FACTORS INFLUENCING PREVENTIVE ORAL CARE BEHAVIORS: APPLYING THE THEORY OF PLANNED BEHAVIOR AND HEALTH BELIEF MODEL

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ABSTRACT

Background: Preventive oral care is crucial for reducing the risk of oral diseases and promoting overall health. However, in Turkey, preventive care services have not yet reached the desired level and studies on the impact of health beliefs, trust, and dental anxiety on preventive dental attendance intentions and behaviors remains limited. **Aim:** This study examined the factors influencing individuals' behaviors in seeking preventive care, using a model that integrated the Theory of Planned Behavior (TPB), Health Belief Model (HBM), anxiety, and trust. **Method:** The study employed a cross-sectional design, and data were collected through a survey from 523 participants in Ankara. Data were analyzed using partial least squares structural equation modeling, including reliability and validity assessment, bootstrapping for hypothesis testing, mediation analysis, and predictive assessment. **Results:** The findings showed that HBM constructs (except barriers), TPB constructs (except perceived behavioral control [PBC]), and anxiety predicted intention, while PBC, trust, and anxiety predicted behavior. Trust is negatively associated with anxiety and HBM barriers, while being positively associated with all other HBM and TPB constructs, including dental attendance, but shows no significant association with intention. Accordingly, anxiety and all TPB and HBM constructs (except PBC and barriers) fully mediated the relationship between trust and intention, whereas anxiety and PBC partially mediated the relationship between trust and behavior. **Conclusion:** This research provides valuable insights for oral healthcare providers to design targeted prevention and education initiatives, addressing various challenges like dental anxiety and trust that may hinder seeking preventive care.

Keywords: Preventive oral care, Dental attendance, Dental anxiety, Planned behavior theory, Health belief model, Trust

KORUYUCU AĞIZ SAĞLIĞI DAVRANIŞLARINI ETKİLEYEN FAKTÖRLER: PLANLANMIŞ DAVRANIŞ TEORİSİ VE SAĞLIK İNANÇ MODELİ UYGULAMASI

ÖZ

Giriş: Koruyucu ağız sağlığı bakımı, ağız hastalıkları riskinin azaltılmasında ve genel sağlığın desteklenmesinde önemli bir rol oynamaktadır. Ancak Türkiye'de koruyucu diş hekimliği hizmetleri henüz istenilen düzeyde değildir ve sağlık inançları, güven ve diş hekimi kaygısının koruyucu davranışlar üzerindeki birlikte etkilerine dair çalışmalar sınırlıdır. **Amaç:** Bu çalışma, Planlı Davranış Teorisi (PDT), Sağlık İnanç Modeli (SİM), kaygı ve güven değişkenlerini bütüncül bir çerçevede birleştirerek bireylerin koruyucu bakım davranışlarını etkileyen faktörleri incelemektedir. **Yöntem:** Araştırmada kesitsel bir yöntem kullanılmış ve Ankara'da 523 katılımcıdan anket yoluyla veri toplanmıştır. Veriler, güvenilirlik ve geçerlilik değerlendirmeleri, hipotez testi için önyükleme, aracılık analizi ve tahmin değerlendirmesini içeren kısmi en küçük kareler yapısal eşitlik modellemesi kullanılarak analiz edilmiştir. **Bulgular:** Bulgular, algılanan engeller dışında tüm SİM bileşenlerinin, algılanan davranışsal kontrol (ADK) hariç tüm PDT bileşenlerinin ve kaygının koruyucu bakım niyetini anlamlı şekilde etkilediğini göstermektedir. Koruyucu davranış ise ADK, güven ve kaygı değişkenlerinden anlamlı biçimde etkilendiği belirlenmiştir. Güven, kaygı ve algılanan engellerle negatif; koruyucu diş hekimi ziyareti dâhil olmak üzere PDT ve SİM'e ait diğer tüm bileşenlerle ise pozitif yönde ilişkili olduğu görülmüştür. Bununla birlikte güven, koruyucu bakım niyetiyle doğrudan anlamlı bir ilişki göstermemektedir. Aracılık analizleri, kaygı ile birlikte PDT ve SİM bileşenlerinin (ADK ve engeller hariç) güven ile niyet arasındaki ilişkiyi tam aracılık yoluyla açıkladığını göstermektedir. Ayrıca, kaygı ve ADK güven ile davranış arasındaki ilişkide kısmi aracılık rolü üstlendiği belirlenmiştir**. Sonuç:** Bu araştırma, koruyucu ağız sağlığı hizmeti sunucularına, bireylerin koruyucu bakım arayışını engelleyebilecek diş kaygısı ve güven gibi çeşitli zorlukları ele alarak hedefe yönelik koruyucu ve eğitici girişimler tasarlamaları için değerli bilgiler sunmaktadır.

Anahtar Kelimeler: Koruyucu ağız sağlığı bakımı, Diş hekimine başvuru davranışı, Diş hekimi kaygısı, Planlı davranış teorisi, Sağlık inanç modeli, Güven

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INTRODUCTION

Preventive oral care involves all measures aimed at avoiding oral diseases and maintaining optimal oral health (1). Common oral issues such as tooth decay (2, 3), periodontal diseases (4), and oral cancers (5) can be effectively managed through preventive measures, leading to improved prognosis and reduced treatment costs. Preventive dental care includes self-care practices like twice-daily brushing, flossing, and using mouthwash, which help remove plaque, bacteria, and food particles, reducing the risk of dental caries, periodontal disease, and halitosis (2, 3). It also encompasses professional care through regular dental check-ups, where oral healthcare professionals detect and address oral diseases early, preserving healthy teeth and gums and minimizing the likelihood of tooth loss and extensive treatments (1, 2). Preventive care not only reduces the likelihood of systemic health conditions such as cardiovascular and liver diseases, cancers, diabetes, and respiratory infections, but it lowers the risk of pregnancy complications and the initiation and progression of Alzheimer's disease (4, 5).

