratings from an observer external to the family ('outsider's view'). As there is little congruence in parenting assessment between these two methodologies (28), both observational and self-report methods were used to measure parenting practices in this study.

The self-report Alabama Parenting Questionnaire (APQ) was used to measure parenting practices on three dimensions: involvement, positive parenting and inconsistent discipline (29). The APQ was designed to tap the most important aspects of parenting practices related to disruptive behaviour problems in children. The measure demonstrated adequate levels of reliability and construct validity (29).

Parenting practices were also observed using Structured Interaction Tasks (SIT) (30–32). This observational method measures relevant aspects of parenting practices known to impact on children's socio-emotional development and behaviours. The SIT contain seven structured tasks which are performed by the child and the parent in a quiet room at the paediatric dental care centre. Tasks include planning a fun activity for the weekend (3 min), problem-solving on a topic selected by the parent (5 min), drawing a picture of their home (7 min), snack break (5 min), problem-solving on a topic selected by the child (5 min), teaching/learning tasks (9 min) and a monitoring task in which the parent interviews the child about a moment when the child was not in the parent's direct presence (5 min). All parent-child interactions were videotaped. The video material was rated using an objective coding system, based on the Coder Impressions (33). The coding system contains specific items for each SIT, as well as general items related to the overall quality of the interaction between parent and child during the entire session. Items measure six underlying dimensions of parenting practices: positive involvement, encouragement, problem-solving, discipline, coercion and interpersonal atmosphere. All observations were coded by one trained and calibrated observer who was blind to the dental condition. A random selection of 12 observations (13%) was double coded by a second blind observer for a reliability check. The percentage agreement between coders (difference in scores = 0, and difference in scores = 0 or 1) was 72.5% and 94.4%, respectively. The intraclass correlation was 0.88.

Family functioning—Family organization and social network were assessed by the Gezinsvragenlijst (GVL, translation 'Family Questionnaire'), a validated measure to assess family functioning and the quality of family relationships (24, 34). Psychometric evaluation supported the reliability and the validity of the GVL (34).

The questionnaire items by Pine et al. and the APQ items were translated into Dutch and back-translated. The self-report questionnaires were interview-administered if a parent was illiterate. All items of the questionnaire by Pine et al., the APQ, the SIT and the GVL were measured on a 5-point Likert scale. A cumulative score for each dimension was computed. The number of items per dimension, the range of the scores, the direction of scores and the internal consistency for each

variable in the present sample are presented in Table 1.

Statistical analysis

Statistical analysis was carried out using SPSS (IBM SPSS Statistics for Windows, Version 20.0; IBM Corp., Armonk, NY, USA). Independent samples *t*-tests were performed to compare mean scores of parental and family-related variables between cases and controls. Furthermore, logistic regression analysis was conducted for the association of parental and family-related variables with the dental condition as the dependent variable (control versus case). To test whether social class and ethnicity modified the effects of parental and family-related variables on the dental condition, interaction terms with social class and ethnicity were introduced into the regression models. Presence of interactions was subsequently examined using the likelihood ratio test. Differences in parental and family-related variables between socioeconomic groups and Dutch, Turkish and Moroccan groups were compared using analysis of variance (ANOVA). A *P*-value of <0.05 was considered significant.

Results

Description of the sample

The study sample included 92 parent-child dyads (46 cases and 46 controls), consisting of 35 Dutch children (14 cases and 21 controls), 31 Moroccan children (18 cases and 13 controls) and 26 Turkish children (14 cases and 12 controls). Seventy-four per cent of the participating parents were biological mothers, and 26% were biological fathers. The mean age of the children was 6.1 ± 0.5 years (range = 5.3–6.9). Cases had an average dmft of 6.5 ± 2.3 (range = 4–12), while controls had a mean dmft/DMFT of 0.0 ± 0.0 . Sample characteristics are summarized in Table 2. Girls were significantly overrepresented in cases (69.6%) compared to controls (47.8%). Cases and controls did not differ significantly in mother's education level, family income, birth order of the child and relationship status of the parents. In terms of oral health behaviours, cases reported more frequent consumption of sugary foods between meals compared to controls (although this was only a trend, *P* = 0.06), but this was not the case for consumption of sugary drinks. There were no statistical differences in tooth brushing frequency, and age tooth brushing was started

