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Measuring determinants of oral health behaviour in parents of preschool children

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Objective: The aim of this study was to develop a valid and reliable measure for oral health behaviour and its determinants in five-year-old Flemish children, based on the Theory of Planned Behaviour (TPB) and to test its predictive validity. ***Methods:*** 1157 parents of five-year-olds completed a questionnaire measuring three behaviours related to oral health among children (dietary habits, oral hygiene, dental attendance) and their determinants (attitude, subjective norms, perceived behavioural control, intention). The sample was randomly split in two halves and principal component analyses were performed on one half sample to identify the factor structure. Confirmatory factor analyses were performed on the remaining half sample to obtain a cross-validation. Predictive validity was tested using multiple regression analyses. ***Results:*** For each behaviour four component structures reflecting the TPB-dimensions, accounting for 44% to 55% of the variance were retrieved and confirmed in the cross-validation. Internal consistency (Cronbach's alpha) of the scales ranged from 0.52 to 0.80. A sizeable percentage of variance of intentions and behaviours was explained by the model. ***Conclusions:*** The TPB components were significant predictors of intentions and behaviours. These findings argue for the reliability and validity of the questionnaire for exploring determinants underlying parental oral health behaviour.

Key words: *parental, oral hygiene; preschool children; questionnaires; theory of planned behaviour*

Introduction

Oral health in preschool children is to a large extent determined by behavioural factors. Inadequate oral hygiene habits, frequent consumption of sugared snacks and drinks and lack of preventive visits to the dentist are important risk factors for caries in young children (Declerck *et al*., 2008; Harris *et al*., 2004).

Promoting good oral health by evoking behaviour changes requires a good insight in the determinants of the behaviours relevant to oral health. These determinants can be understood in the light of the Theory of Planned Behaviour (TPB, Figure 1) (Ajzen, 1991). According to this theory, behaviour is a function of intentions and of the perceived behavioural control (PBC) to perform the behaviour. Intentions, which are considered the immediate antecedents of behaviour, are in turn determined by attitudes, subjective norms, and PBC. Attitudes are derived from beliefs about the likely outcomes of the behaviour and the evaluation of this expected outcome. Subjective norms refer to the perceived social influence to engage in the behaviour and are determined by the normative beliefs concerning expectations of significant others. The extent to which these norms influence behaviour depends on the motivation to comply with them. PBC reflects people's perceived ability to perform the behaviour. It is based on control beliefs about possible facilitators or inhibitors and the strengths of these beliefs. 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 (Figure 1) (Ajzen, 1991).

The TPB has been applied to a broad range of behavioural domains and meta-analytic reviews support its predictive validity (Armitage and Conner, 2001; Godin and Kok, 1996). With regard to oral health, the TPB components could explain a significant proportion of the variance in several oral health related behaviours in older age groups (Astrom, 2008; Astrom and Okullo, 2004; Astrom and Rise, 2001; Buunk-Werkhoven *et al*., 2010; Dumitrescu *et al*., 2011; Luzzi and Spencer, 2008; Masalu and Astrom, 2001). In preschool children the TPB components predicted parental intentions to control sugar snacking (Astrom and Kiwanuka, 2006). However, apart from dietary habits, it is important to consider a broader range of behaviours, including oral hygiene and dental attendance. To our knowledge, no studies exist in which TPB is used to predict oral health behaviour in (parents of) young children.

The aims of the present study were twofold. First, it intended to validate a new questionnaire, based on the TPB, to assess belief-based attitudes, social norms, PBC and intentions with regard to three important behaviours related to children's oral health dietary habits, oral hygiene habits and dental attendance pattern. Secondly, the predictive validity of the TPB was tested by evaluating whether attitudes, subjective norms and PBC could predict intention, and whether intention and PBC could predict the behaviour.