Previous research has shown that preventive oral care services in Turkey are insufficient and require significant improvements to better protect and promote oral health (6, 7). According to the latest WHO data, oral cancer deaths in Turkey reached 1,330, constituting 0.33% of total deaths and the age-adjusted death rate is 1.48 per 100,000 of the population, ranking Turkey #163 globally in 2023. The report also states that oral cancer is the 16th most common cause of death-related cancer in Turkey (8). The prognosis for oral cancer treatment is closely linked to early detection and intervention (5). Moreover, without prevention or early intervention, periodontitis or periodontal diseases can progressively cause severe deterioration of the alveolar bone and oral tissues, ultimately leading to tooth loss and contributing to several systemic diseases (4). A recent study of 11,091 participants revealed a high prevalence of dental caries (76.5%) among Turkish children and adults, with low dental visit frequency being a contributing factor. This study also found lower caries prevalence in urban areas, emphasizing the need to enhance preventive oral health programs, maintain disease surveillance, and develop national oral health targets tailored to Turkey's needs, resources, and structure (7). For instance, in restorative dentistry, preventive care promotes the early identification and treatment of dental caries before it reaches the dentin, which would otherwise necessitate more invasive and costly procedures involving the pulp (3). Thus, early detection and regular oral surveillance through preventive care are crucial for effective treatment and improved survival rates (2, 4, 5).

Though previous research (9-11) has examined dental attendance, preventive attendance has been largely overlooked, limiting understanding of these behaviors despite their public health importance, especially in Turkey. This has led to a limited understanding of preventive care behaviors and a notable gap in the literature. This study aims to address these gaps by examining oral health behaviors and beliefs about preventive care in Turkey, focusing on the roles of trust and dental anxiety in influencing regular preventive dental attendance. To achieve this, it integrates the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB), combining

their strengths to overcome their individual limitations. Although prior research supports HBM–TPB integration (12), this combined framework has not yet been tested in the context of oral healthcare, nor widely discussed among dental patients. By incorporating trust and dental anxiety into this integrated model, the study proposes a more comprehensive framework (Figure 1) and applies it in a novel context that, to the best of our knowledge, has not been previously explored. This research contributes theoretically by advancing the combined use of HBM and TPB with additional psychological constructs. It also offers practical insights to help healthcare providers and policymakers design targeted interventions that promote preventive behaviors and improve community oral health.

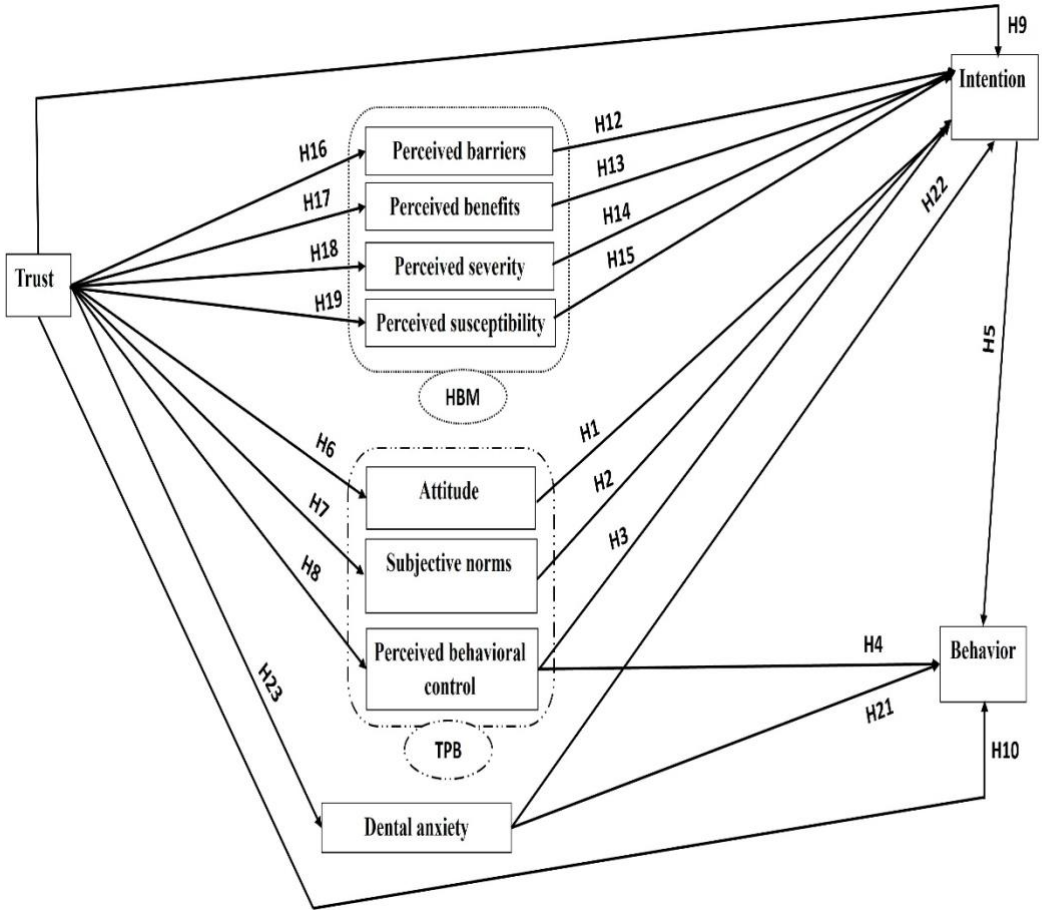

Figure 1. The research framework

Theoretical background and hypotheses

TPB

Introduced as the Theory of Reasoned Action and later extended to TPB with the addition of perceived behavioral control (PBC), the TPB provides a comprehensive framework for understanding the cognitive factors influencing individuals' behaviors (13). Unlike HBM, which primarily focuses on individuals' health beliefs, the TPB incorporates three key constructs—attitude, subjective norms, and PBC that influence both intention and behavior. Attitude represents a person's favorable or unfavorable evaluation of a behavior,

subjective norms reflect the social pressures perceived from others, and PBC indicates the degree to which individuals feel capable of performing the behavior (13).

According to the TPB, positive attitudes toward the benefits of dental visits, social norms supporting dental care, and perceptions of control over dental attendance are likely to increase individuals' intentions to seek preventive care. Empirical evidence also supports that attitude, subjective norms and PBC influence intention (12, 14, 15), and that PBC and intention influence behavior (16, 17). Thus, it is argued that:

H1: Attitude positively associates with intention.

