



Modeling of the Theory of Planned Behavior to Predict Determinants of Oral Health Behavioral Intention in Mothers of Children under 6 Years of Age in Iraq

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ABSTRACT

Introduction: The American Academy of Pediatric Dentistry (AAPD) recommends improving oral health behaviors as essential for the prevention of Early Childhood Caries (ECC), and several studies have evaluated different approaches to explaining human behavior through behavioral and cognitive-behavioral theories. This study aimed to explain predictors of mothers' behavioral intention regarding the oral health of their under-6-year-old children in Iraq based on the Theory of Planned Behavior using structural equation modeling.

Materials and Methods: This cross-sectional study was conducted using a multistage random sampling method, including 926 mothers of under-six-year-olds in Iraq in 2023. A valid questionnaire based on the Theory of Planned Behavior evaluated attitude, perceived behavioral control, subjective norms, and behavioral intention. Descriptive analysis and structural equation modeling (SEM) were used to describe the data and examine the association among the variables.

Results: Out of 926 children, 59.5% were girls. The mean age of the children was 4.0 (SD = 0.9) years, and the mean age of the mothers was 30 (SD = 5.2) years. The mean scores of the attitude, subjective norms, perceived behavioral control, and behavioral intention were 17.5 out of 20, 14.8 out of 20, 18.7 out of 32, and 20.4 out of 24, respectively. Subjective norm score (estimation = 0.12, p-value < 0.001), perceived behavioral control score (estimate = 0.06, p-value < 0.001), and attitude score (estimation = 0.15, p-value < 0.001) positively predicted behavioral intention, with perceived behavioral control being the strongest predictor.

Conclusion: The TPB was supported for predicting behavioral intention in our study population. The health holders should consider the TPB constructs, in particular perceived behavioral control, for improving behavioral intention.

Keywords: Children; Preschool; Intention; Oral health; Theory of planned behavior.

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Introduction

The Global Oral Health Status Report Towards Universal Health Coverage for Oral Health by 2030 declared that 3.5 billion people suffer from oral diseases, 75% of whom live in low- and middle-income countries [1]. The importance of the oral cavity in maintaining good general health in multidisciplinary professional practice is generally neglected. Oral health is an integral part of systemic health, and the complications of childhood caries can also cause systemic problems [2,3]. The Global Burden of Disease Study in 2017 revealed staggering statistics. Over 530 million children worldwide are affected by dental caries in their primary teeth, contributing to the growing burden of early childhood caries (ECC) in Europe. This complex and widespread problem demands innovative and personalized policy approaches [4-6]. Early Childhood Caries reached epidemic proportions in 193 United Nations countries from 2007 to 2017, affecting 23.8% of children under 36 months of age and 57.3% of those aged 36 to 71 months [7]. In the United Arab Emirates, a prevalence of 74.1% was reported among preschool children aged 4–6 years in Ras Al-Khaimah [8]. In one study conducted in Egypt, the prevalence of dental caries in preschool children was 61.4% [9]. In Saudi Arabia, dental caries was prevalent among children (83%-95%) [10]. Based on several studies, the overall prevalence of ECC has been estimated at 53.2% in Iran [11] and 73.3% in Turkey [12].

The American Academy of Pediatric Dentistry (AAPD) recommends improving oral health behaviors as essential for the prevention of ECC and emphasizes a dental visit within six months of the eruption of the first primary tooth and not later than 12 months of age. It also recommends modifying the diet to avoid cariogenic foods and beverages, promoting personal oral hygiene practices, and emphasizing the role of caregivers in brushing children's teeth and the importance of using fluoridated toothpaste [13]. The American Academy of Pediatric Dentistry (AAPD) and the FDI recommend that measures be taken to improve oral health behaviors by educating parents, caregivers, health professionals, and other parties [14,15]. Several studies have evaluated the different approaches to explaining human behavior through behavioral and cognitive-behavioral theories and models, some of which have significantly contributed to the understanding of oral health behaviors, including the Theory of Planned Behavior (Ajzen, 1985) [16,17]. The theory of planned behavior (TPB) introduced by Ajzen in 1985 has been widely applied to predict health behavior and is consid-

ered a practical theoretical framework for behavioral guidance [18]. Several studies have demonstrated that this model could be used as the framework for designing interventions or strategies to enhance behavior, and the constructs in the TPB model are well-documented as predictors of oral health behavioral intentions in various populations [19-21]. This study aimed to identify the predictors of mothers' behavioral intentions regarding the oral health of their children under six in Iraq, based on the theory of planned behavior and utilizing structural equation modeling.