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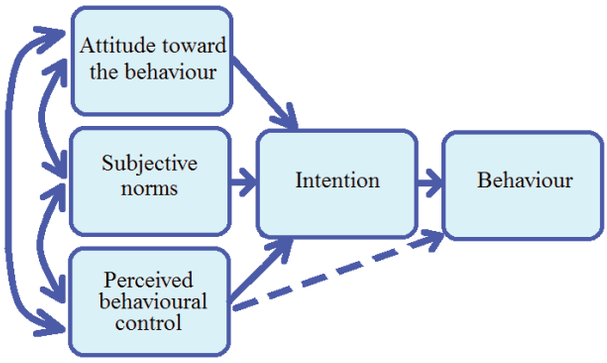

Figure 1. *Theory of Planned Behaviour (Ajzen, 1991)*

Method

The present study is part of the analysis of the baseline data collected before the 'Smile for Life' (Tandje de Voorste) project, a prospective oral health promotion project in preschool children in Flanders, Belgium (Declerck *et al*., 2008). Participants were parents of 1157 five-year-olds from four distinct geographical areas in Flanders (Belgium).

In each of four Flemish regions approximately three hundred five-year-olds (born in 1998) attending third-grade pre-school classes were selected, based on the assumption that 25% of this age group would present with caries experience. To achieve a 95% confidence interval width of 7%, 300 children were needed in every region. As selecting individual children would not have been feasible for ethical, practical and economic reasons, sampling was based on lists of kindergartens in these areas. Although kindergarten attendance is not compulsory in Belgium, attendance levels are very high, with more than 98% of 5-year-old children attending kindergarten in the school year 2002-2003 (source: Ministry of the Flemish Community, Department of Education). The kindergartens were selected using a technique of stratified cluster sampling without replacement. The target population was divided in three strata, representing the three types of educational system in Flanders (i.e. public, municipal and private schools), with an equal spread across rural and urban regions. When a kindergarten was selected for the study, all children in its third grade were included. The kindergartens were selected with a probability proportional to their enrolment. In this way each child of a region had an equal chance to be included in the study. For statistical analyses, an age restriction was applied to enhance reliability and only children between 4.6 and 5.7 years were included in data processing.

Parents were asked to complete a questionnaire, which was provided through the teachers. The questionnaires were accompanied by a letter explaining the purpose of the study. The study protocol received ethical approval from the Medical Ethics Committee at the KU Leuven, Belgium. If parents chose not to participate, the reason was asked.

The questionnaire, based on the TPB contained a number of items measuring attitudes, social norms and PBC as well as intentions and self-reported behaviour for each of the behaviours of interest (dietary habits, oral hygiene habits, dental attendance). Dietary habits, which referred to avoiding the child's daily consumption of sugared in-between snacks and drinks, was measured with four questions expressing this behaviour: the frequency of 1, consumption of in-between drinks; 2, consumption of in-between meals; 3, snack at night and 4, drink at night. Answers were reported on a 5-point scale ranging from 'never' to 'more than once a day'. Two items measured oral hygiene behaviour looking at the 'frequency of brushing' (with answers on a 4-point scale ranging from 'never' to 'twice a day or more') and at the 'frequency of helping with brushing' (with answers on a 4-point scale ranging from 'never' to 'every day'). Dental attendance was measured by asking when the child was last seen by the dentist, with answers on a 4-point scale ranging from 'never' to 'six months ago or less'.

Seventy-one belief-based items were developed to measure the beliefs preceding the determinants of these oral health behaviours. With regard to dietary habits, behavioural beliefs (8 items), normative beliefs (11) and PBC (4) were measured. For oral hygiene habits, the same constructs were measured with 8, 10 and 3 items respectively. Finally, 8, 11 and 5 items were applied to measure the beliefs related to dental attendance. The items included in the final solution are presented in Table 1. Intention towards dietary habits was measured with one item: 'I will make sure that my child does not receive sugary snacks (food or drinks) too often'. Intention towards oral hygiene habits was also measured with one item ('In our family we intent to make sure that our child's teeth get brushed properly every day'). Finally, one item measured intention towards dental attendance ('We intend to take our child twice a year to the dentist for a check-up'). Participants were asked to rate each item on a 5-point Likert scale: 1, strongly disagree; 2, disagree; 3, no opinion; 4, agree; 5, strongly agree.

