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Determinants of oral hygiene behaviour among patients with moderate and severe chronic periodontitis based on the theory of planned behaviour

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Objectives: Health interventions based on cognitive theories effectively bring about behaviour change. Therefore, the present study aimed to assess the determinants of oral hygiene behaviour (OHB) based on the theory of planned behaviour (TPB) among patients with moderate and severe periodontitis. **Methods:** A cross-sectional study was conducted using a 47-item self-report questionnaire to evaluate oral health knowledge (OHK), expected social outcomes (ESO) and OHB based on the variables of TPB [attitude (ATT), social norms (SN) and perceived behavioural control (PBC)] of patients with moderate and severe periodontitis. Analysis of variance was used for comparison between the parameters. Regression analyses identified the significant determinants of OHB. **Results:** A total of 543 patients meeting the inclusion criteria were included. ESO ($B = 0.04$) and OHK ($B = 0.14$) significantly predicted intention to perform OHB. None of the TPB variables significantly predicted OHB. Apart from ESO and OHK, which were significant predictors for both genders, ATT ($\beta = 0.22$) additionally predicted OHB among men. Also, for university graduates, ESO ($\beta = 0.13$) and OHK ($\beta = 0.17$) significantly predicted OHB. Lastly, OHB showed a significant and positive correlation with all the parameters ($P < 0.05$). **Conclusion:** The study concludes that the TPB model facilitates the evaluation of psychosocial determinants of OHB among patients with periodontitis. Also, a significant relationship between gender, OHB and variables of TPB further highlights the importance of patient-focused preventive oral health care education.

Key words: *Psychological aspects of oral hygiene behaviour, oral health promotion, behavioural sciences, India, periodontitis*

INTRODUCTION

The success of health education initiatives and programmes lies in the ability to understand the differences in psychosocial factors (behaviour, attitudes, beliefs, knowledge, skill, etc.) at individual and community levels.[1,2] This can be achieved through the application of social cognitive theories that aid in understanding these psychosocial hurdles. A wealth of evidence further suggests that health education interventions based on cognitive theories are more effective than those not based on these theories because they change and promote healthy behaviours by specifying and targeting beliefs, attitudes, intentions and context-related behavioural change.[1,3–6] Additionally, it has been established that persuading individuals to adopt a healthy self-care practice through behavioural change has the potential to reduce the occurrence of diseases.[1] Hence, the World Health Organization calls for the reorientation of health systems towards prevention and promotion by targeting behavioural risk factors.[7,8]

This reorientation is highly desirable in oral health systems because oral diseases are easily preventable, especially if diagnosed at an early stage. However, information and awareness about this preventive aspect of oral diseases are usually not applied in practice. Thus, dental diseases, particularly dental caries and periodontal disease, continue to be rampant in the population. According to the National Oral Health Survey & Fluoride Mapping,[9] the prevalence of dental caries and periodontal diseases is more than 75% in the Indian adult population, indicating a high

risk of pain and tooth loss in the future. Periodontal disease is an emerging risk factor for various systemic diseases, such as cardiovascular diseases, coronary heart disease, diabetes, chronic obstructive pulmonary disease and low birth weight.[9–12] Many factors, such as age, gender, smoking, stress and bacterial colonisation, impact the initiation and progression of periodontal disease.[13] In addition, the oral hygiene behaviour (OHB) of a person, both in terms of maintenance of optimal oral health (by a proper self-driven dental care regimen) and treatment-seeking when periodontal disease exists, has gained increasing attention.[13,14]

Promoting healthy OHB among patients with periodontitis, however, requires an understanding of the determinants of this behaviour.[15] Many theories have been developed to provide insight into factors influencing OHB; one such theory is the theory of planned behaviour (TPB) described by Ajzen.[16,17] This theory, along with its predecessor, the theory of reasoned action (TRA),[18] states that the determinants for adopting healthy behaviours are based on an individual's intention to engage in a health-promoting behaviour. TPB further suggests that there are three relevant determinants of intentions – attitude (ATT), subjective norms (SN) and perceived behaviour control (PBC).[3–5,7,8,19,20] For example, if people perceive the suggested behaviour as positive (ATT) and believe that others want them to perform the behaviour (SN), it results in a higher intention (motivation) and more likeliness to engage in target behaviours. The TPB extends the TRA model to include PBC (the strength or confidence of an individual to perform the behaviour) as an additional predictor of intent.[21]

A search of the literature disclosed similar studies in the Dominican Republic, the Caribbean and Nepal.[7,8] Hence, this investigation aimed to assess the determinants of OHB based on the TPB among patients with moderate and severe periodontitis in India.