Table 2. Distribution of sociodemographic characteristics and oral health behaviours between cases and controls

Variables	Controls (n = 46) n (%)	Cases (n = 46) n (%)	P ^a
Sociodemographics			
Ethnicity			
Dutch	21 (45.7)	14 (30.4)	0.31
Moroccan	13 (28.3)	18 (39.1)	
Turkish	12 (26.1)	14 (30.4)	
Sex			
Boy	24 (52.2)	14 (30.4)	0.03
Girl	22 (47.8)	32 (69.6)	
Education level (mother)			
Lower education	16 (35.6)	23 (50.0)	0.20
Medium education	13 (28.9)	14 (30.4)	
Higher education	16 (35.6)	9 (19.6)	
Family income			
Below modal	16 (36.4)	24 (52.2)	0.22
Modal	17 (38.6)	16 (34.8)	
Above modal	11 (25.0)	6 (13.0)	
Birth order			
3rd child or more	9 (20.5)	12 (27.3)	0.60
2nd child	19 (43.2)	20 (45.5)	
1st child	16 (36.4)	12 (27.3)	
Relationship status			
Single	8 (17.8)	13 (28.9)	0.21
With partner	37 (87.2)	32 (71.1)	
Oral health behaviours			
Tooth brushing frequency			
(Often) less than twice a day	17 (37.8)	20 (45.5)	0.46
Always twice a day or more	28 (62.2)	24 (54.5)	
Age tooth brushing was started			
Two years old or older	5 (11.1)	6 (14.3)	0.90
Between 1 and 2 years old	15 (33.3)	14 (33.3)	
<1 year old	25 (55.6)	22 (52.4)	
Parental involvement with tooth brushing			
Never – sometimes	13 (32.5)	13 (30.2)	0.82
Often – always	27 (67.5)	30 (69.8)	
Frequency of sugary foods between meals			
Three times or more per day	15 (33.3)	23 (52.3)	0.07
Twice or less per day	30 (66.7)	21 (47.7)	
Frequency of sugary drinks between meals			
Three times or more per day	15 (33.3)	21 (47.7)	0.17
Twice or less per day	30 (66.7)	23 (52.3)	

^aχ²-test.

and parental involvement with tooth brushing between cases and controls.

Correlations between parental and family-related factors

A correlation matrix of all parental and family-related factors is presented in Table 3. A higher dental self-efficacy was significantly associated

with a more internal LoC (Pearson's $r = 0.41$). Dental self-efficacy and LoC were also moderately correlated with several (observed) parenting dimensions, including positive involvement, encouragement and problem-solving. The majority of the SIT dimensions were moderately to strongly intercorrelated. In particular, strong associations were found for encouragement with problem-solving and coercion ($r = 0.59$ and $r = -0.59$, respectively), and for problem-solving with interpersonal atmosphere ($r = 0.60$).

As expected, there was limited congruence between parenting practices measured with the APQ (self-report method) and parenting practices measured with the SIT (observational method). Correlations were $r = 0.24$ (significant at $P = 0.03$) for APQ involvement and SIT positive involvement, $r = 0.06$ (not significant) for APQ positive parenting and SIT encouragement and $r = -0.31$ (significant at $P = 0.003$) for APQ-inconsistent discipline and SIT discipline.

Differences in parental and family-related factors between cases and controls. Parents' LoC was significantly more internal in controls than in cases, but parents' dental self-efficacy did not differ significantly between cases and controls (Table 4). In terms of parenting practices, the SIT dimensions positive involvement, encouragement and problem-solving were significantly higher in controls than in cases. Yet, there were no significant differences between cases and controls on any of the APQ dimensions and on the SIT dimensions discipline, coercion and interpersonal atmosphere. Furthermore, cases did not differ significantly from controls in the quality of family organization and social network.