In preparation of the factor analyses, item frequencies, means and standard deviations were explored to ensure adequate discriminative ability of items. To check normality of the distributions, skewness and kurtosis magnitudes greater than one were identified. For ease of analysis, the coding of negatively phrased items was reversed.

In order to capture the underlying structure of the questionnaire, the total sample of the five-year-olds was randomly split into two subsamples. An exploratory factor analysis (EFA), using Principal Components and Varimax rotation, was performed on one half sample to identify the factor structure. This analysis was performed with PASW Statistics 17 for each of the three behaviours (dietary habits, oral hygiene habits and dental attendance) separately. The factor solution was based on the criteria of eigenvalue greater than 1 and on an inspection of the scree plot. The criteria for the EFA included that factor loadings were preferably above 0.5 with a gap between cross-loadings of at least 0.1. Cross-loadings should not be higher than 0.3 and factor membership must be meaningful and useful. Reliability testing with Cronbach's alpha was performed to decide whether an item should be removed. Since intention was only measured by one item, we omitted this item from the analyses.

Next, confirmatory factor analyses (CFA) were performed on the other half sample to obtain a cross-validation, using the LISREL 8.7 program (Jöreskog and Sörbom,

Table 1. Component and factor loadings for the responses relating to dietary habits, oral hygiene habits and dental attendance

Category and Item	*1*	*2*	*3*	*4*	*C*
Dietary habits					
Less candy helps to prevent dental caries	0.74	-0.13	-0.12	-0.07	0.96
If we limit the amount of snacks for our child he/she will have healthier teeth later	0.72	-0.14	-0.12	-0.03	0.92
Sugary food is damaging for the teeth	0.67	0.00	-0.01	0.00	0.67
Sugary snacks make my child fat	0.62	-0.09	-0.08	-0.10	0.61
Sweets hinder the appetite of my child	0.52	-0.18	-0.01	-0.10	0.63
It's important for my partner to give our child healthy snacks between the meals (e.g. fruit instead of a cookie)	-0.08	0.81	0.11	0.11	0.93
It's important for my partner to limit the amount of snacks for our child	-0.27	0.77	0.02	0.08	0.80
My partner's opinion about our child's nourishment is important to me	-0.15	0.69	0.16	-0.01	0.74
My parent's opinion about our child's nourishment is important to me	-0.05	0.28	0.64	0.01	0.42
My dentist advices me to give my child healthy snacks	-0.21	0.13	0.63	-0.06	0.72
My family doctor gives me advice on healthy snacks for my child	0.12	0.00	0.60	0.03	0.35
My dentist's opinion about our child's nourishment is important to me	-0.40	0.09	0.58	-0.07	0.77
The teachers and board of directors from the school find it important that the children receive healthy snacks during playtime	-0.12	0.05	0.51	0.06	0.45
In our family it is difficult to prevent our child from receiving sugary snacks (drinks and food)	-0.07	0.05	0.04	0.71	0.74
It's often hard to say no to my child when he/she wants candy	0.03	-0.10	-0.22	0.64	0.66
We succeed in giving healthy drinks to our child as in-betweens	-0.19	0.13	0.06	0.56	0.53
We succeed in giving healthy snacks to our child as in-betweens	0.02	0.40	0.19	0.50	0.75
Oral hygiene					
We don't get our child to brush his/her teeth twice a day	0.80	0.07	0.01	0.01	0.73
We don't have time to help our child brush his/her teeth twice a day	0.80	0.00	0.05	-0.03	0.85
It's time-consuming to check each day whether our child has brushed his/her teeth	0.65	-0.01	0.15	0.26	0.82
We manage to brush our child's teeth every day	0.60	0.03	0.28	0.19	0.72
When it comes to oral hygiene, my friends' and acquaintances' opinion is very important to me	-0.02	0.78	-0.03	0.02	0.75
When it comes to oral hygiene, my parent's opinion is very important to me	-0.02	0.69	0.18	0.01	0.78
Our friends and acquaintances find it important that we help our child to brush his/her teeth twice a day	0.12	0.68	-0.07	-0.15	0.83
My parents find it important that my child's teeth get brushed properly	0.17	0.58	0.34	0.06	0.82
It's important for my family doctor that my child's teeth already get brushed at an early age	0.10	0.12	0.74	-0.10	0.93
It's important for my pediatrician that my child's teeth already get brushed at an early age	0.06	0.21	0.73	-0.05	0.80
It's important for my dentist that my child's teeth already get brushed at an early age	0.09	0.02	0.71	0.17	0.83
When it comes to oral hygiene, my partner's opinion is very important to me	0.14	0.35	0.46	0.11	0.59
Buying a toothbrush and toothpaste for the whole family is expensive	-0.05	0.01	-0.06	0.63	0.28
When my child brushes his/her teeth too much, they come loose	0.19	-0.22	0.15	0.59	0.55
The risk of dental caries decreases when my child brushes his/her teeth every day	0.08	0.05	0.43	0.57	0.57
Brushing teeth is annoying for a child	0.37	0.01	-0.18	0.57	0.63
Dental attendance					
We don't have time to take our child to the dentist	0.78	0.21	-0.09	0.08	0.87
I don't see myself taking my child to the dentist	0.67	0.39	-0.12	0.04	0.91
I think of making an appointment with the dentist	0.66	0.14	0.12	0.32	0.87
We manage to take our child to the dentist twice a year	0.63	0.04	0.19	0.36	0.71
For a child a visit to the dentist is not terrible at all	0.06	0.80	0.03	0.16	0.79
Going for a check-up at the dentist is a traumatic experience for a child	0.28	0.79	-0.06	0.06	0.91
Taking my child to the dentist is unpleasant	0.46	0.67	0.04	0.10	0.90
Regularly taking your child to the dentist for a check-up, makes that your child is not afraid of the dentist	0.07	0.57	0.05	0.46	0.70
When it comes to visiting the dentist, my pediatrician's opinion is important to me	-0.01	0.01	0.83	-0.04	0.69
When it comes to visiting the dentist, my family doctor's opinion is important to me	-0.03	-0.03	0.76	-0.13	0.40
When it comes to visiting the dentist, my parent's opinion is important to me	-0.09	-0.10	0.65	0.13	0.51
It's important for our pediatrician that we take our child at an early age to the dentist	0.10	0.08	0.63	0.17	0.85
When it comes to visiting the dentist, my partner's opinion is important to me	0.17	0.25	0.41	0.07	0.74
Regularly paying visits to dentist provides my child's teeth to longer stay sound and healthy	0.14	0.12	0.02	0.81	0.86
The risk on dental caries decreases when you regularly take your child to the dentist for a check-up	0.22	0.11	0.05	0.81	0.85