As a result of its flexibility, the TPB is open to the inclusion of additional variables, allowing for generalisation. In this study, the perceived social corollary of OHB, in other words how an individual perceives that his/her healthy teeth might affect interpersonal interactions [expected social outcomes (ESO)], was also included as it might indirectly motivate a person to perform adequate OHB. In addition, according to the TPB model, decisions on personal oral health are also influenced by oral health knowledge (OHK); hence, this variable was also included in the study.[3,7,8]

METHODS

A cross-sectional study was conducted in the outpatient clinic, Department of Periodontics of Panineeya Institute of Dental Sciences and Research Centre, from 1 October 2016 to 31 January 2017. Based on sample size calculation, a minimum of 250 participants was required. Ethical clearance was obtained from the Institute Review Board of the institution and the study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all subjects. The study fulfilled the STROBE guidelines for cross-sectional study design.

Participants and procedure

The inclusion criteria followed for this study were as follows: age ≥30 years; a minimum of 20 functional teeth; can read and understand English; have moderate periodontitis defined as two or more interproximal sites with clinical attachment loss (AL) of ≥4 mm (not on the same tooth) or two or more interproximal sites with probing depth ≥5 mm (not on the same tooth) or severe periodontitis defined as two or more interproximal sites with AL ≥6 mm (not on the same tooth) and one or more interproximal sites with probing depth of ≥5 mm (not on the same tooth), according to the Centers for Disease Control/American Academy of Periodontology (CDC/AAP) guidelines[22]; no history of systemic conditions (diabetes mellitus, cardiovascular diseases, etc.); and no periodontal surgery or medication (antibiotics, immunosuppressant drugs, non-steroidal anti-inflammatory drugs) in the last month. Subjects with extensive carious lesions, overhang restorations, periodontal abscess and prosthesis (fixed or removable), and those not willing to give written informed consent, were excluded from this study.

Measures

A 47-item self-report questionnaire, similar to that used by Buunk-Werkhoven *et al.*,[4] was used to evaluate OHB based on the variables of the TPB (ATT, SN and PBC), ESO and OHK. Additionally, a few demographic variables, such as age, gender and educational status, were also recorded.

Oral hygiene behaviour was measured using the OHB index. For this index the sum score ranged from 0 to 16, with a high score indicating a high level of adequate OHB[4] (*Table 1*).

In accordance with the TPB, the participant's ATT, SN and PBC of the *focal OHB* were assessed using 17 items. The focal OHB was described as 'brushing your teeth twice a day (once after breakfast and once before going to sleep) using a soft-bristled toothbrush and fluoride-containing toothpaste; brushing softly, without pressure for at least 2 minutes; brushing stepwise by making small strokes (massage) near the gum, along the inside and the outside. In addition to toothbrushing, daily interdental cleaning (i.e. the use of

Table 1 Oral hygiene behaviour index (OHB index): values (weights)

Items	Values	Weight
Frequency of toothbrushing	• Twice a day or more than twice a day	2
	• Once a day	1
	• Not every day	0
Moment of day when toothbrushing	Three times or more a day, including	
	• After dinner in evening and before going to sleep	3
	Twice a day	
	• Morning after breakfast and before going to sleep	3
	• Morning before or after breakfast and noon	2
	• Morning before breakfast or noon and before going to sleep	2
	• After dinner in evening and any other Moment or all combinations	1
	Once a day	
	• Before going to sleep	1
	• Any other moment' than 'Before going to sleep	1
Measure of force of toothbrushing	Softly ('1,2,3')	2
	Softly/forcefully ('4,5')	1
	Forcefully ('6,7')	0
Duration of toothbrushing	'2 minutes' or '3 minutes'	2
	Longer than '3 minutes' or '1 minute'	1
	Shorter than '1 minute'	0
Method of toothbrushing	Bass method	2
	Horizontal movements or combination of methods	1
	Vertical movements or circular movement	0
Fluoride toothpaste	Toothpaste with fluoride	1
	Toothpaste without fluoride or other alternatives	0
Interdental cleaning	At least once a day floss and/or tooth sticks and/or interdental brushes	2
	Not every day interdental cleaning	1
	Never interdental cleaning	0
Tongue cleaning	Every day	2
	Sometimes	1
	Never	0

floss, tooth sticks or interdental brushes at least once a day) and tongue cleaning are also recommended'.[4]

Attitude towards this focal OHB was measured using nine worded statements in a semantic differential format on a 7-point scale: 1 (unimportant) to 7 (important); 1 (unpleasant) to 7 (pleasant); 1 (unhealthy) to 7 (healthy); 1 (negative) to 7 (positive); 1 (annoying not) to 7 (annoying); 1 (useful not) to 7 (useful); 1 (boring) to 7 (exciting); 1 (painful) to 7 (painless); and 1 (stupid) to 7 (smart). A sum score for subject's attitudes was constructed by adding the items (ranging from 9 to 63)[4] (Cronbach's $\alpha = 0.73$).