Materials and Methods

Study design and data collection

This analytical cross-sectional survey was conducted among children under six years old and their parents from April 2023 to December 2023 in rural and urban areas of two randomly selected governorates in Iraq (Baghdad and Kut-Wasit). The participants included mothers with children under six years of age who referred to mother and child clinics at 14 (8 urban and 6 rural) health centers in Baghdad and 9 (5 urban and 4 rural) health centers in Kut-Wasit (Table 1). Data collection was conducted over three days at each health center. The data were collected from a capital city, a town, and rural areas of Iraq. Participants were selected by multistage random sampling. The minimum sample size was determined to be 900 mothers, assuming a population proportion of 0.5. The z-score was established at 1.96 for a 95% confidence level, with α set at 0.05 and a design effect of 2.5. Based on Ramlall's recommendation, the minimum sample size per observed variable was 20 for accurate structural equation modeling, so the calculated sample size was adequate for SEM analysis, too [22].

Inclusion and exclusion criteria

The inclusion criteria were Iraqi nationality, having children under 6 years of age at the time of data collection, the parents' ability to understand the questionnaire, and the parents' willingness to sign the informed consent form. The exclusion criteria were non-Iraqi nationalities, children in early mixed dentition, children who had any erupting permanent teeth such as the first permanent molar, children whose parents failed to attend the day of the interview, children with major debilitating illnesses or disabilities, and children with a significant health problem or major systemic disease.

The Questionnaire

The tool used in this study was a comprehensive ques-

tionnaire based on the Theory of Planned Behavior (TPB) that was answered by mothers. It was adapted from a previous study that demonstrated the validity and reliability of the questionnaire [23]. The questionnaire consisted of 26 closed-ended questions that examined the effects of the TPB constructs (attitudes, perceived behavioral control, and subjective norms) on participants' intentions to improve oral health behaviors. The questionnaire was divided into five sections: Attitude: This section contained five items that asked participants how they felt about certain oral health issues e.g., (having healthy baby teeth is beneficial for the baby's growth and general health, brushing a child's teeth is important for his health, it is good for my child to brush his teeth daily, reducing sugary foods is good for my child, I need to reduce my child's sugar intake. Subjective norms: In this section, five items for each behavior were used to assess subjective norms (e.g., "Most people who are important to me agree or confirm, and most people important to me expect). Perceived behavioral control: In this section, eight items were used to assess perceived behavioral control for each behavior (e.g., "It's easy for me to...", "I am confident that...", "If I want...", "Despite feeling overwhelmed, impatient, or forgetful, I can.") Behavioral intention: This section was divided into two parts: "try to" (2 questions) and "planned to" (3 questions). The final section included background information on gender, the mother's age, and the child's age.

Data management and statistical analysis

The SPSS software, version 26, was utilized to summarize sample characteristics. Mean and standard deviation (SD) were used for continuous variables, while frequencies were used for categorical variables. As the percentage of missing data did not exceed 5% for each variable and the result of not responding to the questions, we used EM (Expectation maximization) imputation to manage them. The responses to all TPB construct items were assessed using a 4-point scale ranging from 0 (totally disagree) to 4 (totally agree). The sum score for each variable was calculated. A Spearman correlation test was conducted to estimate the strength of variable association and evaluate inter-item correlations. The IBM SPSS Amos 24 version 4 was used to test our structural equation model based on the theory of planned behavior (TPB). A good fit was represented by a goodness of fit index (GFI) greater than 0.90, a root mean square error of approximation (RMSEA) below 0.08, Tucker and Lewis index (TLI) greater than 0.90, and comparative fit index (CFI) greater than 0.95 [24].