Dietary habits: responses coded 1 = attitude, 2 = norm partner, 3 = norm others, 4 = perceived behavioural control, C = confirmatory factor analyses, CFA; **Oral hygiene habits**: 1 = perceived behavioural control, 2 = norm of family and friends, 3 = norm of experts and partner, 4 = attitude**; Dental attendance**: 1 = perceived behavioural control, 2 = beliefs about immediate outcomes, 3 = motivation to comply, 4= beliefs about long-term outcomes. Underlined values indicate the highest component loading for a given item.

2004). Besides the chi-square test statistic, the adequacy of the model fit was evaluated using the goodness-of-fit index (GFI), adjusted goodness-of-fit index, comparative fit index (CFI) and the root mean squared error of approximation (RMSEA). The GFI, AGFI and CFI should be above 0.95 (Schumacker and Lomax, 2004) and for RMSEA values below 0.06 indicate a good fit (Hu and Bentler, 1999). The chi-square divided by the degrees of freedom can be regarded as a less biased fit estimate than the chi-square because it is less sensitive to sample size. This ratio should be small; values below three are considered satisfactory (Bollen and Long, 1993). To improve the model fit, error variances between the items were allowed to correlate, based on the modification indices.

The internal consistency of the obtained components was tested by means of Cronbach's alpha. Pearson correlations between the scales were also calculated. Multiple regression analyses were applied to evaluate whether the scales measuring attitude, subjective norms and PBC could predict intentions, and whether intention and PBC could predict behaviour. 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 dietary habits). These analyses were performed using PASW Statistics 17.