Social norms toward the focal OHB were assessed by having the subjects rate the perceived opinions of different significant others. This 7-point scale for SNs was based on four items with score range from 5 to 35[4] (Cronbach's $\alpha = 0.90$).

Perceived behavior control was measured using a sum score constructed from three items and was answered with endpoints (1, don't agree to 5, agree). The sum score on this 5-point scale ranged from 3 to 15[4] (Cronbach's $\alpha = 0.81$).

- In all three cases, a high sum score indicated a more positive ATT, strong perceived approval from significant others and a high level of PBC of the focal OHB.[4]

Expected Social Outcomes of having healthy teeth included six items. Responses varied from 1 (don't agree) to 5 (agree), and a sum score ranged from 6 to 30, which was computed by summing up the scores of all six items[4] (Cronbach's $\alpha = 0.85$).

Oral Health Knowledge was measured with an index consisting of 16 items to assess the status of the individual's OHK. The total score ranged from 0 to 16, with a higher score indicating an individual's higher knowledge of oral health issues.[4]

The Statistical Package for Social Sciences Software (SPSS Version 21.0; IBM, SPSS, Chicago, IL, USA) was used for data analysis. Descriptive statistics were carried out for the demographic variables. Mean scores were calculated for all the parameters based on demographics. Regression and correlation analyses were performed to identify the significant determinants of OHB. Lastly, hierarchical regression analyses were conducted to determine the interaction between each predictor variable, on the one hand, and gender and education, on the other hand, for the total sample. The level of significance was set at $P < 0.05$. The internal consistency of the questionnaire was tested using Cronbach's alpha.

RESULTS

The study sample included 543 subjects [294 (54.1%) men and 249 (45.9%) women] with mean age of 44.52 ± 9.20 years. Only 17.5% of the sample had primary education, 40.3% had high school education and 42.2% possessed a university degree. Almost two-thirds (66.1%) of the study sample had moderate periodontitis and 33.9% had severe periodontitis (*Table 2*).

Comparable numbers of participants with moderate and severe periodontitis gave correct responses for the OHK questionnaire ($P = 0.55$) (*Table 3*).

Except for total SN, which was high among the 61–70 years' age group (28.2 ± 2.2), the mean scores of all other parameters [i.e. total OHB (8.3 ± 2.2), total ESO (24.1 ± 5.2), total ATT (48.9 ± 6.5), total PBC (11.3 ± 3.1) and total OHK (9.5 ± 2.3)] were higher among subjects aged 31–40 years. However, a statistical difference was noted only for total OHB ($P < 0.001$) and total ESO ($P < 0.001$) (*Table 4*).

Men had lower mean scores for all the parameters (total OHB, 7.6 ± 2.2; total ESO, 22.8 ± 5.7; and total OHK, 9.3 ± 2.3) and all the variables of TPB (total ATT, 48.1 ± 6.2; total SN, 26.9 ± 6.6; and total PBC, 10.9 ± 2.9). However, a statistical difference was seen only for total OHB ($P < 0.001$), total ESO ($P = 0.02$) and total SN ($P = 0.01$) (*Table 4*).

With regard to education status, significantly higher mean scores for all the parameters and variables of TPB were recorded among subjects with university education ($P < 0.001$) (*Table 4*).

Based on the severity of periodontitis, subjects with moderate periodontitis had higher mean scores for all the parameters (total OHB, 8.3 ± 2.5; total ESO, 23.9 ± 5.3; and total OHK, 9.4 ± 2.4) and TPB variables (total ATT, 48.9 ± 7.2; total SN, 28.1 ± 6.4; and total PBC, 11.2 ± 3.1). However, a statistical difference was not observed for total OHK ($P = 0.48$) and total PBC ($P = 0.23$) (*Table 4*).

To determine the direction and strength of association between the variables, Pearson's correlation was performed. All the parameters, although weak, showed a positive and significant correlation with TPB variables (*Table 5*).