Results

Descriptive characteristics of the study population

The total number of questionnaires received was 926; of the children, most were female, 59.5% (551). The mean age of the children was 4.0 years (SD = 0.9). The mean age of the mothers was 30.0 years (SD = 5.2). The mean total score for the attitude was 17.5 (SD = 1.5) out of 20. All mothers revealed a positive attitude toward oral health care for the children. Among the mothers, 70.6% and 83.6 % totally agreed that it is good for their children to have routine dental checkups and brush their teeth, while 32.5 % and 34.1% totally agreed with the importance of oral hygiene for the child's general health and with reducing the child's sugar intake, respectively (Table 2).

The mean total score for the subjective norms sum was 14.8 (SD = 1.7) out of 20. The mothers felt that people important to them expected/confirm them to brush their children's teeth (about 96.6% agreed and totally agreed), while only 70% of them had the same perception for reducing sugary snacks for their children (Table 3). The mean total score for the perceived behavioral control sum was 18.7 (SD = 4.6) out of 32. The mothers reported that 74.1% (agree, totally agree) were confident in brushing their children's teeth, while 55.7 reported that it was easy for them to do so. The mothers reported that 60.2% (agree, totally agree) were confident in reducing sugary snacks for their children, while 47.1% reported it to be easy for them (Table 4). The mean total score for behavioral intention was 20.4 (SD = 1.2) out of 24. Most mothers agreed or totally agreed that they either tried or planned to carry out desirable oral health behaviors for their children (Table 5). Table 6 shows the sum scores of model constructs and their ranges and maximum achievable scores.

Correlation between model constructs

Table 7 illustrates the results of the correlation analysis among the TPB constructs. The correlations between behavioral intention and the other three constructs were low to moderate, with the highest coefficient observed for perceived behavioral control (Spearman's coefficient = 0.36). The correlations between the constructs other than intention were moderate.

Structural equation model

The model fitted well with GFI = 0.99, TLI = 0.93, CFI = 0.98, and RMSEA = 0.06. The variance and standardized estimates of the structural model for the study hypotheses were shown in Figure 1. The model was

controlled for the child's age. Subjective norm score (estimate = 0.12, p-value < 0.001), perceived behavioral control score (estimate = 0.06, p-value < 0.001), and attitude score (estimate = 0.15, p-value < 0.001) pos-

itively predicted intention. Perceived behavioral control was the strongest predictor of behavioral intention (standardized estimate = 0.20) (Table 8). The model predicted nearly 20% of the variance in intention.

Table 1. Surveys multistage cluster sampling details.

Kind of Health center	Number of health center	Percentage of health center	Number of Mother/child diad	Percentage of Mother/child diad
Baghdad (urban)	8	43.1	357	38.6
Baghdad (rural)	6	21.2	269	29.0
Kut (urban)	5	19.0	196	21.2
Kut (rural)	4	10.7	104	11.2
Total	23	100	926	100

Table 2. Mothers' attitude toward child oral health in Iraq (n = 926).

Items	Category	Frequency	Percent
1- Having healthy baby teeth is beneficial for the baby's growth and general health	0-Totally disagree	-	-
	1-Disagree	-	-
	2-I have no opinion	-	-
	3-I agree	655	70.7
	4-Totally agree	271	29.3
2- Brushing a child's teeth is important for his health	Totally disagree	-	-
	Disagree	-	-
	I have no opinion	1	0.1
	I agree	624	67.4
	Totally agree	301	32.5
3- It is good for my child to brush his teeth daily	Totally disagree	-	-
	Disagree	-	-
	I have no opinion	-	-
	I agree	152	16.4
	Totally agree	774	83.6
4- It is good for my child to have a routine dental exam	Totally disagree	-	-
	Disagree	-	-
	I have no opinion	-	-
	I agree	272	29.4
	Totally agree	654	70.6
5- It is important for me to reduce my child's sugar intake	Totally disagree	-	-
	Disagree	-	-
	I have no opinion	-	-
	I agree	610	65.9
	Totally agree	316	34.1

Table 3. Mothers' subjective norms about child oral health in Iraq (n = 926).