Similar associations were found when the association of parental and family-related dimensions with the dental condition was examined using logistic regression (results not shown). Sex-adjusted odds ratio's and 95% confidence intervals were 0.92 (0.86–0.98), 0.91 (0.82–0.99), 0.93 (0.88–0.98) and 0.95 (0.92–0.98) for LoC and the SIT dimensions positive involvement, encouragement and problem-solving, respectively, indicating that higher scores on these dimensions were associated with a decreased likelihood of being a case compared to a control. There was no evidence for an interaction with social class or ethnicity: the effect of parental and family-related factors on children's dental condition did not differ significantly across socioeconomic and ethnic strata.

Table 3. Correlation matrix of parental oral health-related attributes, parenting practices and family functioning

Variables	SE	LoC	APQ-1	APQ-2	APQ-3	SIT-1	SIT-2	SIT-3	SIT-4	SIT-5	SIT-6	GVL-1	GVL-2
SE	–												
LoC	0.41*	–											
APQ-1	0.24*	0.16	–										
APQ-2	0.15	–0.12	0.48*	–									
APQ-4	–0.41*	–0.07	0.04	–0.20	–								
SIT-1	0.26*	0.33*	0.24*	0.13	–0.15	–							
SIT-2	0.28*	0.44*	0.16	0.06	–0.19	0.48*	–						
SIT-3	0.32*	0.58*	0.23*	0.10	–0.07	0.345*	0.59*	–					
SIT-4	0.18	0.12	0.14	0.21*	–0.31*	0.16	0.26*	0.47*	–				
SIT-6	–0.13	–0.05	–0.08	–0.13	0.26*	–0.21	–0.59*	–0.21*	–0.40*	–			
SIT-7	0.17	0.46*	0.20	0.16	–0.09	0.23*	0.31*	0.60*	0.36*	–0.07	–		
GVL-1	0.31*	0.16	0.37*	0.26*	–0.08	0.09	0.11	0.16	0.07	0.05	0.04	–	
GVL-2	0.29*	0.11	0.30*	0.18	–0.17	0.12	0.21*	0.17	0.11	–0.05	0.07	0.38*	–

SE, dental self-efficacy; LoC, dental health locus of control; APQ-1, APQ involvement; APQ-2, APQ positive parenting; APQ-3, APQ-inconsistent discipline; SIT-1, SIT positive involvement; SIT-2, SIT encouragement; SIT-3, SIT problem-solving; SIT-4, SIT discipline; SIT-5, SIT coercion; SIT-6, SIT interpersonal atmosphere; GVL-1, GVL organization; GVL-2, GVL social network.

Pearson correlation, * $P < 0.05$.

Table 4. Mean scores and standard deviations of parental oral health-related attributes, parenting practices and family functioning between cases and controls

Variables	Controls ($n = 46$)		Cases ($n = 46$)		P^a
	Mean \pm SD	Range	Mean \pm SD	Range	
Oral health-related attributes					
Dental self-efficacy	35.2 \pm 5.8	22–45	34.4 \pm 4.8	24–45	0.49
Dental health locus of control	31.7 \pm 6.8	12–44	27.3 \pm 7.6	10–39	0.005
Parenting practices (APQ)					
Involvement	41.5 \pm 4.8	27–50	40.7 \pm 4.0	31–48	0.37
Positive parenting	26.1 \pm 2.4	21–30	26.4 \pm 2.8	21–30	0.59
Inconsistent discipline	16.0 \pm 3.0	10–22	14.9 \pm 3.4	7–22	0.13
Parenting practices (SIT)					
Positive involvement	51.5 \pm 4.5	41–59	49.2 \pm 4.8	39–59	0.03
Encouragement	78.7 \pm 8.0	62–92	73.7 \pm 8.7	59–87	0.007
Problem-solving	102.3 \pm 12.6	73–128	92.9 \pm 13.7	52–119	0.001
Discipline	122.0 \pm 4.9	104–125	121.3 \pm 6.9	95–125	0.59
Coercion	20.6 \pm 4.1	16–34	21.8 \pm 4.8	16–34	0.22
Interpersonal atmosphere	109.9 \pm 5.5	94–120	108.7 \pm 5.8	81–117	0.33
Family functioning					
Organization	40.0 \pm 3.2	34–45	39.4 \pm 4.3	28–45	0.42
Social network	38.2 \pm 5.9	20–45	37.1 \pm 7.0	16–45	0.45

SIT, structured interaction tasks.