Table 2 Demographic distribution of the study population

Variables	*n* (%)
Age (years)	
31–40	218 (40.1)
41–50	176 (32.4)
51–60	123 (22.7)
61–70	26 (4.8)
Gender	
Male	294 (54.1)
Female	249 (45.9)
Educational qualification	
Primary school	95 (17.5)
High school	219 (40.3)
University	229 (42.2)
Severity of periodontitis	
Moderate	359 (66.1)
Severe	184 (33.9)
Total	543 (100)

Table 3 Item-wise comparison of correct responses of oral health knowledge (OHK) based on severity of periodontitis

Severity of periodontitis	*n* (%)			*P*-value	Total
	1–5 responses	6–10 responses	11–16 responses		
Moderate periodontitis	19 (5.3)	212 (59.1)	128 (35.7)	0.55	359 (100)
Severe periodontitis	11 (6)	116 (63)	57 (31)		184 (100)

$P < 0.05$ statistically significant.

Table 4 Mean comparison of oral hygiene behaviour (OHB), expected social outcomes (ESO), variables of theory of planned behaviour (TPB) and oral hygiene knowledge (OHK) scores based on demographics

Variables	Total OHB	Total ESO	Variables of TPB			Total OHK
			Total ATT	Total SN	Total PBC	
Age						
31–40 years	8.3 ± 2.2	24.1 ± 5.2	48.9 ± 6.5	28.1 ± 6.6	11.3 ± 3.1	9.5 ± 2.3
41–50 years	8.2 ± 2.7	23.9 ± 5.1	48.3 ± 8.3	27.9 ± 5.9	11.1 ± 3.1	9.4 ± 2.3
51–60 years	7.4 ± 2.1	21.5 ± 6.2	48.3 ± 6.4	26.3 ± 7.1	10.8 ± 2.8	8.9 ± 2.5
61–70 years	6.8 ± 2.3	20.4 ± 6.6	47.9 ± 5.4	28.2 ± 6.0	10.9 ± 3.1	9.1 ± 1.9
P-value	**<0.001***	**<0.001***	0.81	0.07	0.60	0.13
Gender						
Male	7.6 ± 2.2	22.8 ± 5.7	48.1 ± 6.2	26.9 ± 6.6	10.9 ± 2.9	9.3 ± 2.3
Female	8.4 ± 2.5	23.9 ± 5.5	49.0 ± 7.9	28.4 ± 6.3	11.2 ± 3.1	9.4 ± 2.4
P-value	**<0.001***	**0.02***	0.11	**0.01***	0.32	0.62
Education qualification						
Primary education	6.5 ± 1.9	19.4 ± 6.6	45.1 ± 7.3	25.1 ± 6.8	9.4 ± 3.2	8.1 ± 1.9
High school	7.3 ± 1.8	22.3 ± 5.3	48.0 ± 6.2	27.1 ± 6.6	10.8 ± 2.9	8.7 ± 2.1
University	9.3 ± 2.4	25.8 ± 4.1	50.4 ± 7.2	29.2 ± 5.8	12.2 ± 2.6	10.4 ± 2.2
P-value	**<0.001***	**<0.001***	**<0.001***	**<0.001***	**<0.001***	**<0.001***
Severity of periodontitis						
Moderate	8.3 ± 2.5	23.9 ± 5.3	48.9 ± 7.2	28.1 ± 6.4	11.2 ± 3.1	9.4 ± 2.4
Severe	7.4 ± 2.1	21.9 ± 5.9	47.6 ± 6.7	26.7 ± 6.5	10.9 ± 2.9	9.2 ± 2.2
Total	7.9 ± 2.4	23.3 ± 5.6	48.5 ± 7.1	27.6 ± 6.5	11.1 ± 3.1	9.3 ± 2.3
P-value	**<0.001***	**<0.001***	**0.04***	**0.01***	0.23	0.48

Values are given as mean ± standard deviation.
*$P < 0.05$ statistical significance (in bold).

Table 5 Intercorrelations using Pearson's correlation

	Total-OHB	Total-ESO	Total-ATT	Total-SN	Total PBC	Total OHK
Total-OHB	–					
Total-ESO	0.32*	–				
Total-ATT	0.21*	0.31*	–			
Total-SN	0.17*	0.31*	0.35*	–		
Total-PBC	0.23*	0.32*	0.36*	0.42*	–	
Total OHK	0.31*	0.27*	0.08*	0.23*	0.20*	–

*$P < 0.05$ statistical significance.
ATT, attitude; ESO, expected social outcomes; OHB, oral health behaviour; OHK, oral health knowledge; PBC, perceived behavioural control; SE, standard error; SN, social norms.

