

Effects of time and socio-economic status on the determinants of oral health-related behaviours of parents of preschool children

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The oral health-related beliefs of parents have an important impact on the oral health status of their children; however, they are not stable over time. This study aimed to assess the changes, over time, in the determinants of parental oral health-related behaviour based on the Theory of Planned Behaviour and to investigate socio-economic inequalities. The cohort consisted of the parents – mainly the mothers – of 1,057 children born in 2003 and 2004 in Flanders (Belgium). According to the Theory of Planned Behaviour, validated questionnaires, completed at children's birth and at age 3 and 5 yr, assessed parental attitudes, social norms, perceived behavioural control, and intention towards three behaviours: dietary habits, oral hygiene habits, and dental attendance. Linear mixed-model analyses were applied. Positive parental attitudes towards oral health-related behaviours increased between birth and 3 yr of age, whereas the scores for subjective norms and intentions decreased. Scores remained stable for children between three and 5 yr of age. Highly educated mothers had significantly higher scores for attitudes, perceived behavioural control, and intentions than less-educated mothers. Health promotion campaigns should take these natural changes and inequalities of dental beliefs into account when developing and evaluating interventions.

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Oral health-related habits are established very early in life (1). In preschool children, the development of these habits is mediated by parental behaviours, mostly those of the mother (2). Minimizing sugar-containing snacks and drinks, helping with toothbrushing, and taking the child regularly for a preventive oral examination are examples of parental behaviours that will have a positive impact on the child's oral health (3–7). These parental behaviours are in turn influenced by the parents' beliefs and attitudes (8). Cross-sectional studies have shown that a negative attitude of parents towards a healthy diet and good oral hygiene is a risk indicator for caries experience in their offspring (9–12). This has been supported in longitudinal studies showing that parental oral health-related attitudes were clearly associated with the caries increment in their children, both during early childhood and later in life (13–15).

To understand fully how preventive health-related behaviour is based on parental beliefs and attitudes, explanatory models, such as the Theory of Planned Behaviour (Fig. 1), can be informative (16). According to this theory, behaviour is a function of intentions

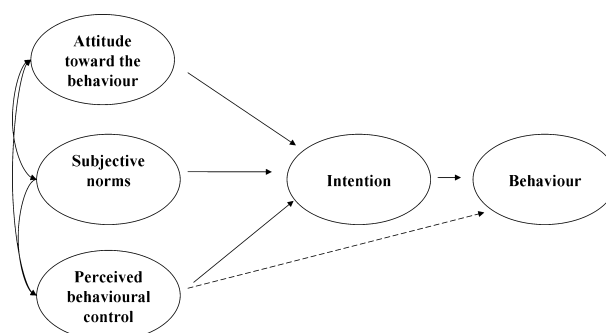


Fig. 1. Theory of Planned Behaviour [AJZEN (16)].

towards the behaviour, modified by the perceived behavioural control (PBC). Intention, which is considered the immediate antecedent of behaviour, is, in turn, based on attitudes towards the behaviour, subjective norms, and PBC (Fig. 1). Attitudes can be defined as the positive or negative evaluations of the expected outcome of the behaviour. Subjective norms refer to the

perception of social normative pressures to engage in a behaviour. These norms are based on beliefs about the perceived judgement of significant others (e.g. friends, family, and dentist) regarding that behaviour. The extent to which these norms influence behaviours depends on the motivation to comply with the norms. Perceived behavioural control refers to the degree to which the individual believes the behaviour is under his/her control. It is determined by control beliefs, which are beliefs about the presence of factors that may facilitate or impede the performance of the behaviour, and by the perceived power of these factors. As such, PBC, like attitudes and subjective norms, has an influence on intentions but can also influence behaviour directly, to the extent that the perception of control accurately reflects actual control (Fig. 1).

The Theory of Planned Behaviour has been applied to a range of health-related behaviours, including oral health (17–19). Several studies have used the Theory of Planned Behaviour to investigate the role of determinants towards parental oral health-related behaviour concerning the child and towards the oral health status of preschool children. Finlayson *et al.* (20) observed that maternal self-efficacy, which is similar to the concept of PBC, is a strong predictor of preschool children's brushing frequency. Åström & Kiwanuka reported that parental PBC was significantly related to their children's caries experience, as parents of children with caries experience perceived themselves to have less control over their child's intake of sugared snacks and perceived them to be more susceptible to tooth decay compared with parents of children without caries experience. Attitudes, subjective norms, and PBC also contributed significantly to the prediction of intention to control sugar snacking in the preschool child, although the explanatory power in this case was low (21).