^aIndependent samples t -test.

The relationship of parental and family-related factors with social class and ethnicity. Social class was significantly associated with parental oral health-related attributes and all SIT dimensions, except discipline (Table 5). Parents of children from higher social classes had a higher dental self-efficacy and a more internal LoC. They also showed higher levels of positive involvement and encouragement, better problem-solving and a better interpersonal atmosphere during interactions with their child, and they were less likely to show coercive

behaviours. The association between social class and the APQ dimension involvement was borderline significant. No significant associations were found for social class with the APQ dimensions positive parenting and discipline, nor with family functioning.

Dutch parents had a more internal LoC (32.7 ± 5.8) compared to Moroccan parents (29.0 ± 7.4 , $P = 0.004$) and compared to Turkish parents (25.5 ± 7.9 , $P < 0.001$). All other parental and family-related factors were not significantly

Table 5. Mean scores and standard deviations of parental oral health-related attributes, parenting practices and family functioning between children with lower, medium and higher educated mothers

Dimensions	Low (<i>n</i> = 39) Mean ± SD	Medium (<i>n</i> = 27) Mean ± SD	High (<i>n</i> = 25) Mean ± SD	<i>P</i> ^a
Oral health-related attributes				
Dental self-efficacy	33.5 ± 5.5	34.6 ± 5.8	36.9 ± 5.2	0.04
Dental health locus of control	24.8 ± 7.7	32.0 ± 4.8	34.2 ± 5.1	<0.001
Parenting practices (APQ)				
Involvement	39.9 ± 3.7	41.6 ± 5.2	42.4 ± 4.2	0.06
Positive parenting	26.1 ± 2.7	26.9 ± 2.1	25.8 ± 2.7	0.27
Inconsistent discipline	15.7 ± 3.2	15.5 ± 3.7	14.9 ± 2.8	0.63
Parenting practices (SIT)				
Positive involvement	48.7 ± 4.8	50.4 ± 4.2	52.6 ± 4.6	0.006
Encouragement	71.2 ± 8.3	78.0 ± 6.9	81.3 ± 7.4	<0.001
Problem-solving	90.3 ± 13.0	100.2 ± 11.5	104.9 ± 13.1	<0.001
Discipline	120.6 ± 7.1	122.7 ± 4.5	122.1 ± 5.5	0.36
Coercion	23.0 ± 4.9	20.1 ± 3.6	19.8 ± 3.9	0.006
Interpersonal atmosphere	107.0 ± 7.2	110.6 ± 3.5	111.3 ± 3.5	0.004
Family functioning				
Organization	38.9 ± 4.3	40.3 ± 3.7	40.1 ± 3.0	0.28
Social network	36.7 ± 7.3	38.5 ± 5.6	38.4 ± 5.9	0.43

SIT, structured interaction tasks.

^aOne-way ANOVA.

different between Dutch, Moroccan and Turkish parents (results not shown).

Discussion

This cross-sectional study found that parents' dental health LoC and observed parenting practices were significantly associated with childhood dental caries in a sample of 5- to 6-year-old children of Dutch, Moroccan and Turkish origin. Parents of caries-free children had a more internal LoC regarding dental health and they were more likely to show positive parenting practices in terms of positive involvement, encouragement and problem-solving, compared to parents of children with four or more decayed, missing or filled teeth.