Results

In total, 1325 five-year-olds from 43 schools were invited to participate. The number of schools (and children) participating in each of the four regions was respectively 11 (318), 10 (316), 12 (341) and 10 (350). Following application of the age restriction, analyses were performed on 1157 cases (87%). The mean age of the five-year-olds was 5.3 (sd 0.3) years and 49% were girls. The parents completing the questionnaire had a mean age of 34.4 years (sd 4.3, range 22-51).

All items showed sufficient variation across the response categories (i.e. less than 95% of responses in a single category), so no items were removed on the basis of this criterion. Still, skewness and kurtosis magnitudes greater than one were present for, respectively, 19% and 29% of the variables. That is why, for the confirmatory analyses, a polychoric correlation matrix and its asymptotic covariance matrix was calculated by Prelis 2.5 (Jöreskog and Sörbom, 2004), with the Weighted Least Squares estimation method. When a more stringent criterion was applied (standard deviation <0.75), a low discriminative power was found for three items, one for each behaviour. These items were removed.

An overview of the component loadings resulting from exploratory factor analyses is presented in Table 1. With regard to **dietary habits**, a solution of four components was found, explaining 44% of the total variance. Two attitude-items were removed due to a conflict in the reliability analysis, and another item due to high loadings on two components. The same analysis was conducted for the items associated with **oral hygiene habits**. Four components were extracted, which jointly explained 49% of the variance, after removal of two items that loaded high on two components. Finally, a principal component analysis was done for the items of **dental attendance**. Because four items referring to 'norms of family' and one item referring to 'norms of experts' obscured the interpretation, they were removed. After removal of these items, four components were extracted, which jointly explained 55% of the total variance. A description of the components and the number of items are presented in Table 2.

The model obtained in the exploratory factor analysis of **dietary habits** met all criteria for a good fit to the data (c^2=314.31, df=113, p<0.001, c^2/df=2.78, RMSEA=0.06, CFI=0.95, GFI=0.97, AGFI=0.97). For **oral**

Table 2. Number of items, internal consistencies, range, mean scores (sd) and intercorrelations for the scales of the questionnaire

Scale	*n items*	*Cronbach's alpha*	*Range*	*Mean (sd)*	*Correlations*			
					2	3	4	5
Dietary habits								
1. Attitude	5	0.71	2-5	4.12 (0.59)	**0.41***	**0.28***	**0.21***	**0.39***
2. Norms of partner	3	0.74	1-5	3.83 (0.72)	-	**0.31***	**0.23***	**0.35***
3. Norms of others	5	0.63	1-5	3.39 (0.61)	-	-	0.05	**0.20***
4. PBC	4	0.55	1-5	3.48 (0.72)	-	-	-	**0.38***
5. Intention	1	-	1-5	3.93 (0.81)	-	-	-	-
Oral Hygiene								
1. PBC	4	0.75	1-5	3.70 (0.81)	**0.15***	**0.24***	**0.34***	**0.57***
2. Norms of family/friends	4	0.69	1-5	2.99 (0.67)	-	**0.39***	0.02	**0.14***
3. Norms of expert/ partner	4	0.69	1-5	3.80 (0.60)	-	-	**0.21***	**0.31***
4. Attitude	4	0.52	1-5	4.06 (0.57)	-	-	-	**0.33***
5. Intention	1	-	1-5	4.25 (0.78)	-	-	-	-
Dental attendance								
1. PBC	4	0.78	1-5	3.90 (0.70)	**0.56***	**0.14***	**0.41***	**0.63***
2. Beliefs about immediate outcomes	4	0.70	1-5	3.89 (0.75)	-	**0.09***	**0.36***	**0.36***
3. Norms	5	0.74	1-5	3.17 (0.60)	-	-	**0.21***	**0.19***
4. Beliefs about long-term outcomes	2	0.80	1-5	4.12 (0.70)	-	-	-	**0.36***
5. Intention	1	-	1-5	3.58 (1.07)	-	-	-	-