Items	Category	Frequency	Percent
1-Brush my child's teeth every day (agree/confirm)	Totally disagree	1	0.1
	Disagree	6	0.6
	I have no opinion	25	2.7
	I agree	599	64.7
	Totally agree	295	31.9
2- Take my child to the dentist routinely for a check-up (agree/confirm)	Totally disagree	2	0.2
	Disagree	78	8.4
	I have no opinion	38	4.2
	I agree	757	81.7
	Totally agree	51	5.5
3- Brush my child's teeth every day (expect me)	Totally disagree	1	0.1
	Disagree	13	1.4
	I have no opinion	32	3.5
	I agree	630	68.0
	Totally agree	250	27.0
4- Reduce the consumption of sweet and sugary items for my child (expect me)	Totally disagree	4	0.4
	Disagree	229	24.7
	I have no opinion	45	4.9
	I agree	415	44.8
	Totally agree	233	25.2
5- Routinely take my child to the dentist for a check-up (expect me)	Totally disagree	2	0.2
	Disagree	61	6.6
	I have no opinion	45	4.9
	I agree	790	85.3
	Totally agree	28	3.0

Table 4. Mothers' perceived behavioral control regarding child oral health in Iraq (n = 926).

Items	Category	Frequency	Percent
1- It's easy for me to brush my child's teeth every day	Totally disagree	174	18.8
	Disagree	184	19.9
	I have no opinion	52	5.6
	I agree	503	54.3
	Totally agree	13	1.4
2- I am confident that I can brush my child's teeth every day	Totally disagree	30	3.2
	Disagree	150	16.2
	I have no opinion	60	6.5
	I agree	670	72.4
	Totally agree	16	1.7
3- If I want, it is easy for me to reduce my child's consumption of milk and sugar products	Totally disagree	48	5.2
	Disagree	407	44.0
	I have no opinion	36	3.9
	I agree	384	41.5
	Totally agree	51	5.5

Items	Category	Frequency	Percent
4- I am sure that I can reduce my child's consumption of milk and sugar products	Totally disagree	115	12.4
	Disagree	23	23.0
	I have no opinion	41	4.4
	I agree	538	58.1
	Totally agree	19	2.1
5- In spite of too much work, impatience, forgetfulness, etc., I can reduce the consumption of sweet and sugary items in my child.	Totally disagree	2	0.2
	Disagree	312	33.7
	I have no opinion	91	9.8
	I agree	451	48.7
	Totally agree	70	7.6
6- It is easy for me to take my child to the dentist for a routine check-up	Totally disagree	26	2.8
	Disagree	245	26.6
	I have no opinion	62	6.7
	I agree	774	15.2
	Totally agree	118	12.7
7- I am confident that I can take my child to the dentist for a routine check-up	Totally disagree	-	-
	Disagree	172	18.6
	I have no opinion	58	6.3
	I agree	598	64.6
	Totally agree	98	10.6
8- In spite of a lot of work, impatience, forgetfulness, etc., I can routinely Taking my child to the dentist for a check-up	Totally disagree	3	0.3
	Disagree	173	18.7
	I have no opinion	71	7.7
	I agree	581	62.7
	Totally agree	98	10.6

Table 5. Mothers' behavioral intention toward oral health care for their children in Iraq (n = 926).