Table 6 Linear regression of self-reported oral health behaviour (OHB) on all parameters

Parameters	Unstandardised coefficients		Standardised coefficients	*t*
	B	SE	Beta (β)	
ATT	0.02	0.01	0.06	1.64
SN	−0.009	0.01	−0.02	−0.58
PBC	0.02	0.03	0.03	0.84
ESO	**0.04***	0.01	0.09	2.25
OHK	**0.14***	0.04	0.14	3.51
Age	−0.007	0.01	−0.02	-0.72
Gender	**0.77***	0.17	0.16	4.39
Education	**1.07***	0.14	0.33	7.37

$R^2 = 0.284$, $F(8,534) = 26.475$.
*$P < 0.001$ statistical significance (in bold).
ATT, attitude; ESO, expected social outcomes; OHK, oral health knowledge; PBC, perceived behavioural control; SE, standard error; SN, social norms.

The linear regression analysis model accounted for 28.4% of the variance in self-reported OHB. Gender, education, ESO and OHK emerged as significant predictors of OHB. However, none of the variables of TPB significantly determined OHB (*Table 6*).

Table 7 shows that for men, ATT, ESO and OHK emerged as significant predictors of TPB [$R^2 = 0.148$, $F(5,293) = 10.028$, $P < 0.001$]. On the other hand, only ESO and OHK significantly determined OHB among women [$R^2 = 0.243$, $F(5,248) = 15.586$, $P < 0.001$]. This hierarchical regression model accounted for 14% and 24% variance for men and women, respectively.

After controlling for education, among the variables of TPB, only ATT significantly predicted OHB for those with high school education [$R^2 = 0.036$, $F(5,218) = 1.578$, $P = 0.16$]. Among university graduates [$R^2 = 0.096$, $F(5,228) = 4{,}714$, $P < 0.001$], both ESO and OHK significantly influenced the OHB. Whilst, in the primary education group, except for ESO, no other significant relationships were detected [$R^2 = 0.099$, $F(5,294) = 1.957$, $P = 0.093$] (*Table 7*).

DISCUSSION

In spite of extensive professional care and oral health education programmes, a rapid decline in oral health status of the Indian population has been observed. This could be a result of the lack of compliance and non-adherence to preventive oral health-care instructions. In addition, a considerable amount of psychological literature suggests that the intention to perform self-care oral hygiene behaviour plays a fundamental role in improving one's oral health.[3–5,7,8]

Meta-analyses have supported the predictive utility of TPB in a wide range of health-related behaviours, such as smoking, alcohol consumption, drug use, exercising behaviours and HIV/AIDS-related

Table 7 Hierarchical regression of oral hygiene behaviour on the expanded theory of planned behaviour controlling for gender education

Parameters	Gender			Education			
	Male	Female	Total	Primary school	High School	University	Total
ATT							
Beta	**0.22***	0.02	**0.20***	−0.02	**0.19***	0.06	**0.10***
t	3.50	0.35	5.01	−0.18	2.48	1.05	2.59
SN							
Beta	−0.10	0.03	**0.16***	−0.08	−0.06	0.04	0.07
t	−1.51	0.49	3.79	−0.76	−0.80	0.63	1.86
PBC							
Beta	0.05	0.11	**0.22***	0.07	−0.04	0.08	**0.08***
t	0.82	1.81	5.50	0.62	−0.56	1.20	2.16
ESO							
Beta	**0.18***	**0.20***	**0.31***	**0.29***	0.02	**0.13***	**0.15***
t	3.04	3.07	7.70	2.75	0.35	2.04	9.49
OHK							
Beta	**0.19***	**0.31***	**0.16***	0.08	0.09	**0.17***	**0.15***
t	3.29	5.26	4.09	0.87	1.33	2.69	3.86

*$P < 0.05$ statistical significance (in bold).
ATT, attitude; ESO, expected social outcomes; OHK, oral health knowledge; PBC, perceived behavioural control; SN, social norms.

behaviours, among adults and adolescents.[23,24] Evidence from studies has stated that TPB accounts for 27% and 39% variance in behaviour and intention, respectively. Furthermore, on comparison with objective or observed measurement, self-report measure of TPB has 11% more variance.[3,15,23] Unlike other theories (Health Belief model, The Transtheoretical model, Theory of Reasoned Action, Protection-motivation theory, etc.), TPB not only takes into consideration a person's ATT (derived from behavioural beliefs) and normative beliefs (i.e. the social pressure from important others, such as relatives, friends and health professionals), it also contemplates that an individual's volitional control influences the intentions to perform a particular behaviour.[1,5,17] ATT is the representation of one's positive or negative appraisal of performing a behaviour. The perceived SN mirrors the individual perception of the social expectations to implement certain behaviour. Lastly, PBC affects both intention and behaviour, giving us information about how much effort a person will expend to overcome the perceived probable constraints in taking up the behaviour and therefore clarifies why a behaviour is not always predicted by intention.[24–26] Hence, considering these merits, TPB was utilised in this investigation to bridge the gap between psychological determinants and intention to adopt OHB.