Although it seems reasonable to assume that the determinants of parental oral health-related behaviours change as the child grows older, natural time trends in parental oral health beliefs have remained largely unexplored. To our knowledge, only one published study has explored the evolution over time of parental oral health-related beliefs and attitudes and its impact on the oral health habits in preschool children. Skeie *et al.* (22) observed that parental attitudes towards the oral health of preschool children became more positive when the children were 5 yr old than when they were 3 yr old. However, this positive evolution was not observed in parents with an immigrant background, and poor dental attitudes were observed in less-educated parents. The latter point indicates the importance of the broad socio-economic environment in which a child is raised. Children from lower socio-economic backgrounds generally have higher oral disease levels and less favourable oral health-related behaviours (12, 22–29). Maternal educational level has been indicated as a good proxy of socio-economic status (30). A lower educational level of both parents has been associated with less positive attitudes towards a healthy diet and with parental indulgence (22), and parents' attitudes towards and intentions for controlling preschool children's sugar

snacking have been found to be more positive in parents with a higher level of education (21). However, none of these studies included behavioural determinants other than attitudes. As such, the understanding of social differences and longitudinal patterns in parental determinants of oral health-related behaviour is incomplete. To address this shortcoming, the present study aimed to assess time trends in parental determinants related to oral health in their preschool child between birth and the age of 5 yr, and to investigate whether maternal educational level, as a proxy for socio-economic status, has an impact on these time trends.

Material and methods

The participants in this study were 1,057 parents whose children were born between October 2003 and July 2004 in two geographical regions of Flanders, which served as control regions for an oral health promotion project called 'Smile for Life' (Tandje de Voorste). This project was performed in collaboration with 'Child and Family', a governmental agency organizing well-baby care, which provides preventive health care and educational guidance free of charge for children from birth until 3 yr of age. Participation in this service is optional and independent of social status or background. Up to 97% of all newborn children in Flanders have at least one home visit by a nurse. More than 90% participate in at least one preventive consultation at the well-baby clinics during the first year of life. All participants were offered the standard care programme of Child and Family. Within the frame of that programme, they received basic oral health education on two occasions: when the child was 6 months old, the advice was given to start toothbrushing; at the age of 2 yr, parents were advised to take the child for a dental examination.

Parents of all children born during the period of recruitment were informed about the project at the first home visit, in order to include at least 500 children in each region. Parental informed consent was obtained via a cover letter. Exclusion criteria for children were: parents who had insufficient language skills to complete a questionnaire in Dutch; serious illness that could have an impact on the child's oral health; premature birth (< gestational week 37); failure of parents to attend the well-baby clinic; or family moving out of the region shortly after the birth of the child. For twins, only the child whose name was alphabetically ranked first was included in the study. The number of children included and excluded is summarized in Fig. 2. The study protocol received ethical approval from the Medical Ethics Committee of the Katholieke Universiteit Leuven, Belgium.

Data were obtained at birth (October 2003–July 2004), at 3 yr of age (February 2007–June 2007), and at 5 yr of age (March 2009–June 2009) through structured questionnaires that included statements to measure parental ideas on children's dietary habits, oral hygiene habits, and dental attendance based on the Theory of Planned Behaviour. The questionnaires were distributed by the nurses of the governmental agency Child and Family during the first home visit after the birth of the child, and by the kindergarten teachers when the child was 3 and 5 yr of age. The questionnaires were validated: principal component analyses revealed four component structures reflecting the Theory of Planned Behaviour dimensions for each of the three