H2: Subjective norms positively associate with intention.

H3: PBC positively associates with intention.

H4: PBC positively associates with attendance.

H5: Intention positively associates with attendance.

TPB and trust

Trust in healthcare is defined as the belief in a provider's competence, benevolence, and integrity (18). Positive patient-dentist interactions, clear communication, and the dentist's ability to create a comfortable and safe environment significantly contribute to trust, which enhances patient engagement with preventive care (19). Trust reduces pain and anxiety perceptions, improves patient satisfaction, and leads to better treatment outcomes (11, 20).

Servidio et al. (14) explored the role of trust in health authorities concerning preventive behaviors like COVID-19 vaccination, and revealed that trust significantly influenced all of TPB constructs. In addition, these relationships align with findings from other fields, where individuals with higher trust are more likely to adhere to subjective norms, develop positive attitudes, and perceive greater control over their behaviors, leading to stronger intentions and subsequent actions (16, 17). Therefore, it is assumed that:

H6: Trust positively associates with attitude.

H7: Trust positively associates with subjective norms.

H8: Trust positively associates with PBC.

A lack of trust, often stemming from negative past experiences, or communication issues, significantly predicts avoidance of dental visits (10, 11). Individuals with low trust in dentists are far more likely to avoid visits compared to those with high trust (19). Patients who trust their dentists are also more likely to follow their professional advice, schedule regular check-ups, and undergo recommended treatments (20). In contrast, individuals with dental distrust are less likely to have visited a dentist within the past year and are more likely to report their oral health as fair or poor (21). Evidence from other domains also shows that trust predicts intention, as demonstrated by Liu et al. (22) and Alzahrani (23), who examined acceptance of fully automated driving and COVID-19 vaccination intention, respectively. Thus, it is proposed that:

H9: Trust positively associates with intention.

H10: Trust positively associates with attendance.

TPB mediating role

The relationship between trust and preventive behaviors, particularly in the context of COVID-19 vaccinations, has been explored by Servidio et al. (14). Their research highlighted trust in health authorities as a foundational element influencing subjective norms, attitudes, and

PBC toward the vaccine, which fully mediated the relationship between trust and vaccination uptake. Research on the adoption of new technologies has similarly supported the indirect effect of trust on intention, mediated through TPB constructs (17). Hence, it is concluded that:

H11a: Attitude mediates the relationship between trust and intention.

H11b: Subjective norms mediate the relationship between trust and intention.

H11c: PBC mediates the relationship between trust and intention.

H11d: PBC mediates the relationship between trust and attendance.

HBM

HBM, developed by Hochbaum in 1952 and further refined by a group of social psychologists in the 1950s, is a psychological framework that aims to explain why individuals engage or fail to engage in preventive health behaviors. Initially applied to public health initiatives, such as disease screenings, the HBM emphasizes the role of individual perceptions in shaping health behaviors (24). According to this model, people's decisions to adopt preventive health measures are influenced by four key constructs: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers.

In the context of dental health, HBM suggests that individuals who understand the benefits of regular dental attendance, such as the early detection of oral diseases or cancer, are more likely to intend to attend dental appointments. In contrast, individuals who perceive significant barriers, such as high costs or long waiting times, may be discouraged from seeking care (6, 24). In Turkey, factors like a shortage of dentists, insufficient public awareness, and high out-of-pocket costs have a considerable impact on individuals' decisions regarding preventive oral health practices (1, 6). Furthermore, perceived threat or risk—comprising susceptibility and severity—serves as a significant deterrent by influencing motivation to engage in regular dental visits aimed at mitigating the risk of oral diseases. Thus, susceptibility describes the extent to which an individual believes they are at risk of developing an oral disease, while severity refers to their perception of how serious the resulting consequences could be (24).

Empirical research supports the applicability of HBM, particularly in disease prevention and health promotion, where its constructs have been shown to significantly predict intentions (12, 23, 25, 26). Previous research demonstrates that perceived benefits, such as the protection offered by vaccines, are strongly linked to intentions, with individuals more likely to engage when they perceive clear benefits (27). Barriers, severity and susceptibility have also been identified as significant predictors of intention in various contexts, such as vaccination uptake, the adoption of new technologies, and adherence to preventive measures during health crises (15, 22, 25). Thus, the following hypotheses are proposed:

H12: Barriers negatively associates with intention.

H13: Benefits positively associates with intention.

H14: Severity positively associates with intention.

H15: Susceptibility positively associates with intention.

HBM and trust

Alzahrani (23) underscored the critical role of trust in shaping health-related behaviors and beliefs, noting that trust is associated with higher perceived benefits and lower

perceived barriers, which predict greater vaccine uptake. In the context of willingness to vaccinate against COVID-19, Suess et al. (27) found that trust positively impacts perceived susceptibility; Goren et al. (25) also demonstrated that trust enhance perceived benefits and reduce barriers, while Liu et al. (22) emphasized how trust improves individuals' perception of benefits and alleviates concerns about risks. Therefore, it is assumed that:

H16: Trust negatively associates with barriers.

H17: Trust positively associates with benefits.

H18: Trust positively associates with severity.

H19: Trust positively associates with susceptibility.

HBM mediating role

Trust indirectly contributes to the willingness to take preventive measures, such as vaccination, by shaping HBM constructs (27). Alzahrani (23) highlighted that trust directly influences vaccination intention, with this relationship mediated by perceived benefits, barriers, and risks, as trust is linked to higher perceived benefits and risk, lower perceived barriers, and greater vaccine uptake. Goren et al. (25) revealed that trust indirectly influences preventive compliance intentions by affecting the perceived benefits and barriers associated with health behaviors. Research in other fields also supports this mediating effect, showing that trust enhances perceived benefits while reducing concerns about risks (22). Thus, it is argued that:

H20a: Barriers mediates the relationship between trust and intention.

H20b: Benefits mediates the relationship between trust and intention.

H20c: Severity mediates the relationship between trust and intention.

H_{20d}: Susceptibility mediates the relationship between trust and intention.