Demographics of a similar study by Buunk-Werkhoven *et al.*,[8] among the Dominican Republic sample, showed that the majority of dental care-seekers were female (60%) with a mean age of 31.6 ± 12 years, and only 19% of the study population had a high level of education. Likewise, in the present study, the majority of participants were in the 31–40 years (40.1%) age group and were male (54.1%). Nearly 42.2% of the participants had university education.

Jonsson *et al.*[27] acknowledged that evaluation of knowledge, expectations and motivation helps in improving the oral health status of periodontal patients. Therefore, OHK on various aspects of oral diseases and their risk factors was estimated in the current study. Although two groups, based on the severity of periodontitis (moderate and severe periodontitis), were included, no significant difference in knowledge was found among them ($P > 0.05$) in the existing study. A minimum of high-school educational qualification with basic knowledge of preventive measures (hygiene techniques, fluoride toothpastes and early recognition of periodontitis) among the current study participants might explain this finding.

A noteworthy finding of the study was that, as age increased, the mean scores for total OHB, total ESO and total ATT decreased, signifying that younger adults had a higher level of oral self-care, higher ESO of having healthy teeth and had a more positive ATT towards OHB. This perhaps explains why they understand the importance of good oral hygiene, both in personal and societal spheres. On the other hand, subjects aged 51–60 years had the lowest mean scores for total SN (26.3 ± 7.1), total PBC (10.8 ± 2.8) and total OHK (8.9 ± 2.5), indicating that they did not consider the opinions of significant others as important, had low knowledge towards OHB and felt less efficient in performing oral hygiene practices. Lower scores among older individuals can be attributed to their limited dexterity in executing complex routine oral care practices and less influence from external factors (family and peers) as a result of their age.

The observations of Deinzer *et al.*[28] among the German population stated that less educated individuals had deficits in periodontitis-related knowledge and its prevention, which was strongly linked to poor oral hygiene behaviour. Consequently, in the current study, as the level of education decreased, the level of oral self-care, ESO of having healthy teeth, feeling of personal mastery and knowledge towards OHB also decreased significantly ($P < 0.05$). Moreover, educational qualification of primary/high school significantly hampered subjects' positive ATT towards OHB ($P < 0.001$), and such subjects also had lower SN ($P < 0.001$).

Women and participants with moderate periodontitis practiced a higher level of oral care, believed that healthy teeth had an effect on their interpersonal relationships (ESO), had positive ATT, more subjective pressure and felt more control in performing hygiene practices as a result of higher OHK. However, a significant difference in the gender-wise comparison was obtained only for total OHB ($P < 0.001$), total ESO ($P = 0.02$) and total SN ($P = 0.01$). This situation can be explained on the grounds that women may be more concerned about their esthetics and hence more compliant towards the oral cleansing exercises.

Similarly to a Romanian pilot study,[20] the present study also showed a positive and significant correlation between OHB and ATT, SN and PBC (TPB variables) ($P < 0.05$). Additionally, OHB was positively and significantly correlated to ESO and OHK ($P < 0.05$).

In the present study, none of the variables of TPB emerged as significant predictors of OHB. On the contrary, in a study by Masalu and Astorm, all the variables of TPB (ATT, SN and PBC) predicted the intention to avoid sugary snacks[29]. The results among a Caribbean population showed that ESO and OHK did not contribute to OHB.[7] On the other hand, social importance of having healthy teeth and OHK independently influenced OHB for the current study population. In order to enhance knowledge, the collective effect of oral health-care instruction brochures, demonstrations and videos presenting

high-risk behaviour and risk information can be employed.[30] Moreover, intervention strategies[30] such as modelling, anticipatory regret and fear arousal of having unhealthy teeth in social context, can also be used. Additionally, in this target group, regular follow-ups can be considered to promote the adoption of desired healthy behaviour and used to evaluate the programme.

The stringent statistical tests showed a variation in interactions between genders, education and potential determinants of OHB. Apart from ESO and OHK, which were relevant in both genders, ATT was also important among men. This was comparable with findings by Buunk-Werkhoven and Dijkstra[31] in a secondary analysis. These results demonstrate and provide more insight into the way that men and women recognise and experience various facets of the instructed OHB. After controlling for education, socially related aspects, such as ESO and OHK, were important for university graduates.