Items	Category	Frequency	Percent
1- Brush my child's teeth twice a day (try)	Totally disagree	1	0.1
	Disagree	2	0.2
	I have no opinion	14	1.5
	I agree	785	84.9
	Totally agree	123	13.3
2- Take my child for a dental check-up (try)	Totally disagree	1	0.1
	Disagree	-	-
	I have no opinion	5	0.5
	I agree	476	51.4
	Totally agree	444	47.9
3- Reduce my child's consumption of sweet snacks (try)	Totally disagree	-	-
	Disagree	-	-
	I have no opinion	22	2.4
	I agree	703	75.9
	Totally agree	201	21.7

Items	Category	Frequency	Percent
4- Brush my child's teeth twice a day (planned)	Totally disagree	-	-
	Disagree	1	0.1
	I have no opinion	4	0.4
	I agree	501	54.2
	Totally agree	418	45.2
5- Limit my child's consumption of sweet snacks (planned)	Totally disagree	-	-
	Disagree	-	-
	I have no opinion	7	0.8
	I agree	449	48.3
	Totally agree	472	51.0
6- Take my child for a dental check- up (planned)	Totally disagree	-	-
	Disagree	-	-
	I have no opinion	3	0.3
	I agree	241	26.0
	Totally agree	682	73.7

Table 6. Mean values and range of constructs of Theory of Planned Behavior Model in Mothers of under 6- year-olds in Iraq (n = 926).

Sum variable	Mean	Standard deviation	Minimum	Maximum	Maximum possible
Attitude score	17.5	1.5	14	20	20
Subjective norm score	14.8	1.7	7	19	20
Perceived behavior score	18.7	4.6	6	27	32
Behavior Intention score	20.4	1.2	16	24	24

Table 7. Spearman's correlations among the constructs of the Theory of Planned Behavior Model in mothers of under 6 -year-olds in Iraq (n = 926).

	Attitude	Subjective norm	Perceived behavior control	Behavior Intention
Attitude		0.35**	0.36**	0.23**
Subjective norm			0.36**	0.27**
Perceived behavior control				0.36*
*p-value < 0.05 ** p-value < 0.001				

Table 8. Structural equation model of study behavior intention based on the theory of planned behavior in mothers of under 6- year- olds in Iraq (n = 926).

	Estimation	SE	CR	p-value
Intention $\leftarrow$ Subjective norm	0.12	0.02	4.79	<0.001
Intention $\leftarrow$ Perceived behavior	0.06	0.009	6.11	<0.001
Intention $\leftarrow$ Attitude	0.15	0.02	5.430	<0.001
Intention $\leftarrow$ Child's age	-0.10	0.04	-2.63	<0.01

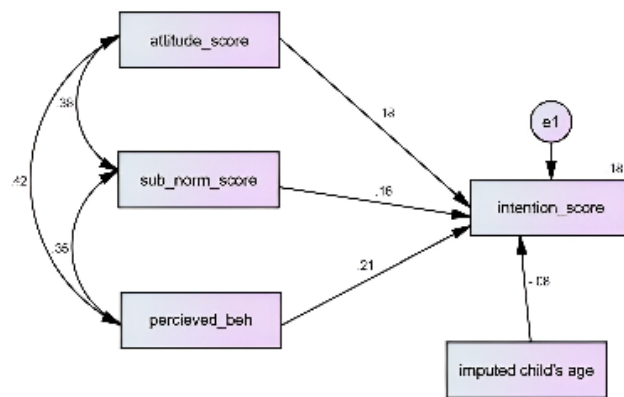


Figure 1. Structural equation modeling of behavior intention based on the theory of planned behavior in mothers of under 6-year-olds in Iraq (n = 926).