Dental anxiety

Dental anxiety, defined as fear or discomfort during dental procedures, consistently hinders rational decision-making regarding oral health (28). Factors contributing to anxiety include negative interactions with dental professionals, feelings of helplessness, and anticipation of pain, often leading individuals to delay or avoid dental visits entirely. Additional contributors, such as the sight and feel of dental instruments, evoke heightened anxiety levels and are significant predictors of fear during dental procedures (29). This anxiety manifests before, during, or after treatments, triggering physiological responses such as increased heart rate, blood pressure, and respiratory rate (28).

Dental anxiety is a strong predictor of dental avoidance, as individuals with higher anxiety levels are more likely to avoid visiting the dentist, even when treatment is needed. This is due to anticipatory fear of pain, discomfort, or invasive procedures, perpetuating a cycle of neglect and worsening oral health (19). Adults with high dental anxiety reported poorer oral, mental, and overall health and had longer intervals since their last dental visit (21). Higher levels of anxiety are associated with less favorable dental service utilization, with irregular and non-attenders most frequently reporting high anxiety (10, 11). In Turkey, dental anxiety correlates with lower dental attendance rates, an increased number of missing teeth, a higher frequency of postponed appointments, and significantly poorer self-care habits (30). Individuals with anxiety are more likely to suffer from higher rates of oral diseases and exhibit irregular dental visits, ultimately leading to a poorer oral health-related

quality of life (29). Hence, it is assumed that:

H21: Anxiety negatively associates with intention.

H22: Anxiety negatively associates with attendance.

The patient–dentist interaction should be characterized by empathy, warmth, and respect, as these qualities foster trust, a sense of security, and mutual participation—elements essential for managing dental fear and achieving successful treatment outcomes (31). Patients with high dental fear are cognitively vulnerable, more sensitive to communication, and prone to misunderstandings, and catastrophic thoughts, which hinder their ability to cope with dental care (29, 31). Distrust in the dentist-patient relationship amplifies misunderstandings and fear, while trust-filled, empathic interactions improve a fearful patient's ability to cope with treatment and reduce avoidance behavior (31). Individuals with lower trust in their dentist are more likely to report negative treatment experiences, including discomfort, embarrassment, personal issues with the practitioner or anxiety (20). Dental anxiety is strongly linked to low levels of trust in dentists, often stemming from negative experiences like discomfort during treatment, embarrassment, or poor communication (11). Leading to the following hypothesis:

H23: Trust negatively associates with anxiety.

Dental anxiety mediating role

Individuals with low trust in their dentist are more likely to experience heightened anxiety, manifesting as fear, discomfort, and physiological responses that ultimately deter them from seeking timely care (28, 31). Negative interactions with dental professionals, feelings of helplessness, and anticipatory fear further aggravate dental anxiety, leading to avoidance behaviors and irregular dental visits (19, 29). Trust-filled and empathetic patient-dentist interactions have been shown to alleviate anxiety by fostering security and mutual participation in care, thereby reducing avoidance and improving attendance (11, 31). Based on this empirical evidence and logical argumentation, it is proposed that:

H24a: Anxiety mediates the relationship between trust and intention.

H24b: Anxiety mediates the relationship between trust and attendance.

METHOD

Research design and procedure

The study employs a quantitative, cross-sectional survey design using a self-administered questionnaire and a convenience sampling. The target population consists of individuals aged 18-64, as they are typically responsible for their own dental health. This will help understanding of preventive care behaviors within the working-age population, as recommended by previous reports (1, 5). According to the Turkish Statistical Institute, Ankara has a total population of 5,864,049 residents (32). Using this estimated number, a sample size calculation was conducted with a 5% margin of error and a 95% confidence level, resulting in a recommended sample size of approximately 384 adults. To mitigate potential complications, 523 responses were collected and used for the analysis (33).

Data collection was conducted through various social media platforms using Google Forms after obtaining approval from the Ethics Board of Atılım University (Approval No.: E-59394181-604.01-96735). The gathered data were analyzed using IBM SPSS Statistics version 20 and

SmartPLS 4 (34). Partial Least Squares Structural Equation Modeling (PLS-SEM) was chosen because it is widely used in social sciences and is a causal-predictive modeling approach that explains underlying causes and predicts future behavior (35). Additionally, PLS-SEM is well-suited for managing complex relationships involving multiple items, mediators, and latent variables, as in this research model (36).

Common method bias (CMB) is a major concern in cross-sectional research because data for both independent and dependent variables are collected using the same method, as in this study. This bias can inflate observed relationships. Therefore, a full collinearity test was performed, and all variance inflation factor (VIF) values were below 3.3 (37). These results indicate that CMB is not a significant concern in this study.

Measures

To test the research hypotheses, a Google Form questionnaire with five parts was developed. The first part focused on the demographic data of the participants. The second part included HBM measures adapted following the original scale guidelines established by (38). Susceptibility (4 items), benefits (3 items), and seriousness (3 items) were adapted from Tsunematsu et al. (26), while barriers were assessed with five items adapted from Chen et al. (39).

The third part covered the TPB constructs, with items adapted from Åstrøm et al. (9) and measured following Ajzen's (13) guidelines. Behavior was assessed with one question on the frequency of dental visits, offering four response options ranging from "twice a year or more" to "less often than every two years." Intention was measured with two items, attitude with four items, subjective norms with three items, and PBC with two items.

The fourth part included the Trust in Dentist scale, adopted from Armfield et al. (20), which consists of 11 items originally derived from a trust scale developed for the medical profession by Hall et al. (18). All items for the HBM, TPB, and Trust in Dentist measures were rated on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree). These measures were translated into Turkish using a forward-backward method (40). The translated measures were reviewed by three experts and pilot-tested with 10 postgraduate students to ensure face and content validity. No further modifications were required.

The fifth part assessed dental anxiety using five items adopted from the Modified Dental Anxiety Scale, originally developed by Humphris et al. (41). These items were rated on a 5-point Likert scale, ranging from "not anxious" to "extremely anxious." The scale was previously validated in the Turkish context by Ilgüy et al. (42) and Tunc et al. (43).