The current study emphasises the need for considering gender and education variations in intervention planning because these are significant predictors of OHB. This insight is important for practical implementation, particularly to refine preventive approaches to obtain desired OHB. As the present study determines only the psychosocial factors of OHB, experimental research is needed for development and implementation of health education programmes. For instance, the study suggests the psychological factors for behaviour change, but also an appropriate channel, method and way of communication should be independently tailored for men, women and subjects with different levels of education. If women and university graduates focus strongly on social outcomes and knowledge, preventive instructions by a dental practitioner/oral hygienist will play a more distinct role. Furthermore, motivating models, such as active learning through skill training and reinforcement, risk-scenario information through risk feedback, self (re)-evaluation and a behavioural journalism approach of media-delivered modelling or use of role-model stories, would be of great interest. In the same line, for men and those with a low level of education, personalised risk feedback via individual counselling, namely role modelling by a peer, can be used as these individuals are generally more sensitive to the social assessment.[30,31]

The cross-sectional nature and single institute-based findings are a few limitations of the study. The use of a self-report questionnaire might lead to social desirability bias; this was another shortcoming of the study. Hence, the findings should be cautiously gauged before generalising to a larger national population. Lastly, TPB may perform in a different way in a wide range of socio-cultural frameworks. As a consequence, it is advisable to test the appropriateness of the theory in different countries to strengthen the authenticity of the results. In spite of the above-mentioned limitations, the present study has several implications, precisely because an elaborate index corresponding to what dental professionals consider to be relevant OHB was used. This study may further assist all oral health professionals working with wide range of cultural subgroups – in what was referred to as 'the most dignified tasks' (i.e. educating patients in oral health and changing patient's oral hygiene behaviour).[4]

The present study concludes that ESO and OHK were associated and strongly determined OHB. However, men had a positive ATT and more social expectations from OHB, while, for women, more knowledge and higher social outcomes determined OHB. Additionally, in participants with university education, OHK and ESO predicted OHB. Lastly, younger adults and women and participants with university education and with moderate periodontitis considered OHB positively, had more pressure from social milieu and felt self-confident, in ESO and OHK compared with their counterparts. Hence, an adequately framed health education programme will endeavour to improve and adhere to the OHB instructions, primarily by changing the ATT in a positive direction and increasing self-efficacy and knowledge, by providing insight into oral diseases. Furthermore, the insight gained into the determinants of OHB helps in implementing an evidence-based, simple and cost-effective preventive approach in the public health system. Also, in a developing country, such as India, where dental care is expensive and unaffordable by the majority of the population, this study might aid primary health-care professionals in designing individually tailored oral health-intervention programmes based on determinants of OHB for the diverse target population. TPB can direct upcoming research on oral hygiene behaviours in different situations.

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Conflicts of interest

The authors declare no conflict of interest.