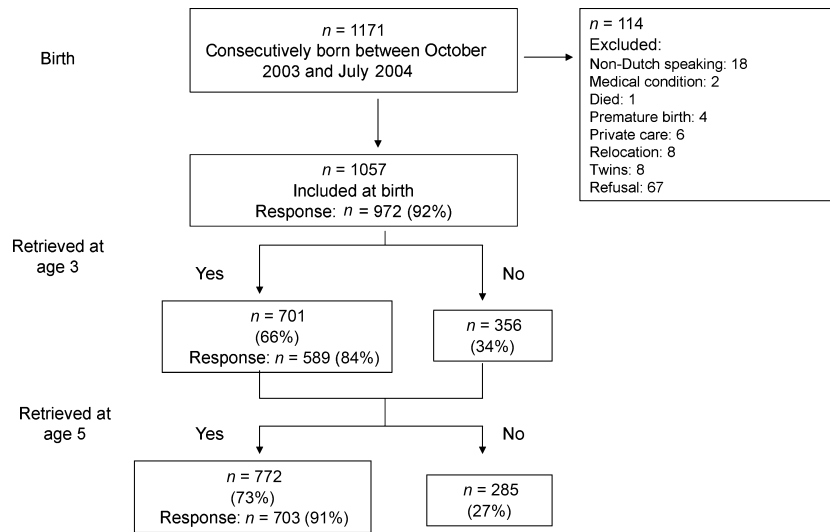


Fig. 2. Number of children included and excluded in the study, retrieval rates at 3 and 5 yr of age, and response rates of the retrieved children.

behaviours, accounting for 44–55% of the variance. Internal consistency (Cronbach's alpha) of the scales ranged from 0.52 to 0.80. Up to 46% of the variance of intentions and behaviours was explained by the TPB-model (31).

The questionnaire comprised 18 items to measure the determinants of dietary habits, classified in five scales: attitude (five questions), norms of partner (three questions), norms of others (five questions), PBC (four questions), and intention (one question). Determinants related to oral hygiene habits were measured through 17 items, also classified in five scales: PBC, norms of family and friends, norms of partner and experts, attitude, and intention. Each scale comprised four items, except intention, which was measured with one item. Finally, dental attendance was measured through 16 items, classified in five scales: PBC (four questions), beliefs about immediate outcomes (four questions), beliefs about long-term outcomes (two questions), subjective norms (five questions), and intention (one question). Participants were asked to rate each statement on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = no opinion, 4 = agree, 5 = strongly agree). Maternal educational level was measured, according to level of education, as primary education, secondary education, higher education, or university level. In preparation for the analyses, the answers were recoded into two categories: low educational level (primary and secondary education) and high educational level (higher education and university). Also, negatively phrased items were recoded. For every participant, a scale score was constructed by calculating the mean of the items that measured the same underlying factor (e.g. attitudes towards dental attendance); these scale scores were calculated at birth, at age 3 yr, and at age 5 yr. As such, the analyses were not based on the individual Likert scores, but on these scale scores.

Data exploration and statistical analyses were performed using SPSS Statistics, version 17 (IBM, Armonk, NY, USA). The data were first explored for missing values, outliers, normality assumptions, skewness, and kurtosis. As the data and residuals were normally distributed, group mean scores and standard deviations of all dependent variables were calculated for every age category and educational level of the mother. For dietary habits, the dependent variables were

the determinant scores on intention, attitudes, norms of partner, norms of other, and PBC at the three ages, resulting in five separate analyses. For oral hygiene, five analyses were performed with the scores for intention, attitudes, norms of family/friends, norms of experts, and PBC at the three ages as outcome variables. Finally, for dental attendance, five analyses were performed using the scores for intention, beliefs about immediate outcomes, beliefs about long-term outcomes, subjective norms, and PBC. To assess the time trend and impact of maternal educational level on the determinants of oral health-related behaviour, a linear mixed-models procedure was used with a restricted maximum-likelihood estimation method. In every analysis, two predictors were included in the model: age and maternal educational level. To control for the repeated measurements in every subject, the variable 'age' was indicated as a repeated factor with three measurements per subject (age = 0, 3, and 5 yr).

A significance level of 0.05 was used for statistical testing. An overview of the analyses and the applied rationale is shown in Fig. 3. When full-model testing indicated significant interactions between age and educational level, contrast testing was applied to explore this further. In the event of no interaction, it was removed from the model and only

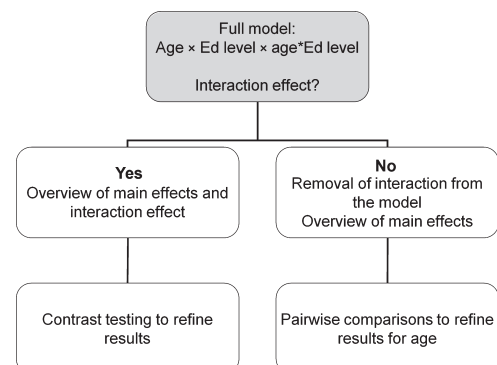


Fig. 3. Rationale of statistical analyses.

the main effects of both fixed factors were estimated. When an effect of age was present, pairwise comparisons with Bonferroni correction were executed on the estimated marginal means to investigate the differences in mean scores between birth and age 3 yr, birth and age 5 yr, and age 3 and 5 yr.