Respondents' profile

Table 1 shows that most participants were female (66.0%), while the age distribution showed a concentration in younger age groups, with 30.6% aged 18-24 and 32.5% aged 25-34. Regarding marital status, 74.0% were single, and nearly half of the participants (49.5%) had an undergraduate degree. The majority reported incomes between $700–$1,430 (41.1%) or $1,430–$2,060 (36.9%). Most participants did not smoke or use tobacco products (73.2%), and a significant portion had not visited a dentist for more than two years (28.5%). The primary reasons for last dental visits were treatment for pain or discomfort (45.7%), while oral hygiene habits varied, with 46.1% practicing good hygiene often.

63.3% of respondents reported having no previous traumatic dental experience, and 49.5% admitted to delaying dental visits.

Table 1. Respondents' demographics

Demographics	Category	Frequency n=523)	%
Gender	Male	178	34.0
	Female	345	66.0
Age	18-24	160	30.6
	25-34	170	32.5
	35-44	147	28.1
	45-65	46	8.8
Marital status	Married	136	26.0
	Single	387	74.0
Education level	High school or below	105	20.1
	Undergraduate	259	49.5
	Master's	80	15.3
	Doctorate	79	15.1
Income ($)	Low (Below 700)	104	19.9
	Lower-middle (700–1,430)	215	41.1
	Upper-middle (1,430–2,060)	193	36.9
	High (Above $2,060)	11	2.1
Smoke\Tobacco products use	Yes	140	26.8
	No	383	73.2
Last visit to dentist	<6 months ago	115	22.0
	6-12 months ago	124	23.7
	1-2 years ago	135	25.8
	>2 years ago	149	28.5
Reason for last visit	Check-up	135	25.8
	Pain or discomfort	239	45.7
	Others (e.g., Cosmetic procedures and follow-ups)	149	28.5
Frequency of good oral hygiene	Rarely	11	2.1
	Occasionally	11	2.1
	Sometimes	104	19.9
	Often	241	46.1
	Always	156	29.8
Previous traumatic/painful experience	Yes	192	36.7
	No	331	63.3
Currently delaying going to the dentist	Yes	259	49.5
	No	264	50.5

RESULTS

Assessment of measurement model

Table 2 presents the loadings, composite reliability (CR), Cronbach's alpha (CA), and average variance extracted (AVE) used to assess the reflective measurement model, evaluating all 11 constructs for internal consistency, reliability, and validity. The loadings exceeded the threshold of 0.70 for all items except 3 items. However, loadings for these were not lower than 0.4 and all other reliability and validity indicators were above the threshold, therefore, they were retained (33). The reliability of all constructs was assessed using CA, with most values exceeding the recommended threshold of 0.70. Although the CA for intention was slightly below 0.70, its CR exceeded this threshold, indicating adequate reliability (35). Convergent validity was established with AVE values greater than 0.50 for all constructs (33).

Table 2. Measurement model assessment

Constructs	Items	Loadings	CA	CR	AVE
Barriers	HBM_BAR_1	0.815	0.863	0.901	0.645
	HBM_BAR_2	0.790			
	HBM_BAR_3	0.817			
	HBM_BAR_4	0.798			
	HBM_BAR_5	0.795			
Benefits	HBM_BEN_1	0.846	0.778	0.871	0.692
	HBM_BEN_2	0.806			
	HBM_BEN_3	0.843			
Severity	HBM_SEV_1	0.757	0.752	0.837	0.562
	HBM_SEV_2	0.699			
	HBM_SEV_3	0.762			
	HBM_SEV_4	0.779			
Susceptibility	HBM_SUS_1	0.715	0.754	0.857	0.668
	HBM_SUS_2	0.852			
	HBM_SUS_3	0.875			
Attitude	TPB_ATT_1	0.730	0.723	0.827	0.544
	TPB_ATT_2	0.729			
	TPB_ATT_3	0.768			
	TPB_ATT_4	0.721			
Subjective norms	TPB_SN_1	0.814	0.730	0.847	0.649
	TPB_SN_2	0.825			
	TPB_SN_3	0.777			
PBC	TPB_PBC_1	0.896	0.742	0.886	0.795
	TPB_PBC_2	0.887			
Intention	TPB_INT_1	0.852	0.680	0.862	0.757
	TPB_INT_2	0.888			
Trust	TR_1	0.742	0.909	0.923	0.522
	TR_2	0.738			
	TR_3	0.748			
	TR_4	0.742			
	TR_5	0.732			
	TR_6	0.739			
	TR_7	0.710			

	TR_8	0.712			
	TR_9	0.684			
	TR_10	0.700			
	TR_11	0.702			
Anxiety	DA_1	0.831	0.868	0.905	0.655
	DA_2	0.805			
	DA_3	0.817			
	DA_4	0.790			
	DA_5	0.803			

As shown in Table 3, discriminant validity was confirmed using the Heterotrait–Monotrait ratio (HTMT). All values were below 0.85 (44), indicating that the model meets the required standards for reliability and validity and is suitable for further analysis.

Table 3. HTMT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Anxiety										
(2) Barriers	0.230									
(3) Benefits	0.518	0.455								
(4) Severity	0.349	0.267	0.657							
(5) Susceptibility	0.239	0.243	0.476	0.391						
(6) Attitude	0.504	0.369	0.844	0.563	0.566					
(7) Intention	0.495	0.365	0.823	0.647	0.520	0.847				
(8) PBC	0.451	0.289	0.716	0.521	0.389	0.687	0.545			
(9) Subjective_norms	0.547	0.327	0.825	0.576	0.450	0.837	0.752	0.782		
(10) Trust	0.379	0.263	0.655	0.437	0.316	0.616	0.536	0.455	0.597	

Assessment of the structural model

After excluding collinearity issues by assessing VIF, PLS bootstrapping (5,000 subsamples) was conducted to compute path coefficients (β), effect sizes (f^2) and their corresponding t-values (Table 4) (33). For the TPB model, H1, H2, H4, and H5 were supported. Attitude had a positive effect on intention (β = 0.293, 95% CI [0.214, 0.371], p<0.001, f^2 = 0.079), and subjective norms also had a positive effect on intention (β = 0.123, 95% CI [0.041, 0.207], p = 0.007, f^2 = 0.014). PBC did not have a significant effect on intention (β = -0.068, 95% CI [-0.136, 0.000], p = 0.050, f^2 = 0.005); therefore, H3 was not supported. PBC had a positive effect on behavior (β = 0.278, 95% CI [0.216, 0.338], p<0.001, f^2 = 0.123), and intention had a positive effect on behavior (β = 0.370, 95% CI [0.307, 0.432], p < 0.001, f^2 = 0.207).