REFERENCES

1. Adair P, Ashcroft A. Theory-based approaches to the planning and evaluation of oral health education programmes. In: Pine C, Harris R, editors. *Community Oral Health*, 2nd ed. Surrey: Quintessence; 2007. p. 307–331.
2. Renz A, Ide M, Newton T *et al.* Psychological interventions to improve adherence to oral hygiene instructions in adults with periodontal diseases. *Cochrane Database Syst Rev* 2007 (2): CD005097.
3. Dumitrescu AL, Wagle M, Dogaru BC *et al.* Modeling the theory of planned behaviour for intention to improve oral health behaviours: the impact of attitudes, knowledge and current behaviour. *J Oral Sci* 2011 53: 369–377.
4. Buunk-Werkhoven YA, Dijkstra A, van der Schans CP. Determinants of oral hygiene behaviour: a study based on the theory of planned behaviour. *Community Dent Oral Epidemiol* 2011 39: 250–259.
5. Daly B, Batchelor P, Treasure ET *et al. Essential Dental Public Health*, 2nd ed. Oxford: Oxford University Press; 2013.
6. Wade KJ, Coates DE, Gauld RD *et al.* Oral hygiene behaviours and readiness to change using the TransTheoritical Model (TTM). *N Z Dent J* 2013 109: 64–68.
7. Buunk-Werkhoven YA, Dijkstra A, Bink P *et al.* Determinant and promotion of oral hygiene behaviour in the Caribbean and Nepal. *Int Dent J* 2011 61: 267–273.
8. Buunk-Werkhoven YA, Burrekers SY, Jongboer A *et al.* Determinants and promotion of oral hygiene behaviour in the Dominican Republic. *Int Dent J* 2011 61: 328–333.
9. National Oral Health Survey and Fluoride Mapping. *An Epidemiological Study of Oral Health Problems and Estimation of Fluoride Levels in Drinking Water*, Vol. 32. New Delhi: Dental Council of India; 2004. p. 67–78.
10. Saito A, Kikuchi M, Ueshima F *et al.* Assessment of oral self-care in patients with periodontitis: a pilot study in a dental school clinic in Japan. *BMC Oral Health* 2009 9: 27.
11. Brein DJ, Fleenor TJ Jr, Kim SW *et al.* Using the theory of planned behvaior to identify predictors of oral hygiene: a collection of unique behaviors. *J Periodontol* 2016 87: 312–319.
12. Shaju JP, Zade RM, Das M. Prevalence of periodontitis in the Indian population: a literature review. *J Indian Soc Periodontol* 2011 15: 29–34.
13. Sabounchi SS, Torkzaban P, Sabounchi SS *et al.* Association of oral health behavior-related factors with periodontal health and oral hygiene. *Avicenna J Dent Res* 2016 8: e29827.
14. Newton TJ, Asimakopoulou K. Managing oral hygiene as a risk factor for periodontal disease: a systematic review of psychological approaches to behaviour change for improved plaque control in periodontal management. *J Clin Periodontol* 2015 42 (Suppl 16): S36–S46.
15. Defranc A, Van den Broucke S, Leroy R *et al.* Measuring oral health behaviour in Flemish health care workers: an application of the theory of planned behaviour. *Community Dent Health* 2008 25: 107–114.
16. Ajzen I. *Attitudes, Personality and Behvaior*. Milton Keynes, UK: Open University Press; 1988.
17. Ajzen I. The theory of planned behaviour. *Organ Behav Hum Decis Process* 1991 50: 179–211.
18. Ajzen I, Fishbein M. *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice Hall; 1980.
19. Buunk-Werkhoven YA, Dihkstra A, van der Wal H *et al.* Promoting oral hygiene behavior in recruits in the Dutch Army. *Mil Med* 2009 174: 971–976.
20. Dumitrescu AL, Duta C, Dogaru CB *et al.* Predicting undergraduates' intentions to improve Oral Health Behaviors: the importance of self-identity – a pilot study. *J Dent Hyg* 2013 87: 224–234.
21. Ward AS, Cobb CM, Kelly PJ *et al.* Application of the theory of planned behavior to nurse practitioners' understanding of the periodontal disease-systemic link. *J Periodontol* 2010 81: 1805–1813.
22. Eke PI, Page RC, Wei L *et al.* Update of the case definitions for population-based surveillance of periodontitis. *J Periodontol* 2012 83: 1449–1454.
23. Armitage CJ, Conner M. Efficacy of the Theory of Planned Behaviour: a meta-analytic review. *Br J Soc Psychol* 2001 40: 471–499.
24. Godin G, Kok G. The theory of planned behavior a review of its applications to health-related behaviors. *Am J Health Promot* 1996 11: 87–98.
25. Williams SL, French DP. Theory of Planned Behaviour variables and objective walking behaviors do not show seasonal variation in a randomised controlled trial. *BMC Public Health* 2014 14: 120.
26. Jonsson B, Baker SR, Lindberg P *et al.* Factors influencing oral hygiene behaviour and gingival outcomes 3 and 12 months after initial periodontal treatment: an exploratory test of an extended Theory of Reasoned Action. *J Clin Periodontol* 2012 39: 138–144.
27. Jonsson B, Ohrn K, Oscarson N *et al.* An individually tailored treatment programme for improved oral hygiene: introduction of a new course of action in health education for patients with periodontitis. *Int J Dent Hyg* 2009 7: 166–175.
28. Deinzer R, Micheelis W, Grenarth N *et al.* More to learn about periodontitis related knowledge and its relationship with periodontal health behaviour. *J Clin Periodontol* 2009 36: 756–764.
29. Masalu JR, Astrom AN. Predicting intended and self-perceived sugar restriction among Tanzanian students using theory of planned behavior. *J Health Psychol* 2001 6: 435–445.
30. Kok G, Schaalma H, Ruiter RA *et al.* Intervention mapping: a protocol for applying health psychology theory to prevention programmes. *J Health Psychol* 2004 9: 85–98.
31. Buunk-Werkhoven YA, Dijkstra A. Gender variations in determinants of oral hygiene behavior: a secondary analysis based on the theory of planned behavior. In: Rush VL, editor. *Planned Behavior: Theory, Applications and Perspectives*. Hauppauge, NY: Nova Science Publisher, Inc.; 2014. p. 37–54.

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