Discussion

This cross-sectional study used a structural equation model of the Theory of Planned Behavior (TPB) to determine and predict the determinants of oral health behavioral intention among mothers of children under six years of age in Iraq. The study found that perceived behavioral control, subjective norms, and attitudes significantly influenced intentions regarding oral health behaviors. This means that a more positive attitude, greater social pressure, and increased perceived behavioral control were all associated with a stronger intention to engage in oral health behaviors. These findings align with studies conducted in other countries, including Ireland, Australia, Indonesia, and Saudi Arabia [25-28]. The benefit of Structural Equation Modeling (SEM) over other statistical procedures is its ability to comprehensively and simultaneously evaluate the hypothesized relationships among both observed and latent variables within the Theory of Planned Behavior (TPB) model. SEM analysis revealed that perceived behavioral control (PBC) was the strongest predictor of oral health behavioral intention (OHBI). Our application of the TPB demonstrated that participants' perceived behavioral control significantly influenced their OHBI. This finding supports the idea that higher self-efficacy is linked to improved oral health behaviors, which is consistent with previous studies on flossing and attendance at dental clinics [20,21]. Additionally, results from a meta-analysis also indicated that PBC is the strongest predictor of health behaviors in the TPB model [29]. The components of the TPB model explained 20% of the variability in oral health behavioral intention (OHBI). Generally, the TPB accounts for between 20% and 40% of the variability regarding various health-related behaviors [30]. In the field of oral health, a number of prior studies have employed the TPB along

with its extended adaptations to predict oral health behaviors (OHB), reporting explained variance ranging from 32% to 66% [25,26,31,32]. One potential reason for the lower explained variance in OHBI compared to other research could be the inclusion of both urban and rural populations in the study. Socioeconomic and structural obstacles might influence how the constructs of the Theory of Planned Behavior (TPB) relate to intentions [29]. Factors such as financial distress, unemployment, transportation difficulties, and access to healthcare are known to impact care-seeking behavior [33], which varies among people in different regions of Iraq, from the capital to rural areas. While there are notable differences in socioeconomic, educational, and cultural conditions, the model still provided a suitable fit and accounted for 20% of the variance in OHBI. Although our sample size was considerable, it was limited to one sex, which restricted the generalizability of the results. Amin et al. also conducted a single-sex study to predict dental attendance and caries experience among children of newcomers in Canada [21].

The Theory of Planned Behavior successfully predicted dental attendance intentions and behaviors among newcomer children. In a study involving pregnant women, Mohammadkhah et al. found that training based on the Theory of Planned Behavior effectively influenced dental and oral health practices among pregnant women and enhanced the clinical outcomes of their self-care routines [34]. In this study, subjective norms were identified as significant predictors of intention, aligning with previous studies conducted in Iran and Indonesia [27,35]. Compared to Western nations, individuals in the Middle East often maintain close family connections. The findings highlighted the significance of expectations based on subjective norms in relation to OHBI. Attitudes toward various behav-

iors have long been regarded as one of the most significant factors influencing those behaviors. Although attitude was important in this research, it demonstrated the weakest association with intention among the three components of the Theory of Planned Behavior (TPB). The diverse educational and cultural backgrounds of our extensive study sample may also account for this observation. Dumitrescu et al. [31] noted that oral health knowledge is associated with attitude. It is possible that in this large population sample, differences in oral health knowledge due to varying educational levels diminished the impact of attitude. This study has several important limitations. One notable weakness is its cross-sectional design, which differs from Ajzen's recommended longitudinal approach for evaluating the original Theory of Planned Behavior (TPB) model. Due to the cross-sectional nature of the study, causal relationships between TPB constructs and behavior cannot be established.

Future longitudinal studies are therefore needed to investigate the temporal and causal relationships between TPB constructs and actual behavior rather than relying on self-reported past behavior. Additionally, since the TPB is a behavioral model, we did not account for other potentially influential factors, such as demographic and environmental variables. Future research should consider incorporating demographic and socioeconomic factors into the model to provide a more comprehensive understanding of the determinants of behavior. Finally, the use of self-reported data may have introduced social desirability bias, as participants may have been inclined to report behaviors or responses that were perceived as socially acceptable or desirable. Although efforts were made to minimize this potential bias through standardized data collection procedures, its influence on the findings cannot be completely excluded.

Conclusion

The results of the present study confirm the fitness of the Theory of Planned Behavior for partially predicting behavioral intentions. Among the constructs of the TPB, perceived behavioral control had the strongest effect. Therefore, health professionals should consider strategies that enable families to control behaviors as a notably effective factor for improving behavioral intentions.

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Conflict of Interest

There is no conflict of interest to declare.

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