For the effect of trust on TPB variables, H6, H7, H8, and H10 were supported, whereas H9 was not supported. Trust positively affected attitude (β = 0.505, 95% CI [0.453, 0.560], p < 0.001, f^2 = 0.342), subjective norms (β = 0.489, 95% CI [0.436, 0.546], p < 0.001, f^2 = 0.314), and PBC (β = 0.374, 95% CI [0.313, 0.437], p < 0.001, f^2 = 0.163). Trust also had a positive effect on behavior (β = 0.160, 95% CI [0.101, 0.220], p<0.001, f^2 = 0.040). However, the direct effect of trust on intention was not

significant (β = 0.002, 95% CI [-0.073, 0.077], p = 0.479, f^2 = 0.000).

For the HBM variables, H13, H14, and H15 were supported, while H12 was not supported. Barriers did not have a significant effect on intention (β = -0.033, 95% CI [-0.092, 0.022], p = 0.167, f^2 = 0.002). In contrast, benefits had a positive effect on intention (β = 0.209, 95% CI [0.124, 0.293], p<0.001, f^2 = 0.035), severity had a positive effect on intention (β = 0.166, 95% CI [0.107, 0.228], p < 0.001, f^2 = 0.037), and susceptibility had a positive effect on intention (β = 0.082, 95% CI [0.024, 0.140], p = 0.010, f^2 = 0.011).

For the effect of trust on HBM variables, H16, H17, H18, and H19 were all supported. Trust had a negative effect on barriers (β=-0.236, 95% CI [-0.307, -0.171], p < 0.001, f^2=0.059), and positive effects on benefits (β=0.556, 95% CI [0.503, 0.609], p <0.001, f^2=0.447), severity (β = 0.392, 95% CI [0.336, 0.454], p < 0.001, f^2 = 0.182), and susceptibility (β = 0.271, 95% CI [0.208, 0.340], p < 0.001, f^2 = 0.079).

For anxiety, H21, 22, and H23 were supported. Anxiety had a negative effect on intention (β =-0.075, 95% CI [-0.135, -0.014], p = 0.021, f^2 = 0.008) and behavior (β = -0.159, 95% CI [-0.220, -0.100], p < 0.001, f^2 = 0.041). Trust also had a negative effect on anxiety (β = -0.338, 95% CI [-0.404, -0.275], p < 0.001, f^2 = 0.129).

The explanatory power of the model was assessed through R^2 values, with all exceeding the 0.10 threshold, demonstrating a reasonable level of explanatory power for the model relationships (35). Behavior shows the highest explained variance, indicating that the model constructs account for 52% of the variance in this variable, followed by intention (50%).

Table 4. Structural model direct relationships

No	Relationships	VIF	β	p	t	CI	F^2		R^2	Decision
H1	Attitude->Intention	2.159	0.293	0.000	6.164	(0.214, 0.371)	0.079	>Intention	0.498	S
H2	Subjective_norms->Intention	2.160	0.123	0.007	2.445	(0.041, 0.207)	0.014			S
H3	PBC->Intention	1.317	-0.068	0.050	1.647	(-0.136, 0.000)	0.005			NS
H4	PBC->Behavior	1.687	0.278	0.000	7.454	(0.216, 0.338)	0.123	>Behavior	0.523	S
H5	Intention->Behavior	1.388	0.370	0.000	9.777	(0.307, 0.432)	0.207			S
H6	Trust->Attitude	1.000	0.505	0.000	15.503	(0.453, 0.560)	0.342	>Attitude	0.255	S
H7	Trust->subjective_norms	1.000	0.489	0.000	14.648	(0.436, 0.546)	0.314	>subjective_norms	0.239	S
H8	Trust->PBC	1.000	0.374	0.000	9.988	(0.313, 0.437)	0.163	>PBC	0.140	S
H9	Trust->Intention	1.583	0.002	0.479	0.053	(-0.073, 0.077)	0.000			NS
H10	Trust->Behavior	1.332	0.160	0.000	4.407	(0.101, 0.220)	0.040			S
H12	Barriers->Intention	1.173	-0.033	0.167	0.966	(-0.092, 0.022)	0.002			NS
H13	Benefits-> Intention	2.509	0.209	0.000	4.052	(0.124, 0.293)	0.035			S
H14	Severity->Intention	1.486	0.166	0.000	4.522	(0.107, 0.228)	0.037			S
H15	Susceptibility->Intention	1.272	0.082	0.010	2.321	(0.024, 0.140)	0.011			S

H16	Trust->Barriers	1.000	-0.236	0.000	5.723	(-0.307, -0.171)	0.059	>Barriers	0.056	S
H17	Trust->Benefits	1.000	0.556	0.000	17.045	(0.503, 0.609)	0.447	>Benefits	0.309	S
H18	Trust->Severity	1.000	0.392	0.000	11.001	(0.336, 0.454)	0.182	>Severity	0.154	S
H19	Trust->Susceptibility	1.000	0.271	0.000	6.712	(0.208, 0.340)	0.079	>Susceptibility	0.074	S
H21	Anxiety->Intention	1.282	-0.075	0.021	2.036	(-0.135, -0.014)	0.008			S
H22	Anxiety->Behavior	1.330	-0.159	0.000	4.359	(-0.220, -0.100)	0.041			S
H23	Trust->Anxiety	1.000	-0.338	0.000	8.660	(-0.404, -0.275)	0.129	>Anxiety	0.114	S

S=Supported, NS=Not supported

Predictive model assessment was conducted examining CVPAT results. Behavior and intention were determined to be key variables. The loss of PLS was lower than loss of indicator average for behavior (difference: -0.276 $p<0.05$), intention (difference: -0.226 $p<0.05$) and overall model (difference: -0.164 $p<0.05$), displaying that predictive validity of the model was fulfilled at the basic level. While PLS loss values of intention (difference: -0.037$p<0.05$) and overall model

(difference: -0.0.033 $p<0.05$) were significantly lower than linear model loss, the difference was not significant for behavior (difference: -0.015 $p>0.05$). Except for behavior, the model showed a strong predictive validity (45).