Results

Forty-nine per cent of the participating children were girls. The mean (SD) age of the parent who completed the questionnaire at birth was 30 (4.5) yr (range, 16–54 yr); 93% of the questionnaires were completed by the mothers. There were 572 (60%) highly educated mothers compared with 379 (40%) mothers with a low level of education. Data on educational level were missing for 106 mothers.

The response rate was 92% at birth, 56% at the age of 3 yr, and 66% at the age of 5 yr. The major reason for missing data at 3 yr of age (34% of the original cohort) as well as at 5 yr of age (27% of the original cohort) was our inability to identify the kindergarten attended by the child or refusal of the school to collaborate. Among children who were retrieved at school, 84% of parents completed the questionnaire when the child was 3 yr of age and 91% of parents completed the questionnaire when the child was 5 yr of age. This means that most of

the missing data could be categorized as ‘missing completely at random’ (Fig. 2).

Table 1 presents the number of participants included in every analysis, as well as the mean scores of the dependent variables, categorized by survey period and by educational level. Overall, the mean determinant scores for dietary habits ranged between 3 and 4. The lowest mean determinant scores were seen for norms of others and PBC, whereas the highest mean determinant scores were observed for intentions and attitudes.

A main effect of educational level on each of the five determinant scores relating to dietary habits of the child was observed: mothers with a high level of education had significantly higher scores compared with mothers with a low level of education (Table 1). Main effects of age were noted for intentions, attitudes, and norms, but not for PBC. Intention scores declined in the first 3 yr (Fig. 4A), followed by a stabilization. Post-hoc tests indicated significant differences between birth and age 3 and 5 yr (both $P < 0.001$). Attitude scores were significantly higher at age 3 and 5 yr compared with birth (Fig. 4A); this was the case for both educational groups, but more so amongst highly educated mothers, as indicated by an interaction effect. Additional contrast testing indicated a significantly larger increase in mean attitude scores of highly educated mothers between birth and age 3 yr ($t[757] = 3.13$, $P < 0.05$) and between birth and age 5 yr ($t[983] = 3.52$, $P < 0.001$) compared with less

Table 1

Mean scores and results of tests of fixed effects of age and education level for each of the determinants towards dietary habits, oral hygiene habits, and dental attendance resulting from linear mixed-model analyses

Determinant	<i>n</i>	Educational level of the mother						Statistical testing					
		Low			High			Age		Educational level		Age × Ed.	
		Yr 0	Yr 3	Yr 5	Yr 0	Yr 3	Yr 5	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
Dietary habits													
Intention	949	4.12	3.84	3.85	4.32	4.05	4.05	40.90	<0.001	42.92	<0.001	—	—
Attitude	949	3.26	4.09	4.09	3.24	4.25	4.25	1096.32	<0.001	18.40	<0.001	9.38	<0.001
Norms of partner	949	4.12	3.89	3.82	4.18	3.99	3.93	40.63	<0.001	8.86	<0.05	—	—
Norms of others	949	3.53	3.56	3.31	3.51	3.27	2.99	51.93	<0.001	47.61	<0.001	11.46	<0.001
Perceived behavioural control	949	3.51	3.47	3.46	3.70	3.68	3.69	0.34	NS	38.67	<0.001	—	—
Oral hygiene													
Intention	947	4.46	4.26	4.34	4.56	4.49	4.50	8.08	<0.001	28.13	<0.001	—	—
Attitude	947	4.11	4.29	4.26	4.22	4.49	4.50	49.12	<0.001	65.95	<0.001	3.14	<0.05
Norms of family/friends	948	2.75	2.98	2.94	2.70	2.84	2.92	24.83	<0.001	4.55	<0.05	—	—
Norms of experts/partner	947	4.04	3.80	3.90	3.90	3.72	3.87	20.09	<0.001	12.02	<0.05	—	—
Perceived behavioural control	948	4.25	3.99	4.05	4.19	4.02	4.08	21.94	<0.001	0.33	NS	—	—
Dental attendance													
Intention	945	4.01	3.70	3.85	4.01	3.64	3.87	24.85	<0.001	0.03	NS	—	—
Beliefs about immediate outcomes	947	3.56	3.86	4.04	3.61	3.93	4.17	128.32	<0.001	7.74	<0.05	—	—
Beliefs about long-term outcomes	947	4.16	4.09	4.12	4.23	4.18	4.30	2.52	NS	16.01	<0.001	—	—
Subjective norms	947	3.38	3.04	3.01	3.38	2.92	2.95	133.40	<0.001	3.58	0.059	—	—
Perceived behavioural control	947	4.14	4.36	4.40	4.18	4.44	4.56	83.36	<0.001	11.82	<0.05	—	—