*p<.001, PBC = Perceived Behavioural Control

hygiene habits, fit indices provided only a moderate fit (c^2=367.37, df=98, p<0.001, c^2/df=3.7). After allowing two correlations between error variances, the model obtained in the exploratory factor analysis exhibited sufficient fit to the data (c^2=314.96, df=96, p<0.001, c^2/df=3.3, RMSEA=0.068, CFI=0.92, GFI=0.97 and AGFI=0.96). The same holds for **dental attendance,** where the model also lacked adequate fit (c^2=309.58, df=84, c^2/df=3.68). After allowing two error variances to correlate, fit indices turned out to be adequate (c^2=236.16, df=82, p<0.001, c^2/df=2.88, RMSEA=0.06, CFI=0.95, GFI=0.98 and AGFI=0.97). An overview of the factor loadings resulting from CFA is presented in Table 1. In column C the factor loading of every item obtained through confirmatory factor analyses is shown. These factor loadings are the parameter estimates from the measurement equations, as calculated by the LISREL programme.

Internal consistency coefficients ranged from 0.52 to 0.80 (see Table 2). A value of 0.70 is generally regarded as an acceptable level, but lower thresholds are often used in literature (Reynaldo and Santos, 1999). Taking into account the sensitivity of Cronbach's alpha to a low number of items, these values suggest that the scales are homogenous.

Table 2 also lists the Pearson correlations between the scales. Overall, moderate positive intercorrelations were found between the scales, suggesting that the scales are measuring distinct, but related constructs. The correlations between the two norm scales for dietary habits on the one hand and oral hygiene habits on the other hand are moderate. So is the correlation between the two 'belief' scales for dental attendance, which are both constituted of items measuring attitudes.

Predictive values and the explained proportion of variance resulting from the multiple regression analyses to predict intentions are summarized in Table 3. Both norm factors related to dietary habits and oral hygiene habits were combined as well as both factors measuring attitudes towards dental attendance. It is clear that intentions were significantly predicted by attitudes, norms and PBC, as prescribed in the TPB.

Table 3. Multiple regressions for the contribution of attitude, subjective norms and perceived behavioural control to intention and for the contribution of intention and perceived behavioural control to the prediction of behaviour concerning dietary habits, oral hygiene habits and dental attendance

	R^2	β	t	p
Intention re dietary habits	0.27			
Attitude		0.25	8.30	**<0.001**
Subjective norms		0.19	6.43	**<0.001**
Perceived control		0.29	10.66	**<0.001**
Intention re oral hygiene habits	0.36			
Attitude		0.14	5.37	**<0.001**
Subjective norms		0.14	5.43	**<0.001**
Perceived control		0.49	18.09	**<0.001**
Intention re dental attendance	0.41			
Attitude		0.09	2.85	**<0.05**
Subjective norms		0.09	3.89	**<0.001**
Perceived control		0.57	19.23	**<0.001**
Dietary Habits - between meals	0.06			
Intention		-0.11	-3.53	**<0.001**
Perceived control		-0.17	-5.49	**<0.001**
Dietary Habits - between drinks	0.15			
Intention		-0.11	-3.55	**<0.001**
Perceived control		-0.33	-11.00	**<0.001**
Dietary Habits - drink at night	0.01			
Intention		0.09	2.65	**<0.05**
Perceived control		-0.12	-3.64	**<0.001**
Dietary Habits - snack at night	0.03			
Intention		0.02	0.48	0.635
Perceived control		-0.17	-5.22	**<0.001**
Oral hygiene - brushing frequency	0.46			
Intention		0.18	6.64	**<0.001**
Perceived control		0.56	20.65	**<0.001**
Oral hygiene - help with brushing	0.10			
Intention		0.18	5.12	**<0.001**
Perceived control		0.18	5.11	**<0.001**
Dental attendance - last visit	0.41			
Intention		0.13	4.26	**<0.001**
Perceived control		0.55	18.50	**<0.001**

To measure the impact on the actual reported behaviour, four outcome measures were used to assess dietary habits: the consumption of sugar-containing: 1, in-between meals; 2, in-between drinks, 3; drinks at night; and 4, snacks at night. Consumption by the child of in-between meals and drinks was predicted both by PBC and intention. Having a drink at night was predicted by PBC and to a lesser extent by intention. Yet PBC was the only significant predictor for the consumption of snacks at night. Used as outcome measures for oral hygiene habits were: 1, brushing frequency; and 2, help with brushing. Intention and PBC were significant predictors of both brushing behaviours. Finally dental attendance, measured by the child's last reported visit to the dentist, was predicted both by intention and PBC. These results are shown in Table 3.