Assessment of the mediation effects

Preacher and Hayes's (2004) method was applied to evaluate the mediating effect, utilizing a bootstrapping procedure with 5,000 samples to assess β, p-values, t-values, and confidence interval (CI), as shown in Table 5 (33).

For TPB-related mediation, attitude significantly mediated the relationship between trust and intention (β = 0.148, 95% CI [0.107, 0.191], $p < 0.001$), supporting H11a. Subjective norms also significantly mediated this relationship (β = 0.060, 95% CI [0.020, 0.102], p = 0.008), supporting H11b. However, PBC did not mediate the relationship between trust and intention (β = -0.025, 95% CI [-0.052, 0.000], p = 0.055), so H11c was not supported. In contrast, PBC significantly mediated the relationship between trust and behavior (β = 0.104, 95% CI [0.077, 0.134], $p < 0.001$), supporting H11d.

For HBM-related mediation, barriers did not mediate the relationship between trust and intention (β = 0.008, 95% CI [-0.005, 0.022], p = 0.176), so H20a was not supported. Benefits significantly mediated this relationship (β = 0.116, 95% CI [0.069, 0.165], $p < 0.001$), supporting H20b. Severity also showed a significant mediating effect (β = 0.065, 95% CI [0.041, 0.094], $p < 0.001$), supporting H20c, and susceptibility significantly mediated the relationship between trust and intention (β = 0.022, 95% CI [0.006, 0.040], p = 0.017), supporting H20d. Dental anxiety significantly mediated the relationship between trust and intention (β = 0.025, 95% CI [0.005, 0.047], p = 0.025), supporting H24a, and also the relationship between trust and behavior (β = 0.054, 95% CI [0.032, 0.079], $p < 0.001$), supporting H24b.

Since H9 is unsupported, (H11a, H11b, H20b, H20c, H20d, and H24a) are

considered full mediations, while H11d and H24b are considered partial mediations as H_{10} is supported.

Table 5. Mediation effects

No	Relationships	B	p	t	95%CI	Decision
H11a	Trust->Attitude->Intention	0.148	0.000	5.848	(0.107-0.191)	FM
H11b	Trust->subjective_norms->Intention	0.060	0.008	2.415	(0.020-0.102)	FM
H11c	Trust->PBC->Intention	-0.025	0.055	1.597	(-0.052-0.000)	NM
H11d	Trust->PBC->Behavior	0.104	0.000	6.027	(0.077-0.134)	PM
H20a	Trust->Barriers->Intention	0.008	0.176	0.932	(-0.005-0.022)	NM
H20b	Trust->Benefits->Intention	0.116	0.000	3.991	(0.069-0.165)	FM
H20c	Trust->Severity->Intention	0.065	0.000	4.039	(0.041-0.094)	FM
H20d	Trust->Susceptibility->Intention	0.022	0.017	2.123	(0.006-0.040)	FM
H24a	Trust->Anxiety->Intention	0.025	0.025	1.968	(0.005-0.047)	FM
H24b	Trust->Anxiety->Behavior	0.054	0.000	3.759	(0.032-0.079)	PM

FM=Full mediation, NM=No mediation, PM=Partial mediation

DISCUSSION

This research aimed to predict the psychological and behavioral determinants of regular professional preventive care by developing a framework that integrates the HBM and TPB, while also incorporating dental anxiety and trust.

The analysis confirmed that attitude and subjective norms (H1–H2) significantly influence intention, and that intention (H5) then affects behavior, consistent with the TPB framework (13). These findings also align with previous research showing intention as a key predictor of behavior across various domains, including technology acceptance (16, 17), COVID-19 vaccination uptake and engagement in preventive behaviors (12, 14, 15), and dental attendance among Norwegians (9). However, in contrast to Åstrøm et al. (9), who found that PBC influenced intention but not dental attendance, this study shows that PBC facilitates actual action (H4) rather than a motivator of intention (H3). When a behavior depends heavily on actual control factors (e.g., time, money, and service access), PBC can directly influence whether the behavior is performed, regardless of intention levels (13). In this research, participants may have already formed intentions based on attitudes (value perceptions) and subjective norms (social expectations) about preventive care, leaving PBC to exert its influence primarily at the behavioral stage.

The PLS analysis suggests that trust is significantly and positively associated with TPB constructs (H6–H8), in line with Alfansuri and Soetjipto (16), Borhan et al. (17), and Servidio et al. (14), some of whom showed that trust may enhance the

predictive power of the TPB in explaining intention. Trust was also significantly associated with dental attendance (H9), consistent with Servidio et al. (14). However, trust was not significantly associated with intention (H10), contrasting with findings by Liu et al. (22) and Alzahrani (23) but aligning with prior research by Borhan et al. (17), Goren et al. (25), and Servidio et al. (14), who demonstrated that the trust–intention relationship is indirect, operating through TPB constructs rather than directly. Their results also support this study's finding that attitude and subjective norms fully mediate the relationship between trust-intention (H11a–H11b). This suggests that trust influences intention by reducing uncertainty through shaping attitudes and perceived social pressure, rather than through a direct trust–intention relationship. However, unlike these studies, no mediation effect of PBC was found between trust-intention (H11c). Instead, PBC partially mediates the relationship between trust-behavior (H11d), which may indicate that trust influences dental attendance both directly and indirectly through PBC.

HBM constructs also predicted intention (H13–H15), except for perceived barriers (H12). This exception may be explained by the fact that the sample was drawn from Ankara, where access to preventive care may be relatively easier due to a higher number of dentists, better infrastructure, and relatively affordable services compared to rural and underdeveloped areas (6, 7). The positive association of perceived benefits and risks (i.e., encompassing severity and susceptibility) with intention aligns with the foundational premise of the HBM (24) and is consistent with previous research on other preventive health behaviors (12, 23, 25, 27). Thus, even when perceived barriers are minimal due to favorable local conditions, recognizing the benefits and understanding the potential severity and likelihood of a health threat could act as important drivers of intention.