Interestingly, several observed parenting practices (measured with the SIT) were significantly associated with childhood dental caries, while similar parenting practices measured through self-report (with the APQ) were not. In line with this, the observational ratings did not correlate strongly with self-report ratings of parenting practices. Findings from other dental health studies are equivocal: one study reported strong differences in observed parenting practices between children with and without dental caries (21), while two studies using self-report methods (the Parenting Scale and the Authoritative Parenting Index) did not find an association between parenting and children's oral health outcomes (16, 22). Thus, the

question is raised: Which findings are more valid? The above-mentioned studies, including the present study, used well-validated self-report family measures with good psychometric properties. Still, there is considerable discussion regarding the advantages and disadvantages of using self-report methods versus observational methods for parenting assessment (28, 35). Self-report methods rely on parents' own beliefs and perceptions of their parenting behaviour. However, it is generally accepted that these can be quite distinct from actual behaviours (36). Furthermore, there may be a tendency of parents to answer questions about their parenting in a socially desirable manner. Structured observational methods do not possess these limitations and have the advantage that all participants receive the exact same standardized instruction. However, with observational ratings, there is a risk that results may be biased by the interpretation of the observer, yet this was limited in the present study, because coders were blind to the child's dental condition and intercoder agreement was high.

Another issue with self-report parenting assessment is that most parenting measures have been developed for use in a clinical context, designed to distinguish between 'problem families' and 'non-problem families'. Yet, in oral health research, the majority of the participating families are normative families that do not necessarily have clinical problems. Therefore, the self-report methods used in oral health studies may not have been sensitive enough to discriminate among parenting practices

within the normative range. The current study demonstrated a significant and meaningful relationship between observed parenting practices and childhood dental caries. This suggests that observational ratings are able to detect subtle nuances in parenting practices that are relevant to caries development. Thus, it seems that research into parenting behaviours in relation to oral health outcomes may better rely on objective observational methods, rather than self-report ratings.

Oral health behaviours likely play an important mediating role in the relationship between parental factors and children's caries experience. The role of parents is central in shaping children's behaviours, attitudes and social norms regarding oral health (11). Their perceptions of LoC, or judgment about their ability to control their child's dental health, can be an important argument for why they engage in oral health-promoting behaviours for their children. Parenting practices provide the context in which parents' intended oral health-promoting behaviours are delivered and interpreted by the child. For example, positive parenting practices may directly enhance children's uptake of healthy habits through modelling and reinforcing proper behaviours (e.g. with rewards or praising words) (37), and through monitoring and controlling children's dietary intake and oral hygiene habits. Furthermore, it has been shown that behavioural directions are most accepted by the child when the parent displays moderate levels of strictness and when the child experiences greater involvement or warmth from the parent (38, 39). On the other hand, ineffective parenting (characterized by highly demanding disciplining practices and low levels of positive interaction) has been associated with a higher degree of resistance and noncompliance in children (40, 41), which may have similar effects on children's compliance with oral health behaviours. Ineffective parenting has also been related to an unhealthy diet and childhood obesity, including higher caloric intake, lower fruit and vegetable consumption and lower frequency of eating breakfast (38, 42–45). Our findings of lower levels of positive involvement, encouragement and problem-solving in children with dental caries, compared to caries-free children, suggest that ineffective parenting also affects children's dental health.

There is clear evidence for a socioeconomic gradient in childhood dental caries, yet the underlying mechanisms that account for the strong relationship between social class and children's caries experience are not fully understood. It is plausible

that parenting and family factors are partially responsible for socioeconomic inequalities in children's dental health, as parenting and family factors are known to be socially patterned (46, 47). The current study confirmed an association between parental and family-related factors and socioeconomic status; being from a lower social class increased the likelihood of having parents with less favourable oral health-related attributes and parenting practices. These, in turn, were associated with an increased risk of dental caries in children, which supports the potential mediating role of parents' oral health-related attributes and parenting practices in the relationship between socioeconomic conditions and childhood dental caries. The mediating role of family factors has been conceptualized in a theoretical model by Fisher-Owens et al. (48) and empirically tested in a structural path model (49). This model implies that social conditions indirectly influence children's oral health behaviours and subsequently children's caries experience through an impact on interrelated parental and family factors. Parents' LoC was significantly more external in parents of Moroccan and Turkish backgrounds, compared to Dutch backgrounds, which could contribute to the explanation of ethnic variation in children's caries experience. However, whether this factor plays a mediating role in ethnic inequalities in children's dental health, in addition to other explanatory variables, including SES, should be further investigated in a sufficiently large sample using structural equation modelling.