Discussion

This study aimed to develop a valid and reliable (Dutch) questionnaire, based on the TPB, for the measurement of three important behaviours (dietary habits, oral hygiene and dental attendance), which impact on oral health in preschool children. For each of these behaviours, exploratory analyses on one half of the dataset and subsequent confirmation using CFA on the other half revealed an underlying structure that to a large extent reflected the TPB dimensions, in the sense that four, instead of the common three TPB-components, were identified. Whereas subjective norms were hypothesised to measure a single concept, a distinction arose between norms of partner/family and friends, versus norms of experts/others for dietary and oral hygiene habits. However, moderate correlations between these components might indicate that they are derivatives of the same underlying construct. The same applies to dental attendance, where attitude fell apart in two components, beliefs about immediate outcomes, which reflect the possible discomfort or fear children might have when visiting the dentist, and beliefs about long-term outcomes, reflecting the positive consequences of visiting the dentist for oral health later in life. Again, moderate correlations between both components point to the presence of a common underlying attitudinal construct.

In terms of external validation of the questionnaire, multiple regression analyses indicated that the scales measuring attitude, subjective norms and PBC all contributed strongly to the prediction of the intention to perform all three oral health related behaviours, and that intentions and PBC predicted significantly all reported behaviours. The one exception is 'snack at night', which was only predicted by PBC and not by intention.

A sizeable percentage of variance of intentions and behaviours among parents of five-year olds is explained by the model. The combined determinants explained 27% to 41% of the variance in intention, which is in line with the percentage reported by Armitage and Conner (2001). They found in their meta-analytic review that attitude, subjective norms and PBC in combination accounted for 39% of the variance in intention across 154 studies. In the same review, intentions and PBC explained 27% of the variance in behaviour across 63 studies. The results of our study related to visiting the dentist and brushing frequency are in line with this review as the model explained respectively 41% and 46% of the variance in behaviour. For 'help with brushing' and the behaviours concerning dietary habits, the prediction of behaviour by the TPB model is small to modest as intention and PBC explained only 1% to 15% of the variance. Environmental determinants or other cognitive factors could account for another portion of the variance in these behaviours. These results confirm the predictions of earlier studies and thereby add to the construct validity of the TPB towards oral health related behaviour (Astrom and Kiwanuka, 2006). When looking at the individual contribution of each component to the prediction, perceived behavioural control turned out to be the most important predictor of intentions and behaviours. Interventions aiming to improve behaviour should take this into account. One appropriate technique to improve these control beliefs is through a skills training (Michie *et al*., 2008).

There are some limitations in our study. First, it must be noted that our study did not use identical methods to measure the TPB-constructs as the studies described by Armitage and Conner. In our questionnaire, the constructs of attitudes and subjective norms were only measured indirectly (using the underlying beliefs). According to the TPB, the indirect measure has two components, namely the belief and an evaluation of this belief. We decided not to measure the evaluations of every behavioural belief, as several authors stated that in some cases such an evaluation can be absurd (e.g. Godin and Kok, 1996). In accordance with the suggestions of these authors we omitted the obvious evaluation items and diverged slightly from the TPB. Therefore be cautious in comparing results. Nonetheless, this study reveals satisfactory psychometric qualities of the questionnaire, which makes it a useful tool for investigating oral health behaviours in five-year old children.

Secondly, it must be noted that intentions and behaviour were measured in the same questionnaire, so there is no time frame between both measurements.

Conclusions

This study demonstrated the applicability of the TPB in predicting parental oral health behaviour among five year old children, and produced a valid and reliable questionnaire to measure the cognitive concepts related to this theory. The questionnaire can define the important determinants of parental oral health behaviour, so preventive actions can be targeted at them.

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