NS, not significant; F, test statistic with F-distribution.

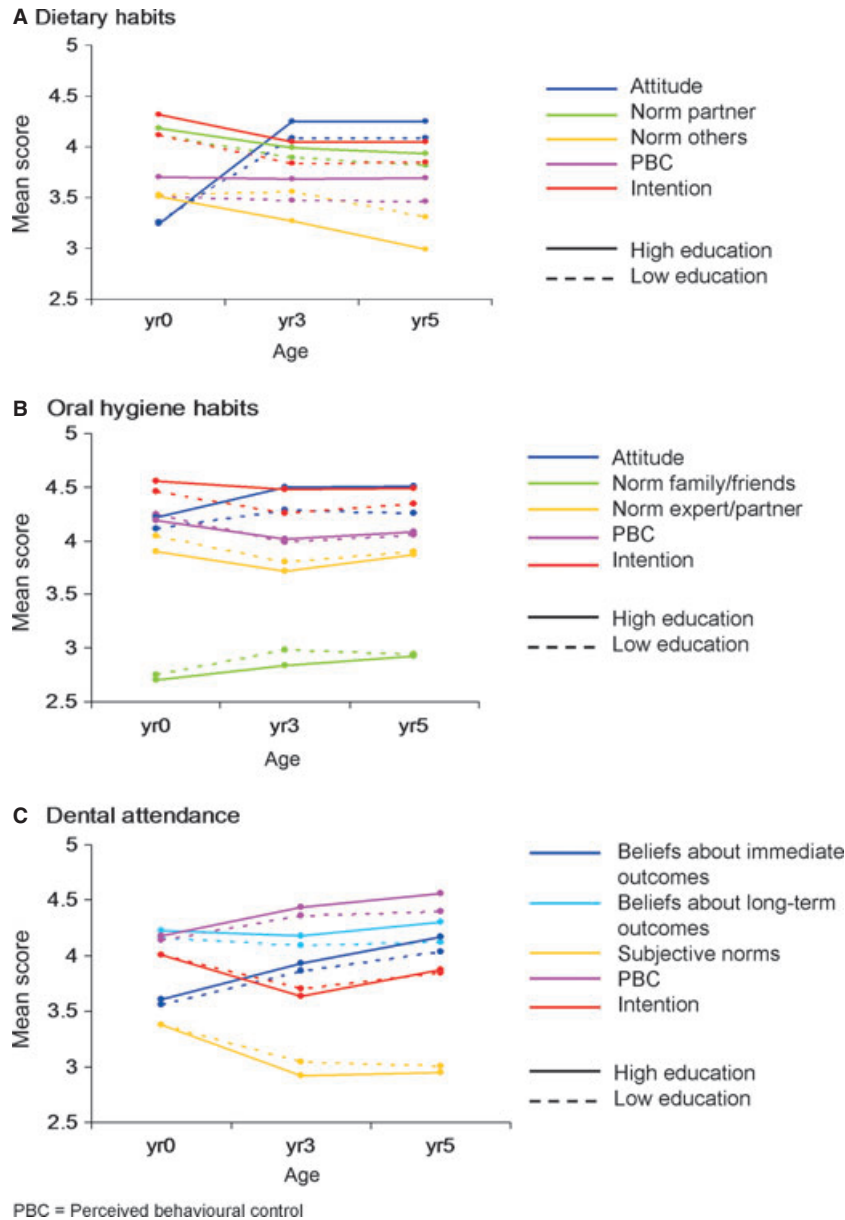


Fig. 4. Mean scores of the dependent variables for dietary habits (A), oral hygiene habits (B), and dental attendance (C) at birth, 3 yr of age, and 5 yr of age.