One of the evident strengths of this study was the use of reliable and valid instruments to measure parental and family-related factors. The instruments had good psychometric properties, and they derive strength from their basis in theoretical models. A novel approach was that both observational and self-report methods were used, providing multiple perspectives of the family. Furthermore, this study included a unique study sample with a large proportion of children from lower social class and from Moroccan and Turkish origin, which are difficult groups to recruit for research purposes. However, some potential limitations should be taken into account. Limitations include the relatively small sample size of the subgroups and the limited generalizability. Children from a general dental practice and children whose parents do not speak the Dutch language were not included, and the nonresponse rate was relatively high. Nevertheless, the current study sample was

appropriate for testing the hypotheses, and the number of included participants was sufficient to detect statistically significant differences with an effect size $d = 0.45$, a power of 0.80 and a significance level of $\alpha = 0.05$. Notably, there were no significant differences in social class between caries-free children and children with dental decay. The absence of an expected difference in caries level in relation to social class could perhaps be attributed to selection bias and the fact that children with and without dental caries were recruited from the same patient population of the paediatric dental care centre. In addition, no conclusions on temporal and causal associations of variables can be deduced from this cross-sectional study. Despite evidence for temporal stability of parenting and family functioning (50, 51), life events and transitions that occur in the family may affect parental and family-related factors over time. Prospective, longitudinal studies are therefore needed to investigate the role of parental and family-related factors in the initiation of children's oral health behaviours and the development of childhood dental caries over the years. Such an approach will also allow in-depth examination of the mediating or moderating effects of these family factors on socioeconomic inequalities in childhood dental caries.

In conclusion, parents' internal belief of their ability to control their child's dental health and observed positive parenting practices on the dimensions of positive involvement, encouragement and problem-solving were important indicators of dental health in children of Dutch, Moroccan and Turkish origin. Findings of this study indicate that these parental factors are potential mediators of socioeconomic inequalities in children's dental health. The important influence of parents on childhood dental caries supports the design of health promotion strategies that intervene at this level to further reduce caries levels in children, especially in those at higher risk.

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References

- Petersen PE. World Health Organization global policy for improvement of oral health – World Health Assembly 2007. *Int Dent J* 2008;58:115–21.
- Pitts N, Amaechi B, Niederman R, Acevedo AM, Viana R, Ganss C et al. Global oral health inequalities: dental caries task group–research agenda. *Adv Dent Res* 2011;23:211–20.
- Watt R, Sheiham A. Inequalities in oral health: a review of the evidence and recommendations for action. *Br Dent J* 1999;187:6–12.
- Do LG. Distribution of caries in children: variations between and within populations. *J Dent Res* 2012;91:536–43.
- Verrrips GH, Kalsbeek H, Eijkman MAW. Ethnicity and maternal education as risk indicators for dental caries, and the role of dental behavior. *Community Dent Oral Epidemiol* 1993;21:209–14.
- Truin GJ, van Rijkom HM, Mulder J, van 't Hof MA. Tandcariës en erosieve gebitsslijtage bij 5- en 6-jarige en 11- en 12-jarige Haagse schoolkinderen Verandert de prevalentie? *Ned Tijdschr Tandheelkd* 2004;111:74–9.
- CBS Statline. 2014; available at: <http://www.cbs.nl/nl-NL/menu/themas/dossiers/allochtonen/cijfers/extra/aandeel-allochtonen.htm> [last accessed 2 April 2014].
- Watt RG. From victim blaming to upstream action: tackling the social determinants of oral health inequalities. *Community Dent Oral Epidemiol* 2007;35:1–11.
- Schou L, Wight C. Does dental health education affect inequalities in dental health? *Community Dent Health* 1994;11:97–100.
- Kay L, Locker D. Is dental health education effective? A systematic review of current evidence. *Community Dent Oral Epidemiol* 1996;31:3–24.
- Hooley M, Skouteris H, Boganin C, Satur J, Kilpatrick N. Parental influence and the development of dental caries in children aged 0–6 years: a systematic review of the literature. *J Dent* 2012;40:873–85.
- Tang C, Quiñonez RB, Hallett K, Lee JY, Whitt JK. Examining the association between parenting stress and the development of early childhood caries. *Community Dent Oral Epidemiol* 2005;33:454–60.
- Menon I, Nagarajappa R, Ramesh G, Tak M. Parental stress as a predictor of early childhood caries among preschool children in India. *Int J Paediatr Dent* 2013;23:160–5.
- Bonanato K, Paiva SM, Pordeus IA, Ramos-Jorge ML, Barbabela D, Allison PJ. Relationship between mothers' sense of coherence and oral health status of preschool children. *Caries Res* 2009;43:103–9.
- Qiu RM, Wong MCM, Lo ECM, Lin HC. Relationship between children's oral health-related behaviors and their caregiver's sense of coherence. *BMC Public Health* 2013;13:239.
- Seow WK, Clifford H, Battistutta D, Morawska A, Holcombe T. Case-control study of early childhood caries in Australia. *Caries Res* 2009;43:25–35.
- Reisine S, Litt M. Social and psychological theories and their use for dental practice. *Int Dent J* 1993;43 (Suppl 1):279–87.
- Litt MD, Reisine S, Tinanoff N. Multidimensional model of dental caries development in low-income