Trust is also found to be a significant predictor of HBM constructs (H16–H19), consistent with prior COVID-19 literature (23, 25, 27) and technology acceptance research (22). These studies suggest that trust enhances the credibility and acceptance of health messages, resulting in more positive health beliefs. Trust also reduces uncertainty, increases confidence and shapes cognitive appraisals by leading individuals to perceive greater benefits and risks and fewer barriers. This body of evidence further supports this research's findings that HBM constructs (H20b–H20d)—excluding barriers (H20a), which was rejected—fully mediate the trust–intention relationship. Overall, the results indicate that trust influences intention primarily through these constructs, which is consistent with previous research in other domains (22, 23, 25, 27). Specifically, trust appears to shape how individuals cognitively appraise health behaviors (i.e., by evaluating risks and benefits) rather than directly driving compliance.

PLS results demonstrate that dental anxiety negatively affects both intention and behavior (H21–H22). This is consistent with Saba and Katirci (30), who found that high dental anxiety led to irregular dental visits, postponed treatments, and avoidance of care except in emergencies. Their research also indicated that higher anxiety was associated with more missing teeth, likely due to delayed or untreated dental conditions becoming irreparable. These findings are consistent with the present

study, as although 63.3% of participants reported no prior traumatic or painful dental experiences, 50% currently delay dental visits, and 45.7% indicated pain or discomfort as the reason for their last visit. Moreover, the results showed that trust is negatively associated with dental anxiety (H23), which is consistent with previous research (11). These results may be attributed to the fact that higher trust in dentists is linked to positive interpersonal experiences and respectful treatment, which reduce the likelihood of anxiety. Meanwhile, negative experiences, including criticism, embarrassment, fainting, or feeling light-headed, have been shown to erode trust and increase dental anxiety (20). This study also shows that dental anxiety fully mediates the trust–intention relationship (H24a) and partially mediates the trust–behavior relationship (H24b), indicating that negative beliefs and cognitions about dentists strongly predict poor attendance both directly and indirectly through anxiety. These results might be due to the fact that negative beliefs can deter attendance independently of anxiety, and negative cognitive perceptions about dentists contribute to dental avoidance (10).

Theoretical implications

Although the HBM and TPB models have been applied to general health behaviors (12), their combined use in oral healthcare remains novel and provides a comprehensive framework for understanding preventive oral care behaviors. The inclusion of trust and dental anxiety further strengthens the novelty of this approach, as these two critical yet often overlooked psychological factors play an important role in dentist–patient relationships. In addition, by examining the mediating roles of HBM, TPB, and dental anxiety in the relationship between trust and intention—an area that remains largely unexplored in oral care research and rarely addressed in other health contexts (e.g., 23, 14) this study uncovers novel links between these key variables and provides a foundation for future research on the interplay among them within this context.

Practical implications

In Turkey, where 76.5% of individuals experience dental caries, primarily due to low dental visit frequency (7), the importance of preventive oral care in addressing the high prevalence of dental diseases becomes evident. The findings of this research provide a foundation for oral healthcare providers to develop comprehensive interventions targeting health beliefs and behaviors. Relevant stakeholders, including government officials and policymakers, should integrate oral health education at all academic levels to improve beliefs and attitudes and promote long-term behavioral change. These initiatives should emphasize the benefits of early preventive care in reducing invasive treatments, improving prognosis, and lowering healthcare costs (4, 5). They should also raise awareness of benefits such as early detection of oral cancer and periodontal disease while highlighting the risks of neglecting oral health, including progression to systemic conditions such as diabetes and cancer.

This research also highlights the crucial role of trust in dentists. Providers should therefore prioritize transparency and patient-centered care, demonstrating empathy and sensitivity to patients' emotional needs to build long-term relationships. Such approaches create supportive environments that reduce fear,

improve treatment perceptions, and encourage regular dental visits. The significant role of dental anxiety as a barrier to regular attendance is also identified. Oral care programs should therefore promote preventive care by mitigating dental anxiety through strategies such as effective communication, including active listening and empathy (11). In addition, transparent communication can strengthen trust and confidence, whereas relaxation techniques, patient education about treatments, and psychological support can help further reduce anxiety (19). Shared decision-making could also enhance patients' sense of control and help alleviate their anxiety. These approaches could foster healthier behaviors, especially for first-timers. Overall, such tailored intervention efforts can increase preventive dental attendance, enhance engagement in preventive care, encourage motivation, and improve adherence to preventive measures. They may also help embed these values within the national culture and contribute to Türkiye's sustainable development goals.

Limitations and future research

Due to the cross-sectional design of this research, longitudinal studies are recommended to improve generalizability and capture changes in beliefs over time. The researchers were also unable to collect data from other cities. Therefore, there is a strong need for studies conducted across multiple locations in Turkey to enable meaningful comparisons, particularly in areas where barriers to preventive care may be more prominent. Drawing from the findings of this research, future studies should explore how different sociodemographic groups influence behaviors and examine the role of cues to action in dental attendance, particularly in relation to social media and government initiatives. Additional factors, such as cultural influences, health literacy, and access to healthcare services, should also be examined to provide a more comprehensive understanding of preventive care behaviors. Future research is also recommended to conduct comparative studies examining these relationships in contexts with well-established preventive oral care systems, such as the United States and several European countries.

AUTHOR CONTRIBUTIONS

Conceptualization, methodology, data collection, and drafting, F.A.; research design and statistical analysis, K.G.K.; research design and critical review, D.T.; data collection and manuscript review, İ.A.A.; data collection and manuscript review, N.K. All authors have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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CONFLICTS OF INTEREST

The authors have declared no conflict of interest.

ETHICAL APPROVAL

Ethical approval was obtained from the Atılım University Ethics Committee (Approval No.: E-59394181-604.01-96735; Date: October 3, 2024). The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all

participants prior to their inclusion in the study.

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