educated mothers, while scores remained stable between ages 3 and 5 yr in both groups. Mean scores for norms of partner decreased over the whole period (Fig. 4A) and post-hoc tests indicated significant differences between birth and age 3 yr and 5 yr (both $P < 0.001$). For norms of others, a decrease was observed between birth and age 3 yr ($t[1069] = -3.72$, $P < 0.001$) and between birth and age 5 yr ($t[1184] = -4.05$, $P < 0.001$) among highly educated mothers, but not among mothers with a low level of education, as indicated by an interaction effect. Between ages 3 and 5 yr there was an equal decrease in both groups, and contrast testing indicated no interactions.

Mean determinant scores relating to the oral hygiene habits of the child were relatively low for norms of

family/friends, compared with the other variables (Table 1). Main effects of maternal educational level were seen for all determinants, except for PBC: highly educated mothers scored significantly higher on intentions and attitudes and lower on subjective norms compared with less educated mothers (Fig. 4B). Main effects of age were present for all determinants. Mean attitude scores increased with age and an interaction was present between age and educational level. Contrast testing indicated that the increase between birth and 5 yr of age was larger for highly educated mothers ($t[1340] = 2.41$, $P < 0.05$), indicating a more favourable trend in attitudes than in less educated mothers. For norms of family/friends, a significant increase between birth and 3 yr of age was seen (all $P < 0.001$), followed by a

stabilization (Fig. 4B). For norms of experts and partner a totally different pattern was seen, with a decrease in the first 3 yr, followed by an increase in the last 2 yr (all $P < 0.05$). Finally, a decrease was seen in the first 3 yr for PBC (all $P < 0.001$) and intention (all $P < 0.05$), followed by comparable scores 2 yr later (Fig. 4B).

For dental attendance, highest mean determinant scores were seen for PBC and beliefs about long-term outcomes (Table 1). There were main effects of maternal educational level for both attitude measures and PBC, with higher scores for highly educated mothers (Table 1, Fig. 4C). For age, main effects were seen for all determinants except for beliefs about long-term outcomes. For beliefs about immediate outcomes, the post-hoc tests indicated an overall increase, with significant differences between all ages (all $P < 0.001$). The same was observed for PBC, but differences were only significant between birth and age 3 yr ($P < 0.001$). Subjective norms showed a decrease in the first 3 yr ($P < 0.001$), followed by a stabilization (Fig. 4C). Finally, mean scores for intention tended to decrease in the first 3 yr ($P < 0.001$) and increase again between 3 and 5 yr of age ($P < 0.05$, Fig. 4C).

Discussion

The present study aimed to assess time trends in parental determinants of oral health-related behaviour towards their preschool children and to investigate the impact of maternal educational level as a proxy of socio-economic status. During the whole study period, scores for attitudes, intentions, and PBC remained favourable towards a healthy lifestyle. On the other hand, scores for subjective norms were low at birth, indicating that parents did not attach much importance to the opinion of others, and these scores also diminished with age, suggesting that parents did not experience much social pressure related to diet and dental attendance.

In general, scores for attitudes towards the three behaviours increased between birth and the age of 3 yr. This increase can be explained, as parents received the standard preventive health programme at the Well-Baby Clinics during this period, which included some very basic oral health information. It is possible that the exposure of parents to this information led to an increase in their awareness and attitudes. On the other hand, a decrease of intention scores in these first 3 yr was observed for all behaviours, probably because of barriers arising in daily life that conflicted with the good intentions reported at birth. Behaviours such as healthy eating and tooth-brushing require effort from the parents on a daily basis, which may inhibit an increase of these intentions. Consistently, this might also explain the decrease, over time, found for PBC scores towards oral hygiene habits.