- preschool children. *Public Health Rep* 1995;110:607–17.
19. Adair PM, Pine CM, Burnside G, Nicoll AD, Gillett A, Anwar S et al. Familial and cultural perceptions and beliefs of oral hygiene and dietary practices among ethnically and socio-economic all diverse groups. *Community Dent Health* 2004;21(Suppl. 1):102–11.
 20. Lencová E, Pikhart H, Broukal Z, Tsakos G. Relationship between parental locus of control and caries experience in preschool children – cross-sectional survey. *BMC Public Health* 2008;8:208.
 21. de Jong-Lenters M, Duijster D, Bruist M, Thijssen J, de Ruiter C. The relationship between parenting, family interaction and childhood dental caries: a case-control study. *Soc Sci Med* 2014;116:49–55.
 22. Aleksejūnienė J, Brukiene V. Parenting style, locus of control, and oral hygiene in adolescents. *Medicina (Kaunas)* 2012;48:102–8.
 23. Kazak AE. A contextual family/systems approach to pediatric psychology: introduction to the special issue. *J Pediatr Psychol* 1997;22:141–8.
 24. Duijster D, Verrips GHW, van Loveren C. The role of family functioning in childhood dental caries. *Community Dent Oral Epidemiol* 2014;42:193–205.
 25. Nanjappa S. Family functioning and frequency of sugar consumption by 3 and 4 year old children in Outer North East London. PhD thesis, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, 2012.
 26. Poorterman JHG, Schuller AA. Tandheelkundige verzorging Jeugdige Ziekenfondsverzekerden (TJZ). Eindmeting 2005. Amsterdam/Leiden: Academisch Centrum Tandheelkunde Amsterdam, TNO Kwaliteit van Leven; 2006.
 27. Pine CM, Adair PM, Nicoll AD, Burnside G, Petersen PE, Beighton D et al. Developing explanatory models of health inequalities in childhood dental caries. *Community Dent Health* 2004;21(Suppl. 1):86–95.
 28. Hampson RB, Beavers WR, Hulgus YF. Insiders' and outsiders' views of family: the assessment of family competence and style. *J Fam Psychol* 1989;3:118–36.
 29. Shelton KK, Frick PJ, Wootton J. Assessment of parenting practices in families of elementary school-aged children. *J Clin Child Psychol* 1996;25:317–29.
 30. Forgatch MS, DeGarmo DS. Parenting through change: an effective prevention program for single mothers. *J Consult Clin Psychol* 1999;67:711–24.
 31. DeGarmo DS, Forgatch MS. Efficacy of parent training for stepfathers: from playful spectator and polite stranger to effective stepfathering. *Parent Sci Pract* 2007;7:331–55.
 32. Ogden T, Hagen KA. Treatment effectiveness of parent management training in Norway: a randomized controlled trial of children with conduct problems. *J Consult Clin Psychol* 2008;76:607–21.
 33. Forgatch MS, Knutson NM, Mayne T. *Coder impressions of ODS lab tasks*. Eugene, OR: Oregon Social Learning Center; 1992.
 34. Scholte E, Van der Ploeg J. The Family Questionnaire: a measure to assess the quality of family functioning. *J Fam Issues* 2013. doi: 10.1177/0192513X13506707.
 35. Tutty LM. Theoretical and practical issues in selecting a measure of family functioning. *Res Soc Work Pract* 1995;5:80–106.