It is striking that for dietary habits and oral hygiene habits, the scores for attitudes, norms, PBC, and intentions showed different evolutions, even though the Theory of Planned Behaviour predicts them to be inter-related and to influence each other. However, the relative contribution of each factor can depend on the motiva-

tional stage of behavioural change for an individual. For example, earlier research showed that attitudes were low in the precontemplation phase but increased strongly as soon as one became aware of the importance of performing a certain behaviour (i.e. in the contemplation phase). On the other hand, PBC remained low during both precontemplation and contemplation phases, and started to increase only when the preparation phase was reached (32). It is possible that parents changed phases during the observation period, which would explain the changes in the determinants.

For dental attendance, the increases in scores for attitudes and PBC between ages 3 and 5 yr were accompanied by an increase in scores for intentions, as predicted by the Theory of Planned Behaviour (16). The increase in scores for attitudes between these ages is also in line with the results from Skeie *et al.* (22). It is indeed possible that the scores of these determinants increased because the child was presenting with an oral health problem and had to visit the dentist for treatment.

Important differences were observed between mothers with a high level of education and mothers with a low level of education: mean scores for attitude, PBC, and intention were significantly higher in highly educated mothers of all ages, whereas these mothers seemed to attach less importance to the norms of important others because they had significantly lower scores for this than mothers with a low level of education. These results are in line with those of Skeie *et al.*, (22) where mothers with a low level of education tended to have more unfavourable dental attitudes. There are several possible explanations for the poorer dental attitudes in parents with a low level of education. The norms and attitudes of parents may be influenced by prevailing child-rearing norms in their communities (13) and be transmitted from one generation to the other (33). In parents with a low level of education, oral health might not be valued as positive and important as among highly educated parents (21). Moreover, when economic constraints are present in daily life, good oral health habits might not be a priority for parents. Also, parents with a low level of education often lack the skills to process certain health-related information and to interact with institutions and health professionals, leading to less positive attitude scores (26).

As health determinants are predictive of intentions, behaviour, and oral health status (21), social differences in these determinants might explain part of the health inequalities in caries experience and other oral pathologies. Many studies have indicated that parental oral health behaviours were worse among groups of low socio-economic status (12, 27, 28), leading to worse oral health in their offspring. The present study shows that the inequalities in oral health are already present at the level of the determinants before the behaviour.

It should be noted that parametric methods were applied for the statistical analyses, although the data were originally derived from Likert-scales, for which non-parametric methods would be more appropriate. There is, however, a consensus that ordinal data can be treated as interval-level data when the data are normally

distributed and there are large numbers of participants. As our data met these conditions, linear mixed-model analyses could be applied and interpreted meaningfully. Additionally, no individual Likert scores were used, but rather mean scores derived from multiple items that measure the same underlying factor. This method has been applied earlier in research applying the Theory of Planned Behaviour (17, 34, 35).

It is a limitation of this study that the measurement of socio-economic status did not incorporate all potential indicators of social inequality, as it was based only on maternal education, not on factors such as income or occupation. However, maternal educational level has previously been suggested as a good proxy for socio-economic status (30). Also, all parents who did not continue their education after the age of 18 were assigned to the category 'low educational level'. It would have been interesting to make a distinction between parents who only finished primary school and those who finished secondary school. Unfortunately, the group who only finished primary school was too small to analyze separately and therefore both groups were combined. Moreover, as the questionnaires were only available in Dutch, children whose parents did not understand Dutch – often from families with an immigrant background – were not included in the study. Of all families who did not meet the inclusion criteria, 16% were excluded because they did not understand enough Dutch to fill in the questionnaires. It might therefore be interesting to translate and validate the questionnaires in other languages, to evaluate whether the results can be generalized to non-Dutch-speaking parents. Finally, as we used the same questionnaire at three different time-points, it is possible that a learning effect occurred. However, there was a 3-yr gap and a 2-yr gap between the measurements, which can be considered as quite large. It is also possible that a response bias towards socially acceptable answers occurred, which is difficult to address in studies where data are collected through questionnaires.

In conclusion, parental determinants of the oral health of their children tend to change as the child grows older without a targeted intervention taking place. Educational programmes aimed at parents of preschool children should take these natural evolutions into account. In order to correctly attribute a (positive) outcome to an interventional programme, a control group should be included to monitor these time effects. More attention should also be given to parents with a lower educational level, as their attitudes, PBC, and intentions towards healthy behaviour are less positive and they tend to experience more social pressure. As these determinants are predictive of worse oral health, targeted prevention programmes might be needed for parents with a lower educational level.

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