 36. Schwarz JC, Barton-Henry ML, Pruzinsky T. Assessing child-rearing behaviors: a comparison of rating made by mother, father, child and sibling on the CRPBI. *Child Dev* 1985;56:462–79.
 37. Stark LJ, Collins FL Jr, Osnes PG, Stokes TF. Using reinforcement and cueing to increase healthy snack food choices in preschoolers. *J Appl Behav Anal* 1986;19:367–79.
 38. Rhee K. Childhood overweight and the relationship between parent behaviors, parenting style, and family functioning. *Ann Am Acad Pol Soc Sci* 2008; 615:11–37.
 39. van der Horst K, Kremers S, Fereira I, Singh A, Oenema A, Brug J. Perceived parenting style and practices and the consumption of sugar-sweetened beverages by adolescents. *Health Educ Res* 2007;22:295–304.
 40. Lytton H. Correlates of compliance and the rudiments of conscience in two-year-old boys. *Can J Behav Sci* 1977;9:242–51.
 41. Kuczynski L, Kochanska G, Radke-Yarrow M, Girnius-Brown O. A developmental interpretation of young children's noncompliance. *Dev Psychol* 1987;23:799–806.
 42. Kremers SP, Brug J, de Vries H, Engels RCME. Parenting style and adolescent fruit consumption. *Appetite* 2003;41:43–50.
 43. Patrick H, Nicklas TA, Hughes SO, Morales M. The benefits of authoritative feeding style: caregiver feeding styles and children's food consumption patterns. *Appetite* 2005;44:243–9.
 44. Arredondo EM, Elder JP, Ayala GX, Campbell N, Baquero B, Duerksen S. Is parenting style related to children's healthy eating and physical activity in Latino families? *Health Educ Res* 2006;21:862–71.
 45. Wake M, Nicholson JM, Hardy P, Smith K. Preschooler obesity and parenting styles of mothers and fathers: Australian national population study. *Pediatrics* 2007;120:1520–7.
 46. Belsky J, Bell B, Bradley RH, Stallard N, Stewart-Brown SL. Socioeconomic risk, parenting during the preschool years and child health age 6 years. *Eur J Public Health* 2006;17:508–13.
 47. Brown J, Cohen P, Johnson JG, Salzinger S. A longitudinal analysis of risk factors for child maltreatment: findings of a 17 year prospective study of officially recorded and self-reported child abuse and neglect. *Child Abuse Negl* 1998;22:1065–78.
 48. Fisher-Owens SA, Gansky SA, Platt LJ, Weintraub JA, Soobader MJ, Bramlett MD et al. Influences on children's oral health: a conceptual model. *Pediatrics* 2010;120:510–20.
 49. Duijster D, van Loveren C, Dusseldorp E, Verrips GHW. Modelling community, family and individual determinants of childhood dental caries. *Eur J Oral Sci* 2014;122:125–33.
 50. Clerkin SM, Marks DJ, Policaro KL, Halperin JM. Psychometric properties of the Alabama parenting questionnaire-preschool revision. *J Clin Adolesc Psychol* 2007;36:19–28.
 51. Shaffer A, Lidhiem O, Kolko DJ, Trentacosta CJ. Bidirectional relations between parenting practices and child externalizing behavior: a cross-lagged panel analysis in the context of a psychosocial treatment and 3-year follow-up. *J Abnorm Child Psychol* 2013;41:199–210.