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Original Article

Association between health beliefs and patient delay in oral cancer diagnosis in Pakistan: An exploratory factor analysis

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KEYWORDS

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Patient delay

Abstract *Background/purpose:* The Health Belief Model (HBM) has been applied to study help-seeking behaviors for various chronic diseases, but the association between HBM and patient delay in oral cancer (OC) diagnosis remains under-explored. The objectives of this study were to describe sociocultural perceptions of OC using the HBM framework and the association between sociocultural perceptions and patient delay in Pakistan.

Materials and methods: We conducted a multicenter cross-sectional study among 152 patients diagnosed with oral squamous cell carcinoma (OSCC). We collected data by structured, questionnaire-based interviews. We performed exploratory factor analysis (EFA) with varimax rotation on HBM questions to identify latent constructs, then we used multivariate logistic regression to assess their association with patient delay.

Results: We identified six factors using EFA: perceived economic barriers, religious beliefs, perceived severity, perceived susceptibility, psychological barriers, and cues to action. Religious beliefs emerged as a distinct factor, while perceived severity incorporated items from multiple HBM domains. Perceived economic barriers were positively associated with patient delay (AOR = 10.18; 95 % CI: 2.00–62.50), whereas perceived severity (AOR = 0.13; 95 % CI: 0.03–0.49) and perceived susceptibility (AOR = 0.25; 95 % CI: 0.07–0.81) were negatively associated with patient delay.

Conclusion: We were able to identify latent constructs in HBM using EFA that were both risk

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factors and preventive factors for patient delay. The findings of our study suggest that relevant stakeholders should consider developing culturally sensitive interventions that focus on reducing economic barriers and emphasize OC's severity and susceptibility.

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Introduction

The patient interval refers to the period between a patient's initial recognition of symptoms and their first consultation with a healthcare provider.¹ Prolonged patient interval, commonly referred to as "patient delay", is regarded as the most substantial contributor to total diagnostic delay in oral cancer (OC), typically ranging from two to seven months.²

Although numerous studies have examined the influence of social determinants of health (e.g., socioeconomic status, healthcare access) and clinical factors (e.g., symptom severity) on patient delay, fewer studies have investigated the role of cognitive and psychosocial characteristics.^{3,4} Patients may postpone help-seeking due to fear, fatalistic attitudes, social stigma, or deep-rooted cultural beliefs.^{5,6} Beliefs may independently influence healthcare-seeking behaviors among OC patients. Deep-rooted perceptions of fate, divine will, and social stigma can lead individuals to avoid biomedical treatment.⁷ Cultural beliefs contribute to distorted understandings of OC, reducing the perceived importance of early screening and timely intervention.⁸ Patients may also resort to self-remedies, self-medication, or traditional healers before seeking formal medical care.⁶ Despite their influence, the role of such sociocultural frameworks in shaping care-seeking behaviors remains critically understudied in regions with high burden of OC, such as South Asia, where religious and cultural norms strongly affect patient decision-making.⁷

The Health Belief Model (HBM) provides a well-established theoretical framework for measuring health-related beliefs.⁹ It has been widely applied to assess the influence of cognitive and psychosocial characteristics on delayed care-seeking behaviors for various diseases, including ovarian and breast cancer.^{10,11} Thus, the HBM is highly relevant for investigating delayed care-seeking behaviors in OC. A descriptive study in Malaysia examined patient perceptions using the HBM,¹² and the model has also been applied to OC screening in other settings.⁸ However, no study has assessed the extent to which HBM influences patient delay in OC. Pakistan is a Muslim-majority, lower-middle-income country in South Asia with a relatively high burden of OC. This context provides an ideal setting to explore the influence of sociocultural perceptions on patient delay based on the HBM framework. The objectives of this study were (1) to describe patients' sociocultural perceptions regarding OC diagnosis and treatment using the HBM framework and (2) to assess the extent to which these perceptions are associated with patient delay.

Materials and methods

We conducted this multicenter, cross-sectional study between April and September 2023 in Khyber Pakhtunkhwa (KPK), Pakistan. The study sites included three tertiary hospitals (Hayatabad Medical Complex (HMC), the Institute of Radiotherapy and Nuclear Medicine (IRNUM), and Mardan Medical Complex (MMC)) and one university dental hospital (Sardar Begum Dental College and Hospital (SBDC&H)).

We invited all oral squamous cell carcinoma (OSCC) patients (ICD: C00-C06)¹³ present at the study site during the study periods to participate. We excluded patients with recurrent OSCC and those who were likely unable to complete the study interview. We approached eligible patients in outpatient clinics, provided study information, and scheduled interviews based on their availability. The final sample size was 152 participants, in accordance with the recommended participant-to-item ratio of 5:1 for exploratory factor analysis.¹⁴ Further methodological details are available in a published source.¹⁵

The study instrument was a paper-based, structured interview questionnaire comprising three sections: (1) socio-demographic characteristics and prior knowledge about OC; (2) access to healthcare, challenges, and diagnostic timelines;¹⁵ and (3) sociocultural perceptions of OC diagnosis and treatment (based on an adaptation of the HBM). We drafted the questionnaire in English, translated the questionnaire into Urdu, back-translated the Urdu version to English, and compared the original and the back-translated English versions to ensure accuracy.¹⁶ The questionnaire's content validity was assessed by a panel of three experts (two public health professionals and one questionnaire design specialist). Based on their feedback, we revised the wording of several questions. The final version included 30 questions and yielded a Content Validity Index (CVI) of 1.0.¹⁷

We measured sociocultural perceptions of OC (exposure variables) across six domains of the HBM, namely: (1) perceived susceptibility; (2) perceived severity; (3) perceived benefits; (4) perceived barriers; (5) self-efficacy; and (6) cues to action. This section comprised 31 items rated on a five-point Likert scale (1 = strongly agree to 5 = strongly disagree).

We defined the appraisal interval as the time from initial symptom recognition to the perceived need for care, and the help-seeking interval as the time from this perceived need to the first consultation with a healthcare provider. Together, these intervals constituted the patient interval. We defined patient delay as either an appraisal or a help-

seeking interval that exceeded 30 days.^{18–20} Based on the literature,^{3,4,21} we designated sociodemographic characteristics, dental care utilization, healthcare access, OC knowledge, and the use of traditional remedies or self-medication as potential confounders in the association between sociocultural perceptions of OC and patient delay.

The primary investigator (UA), a licensed dentist, conducted all study interviews. Written informed consent was obtained from each participant prior to data collection. Each interview lasted approximately 15–20 min. UA reviewed each questionnaire immediately afterward to ensure completeness and data accuracy. We verified patient responses with referral letters and medical records to minimize recall bias.

The Human Research Ethics Committee of the Faculty of Dentistry, Prince of Songkla University, Thailand (EC6602-009), and the respective ethics committees of all participating hospitals: Hayatabad Medical Complex (HMC-QAD-F-00), Institute of Radiotherapy and Nuclear Medicine (IRNM/RDPC/2023/27), Mardan Medical Complex (327/BKMC), and Sardar Begum Dental College and Hospital (approved May 5, 2023), approved the study. We conducted all procedures in accordance with relevant ethical guidelines and the principles of the Declaration of Helsinki.

Statistical analysis

We used descriptive statistics to describe the basic characteristics of the study participants. We then used the Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy to assess the suitability of the data for exploratory factor analysis (EFA), using the KMO value of 0.6 as the cut-off point for sampling adequacy being suitable for EFA.²²

We performed EFA using Principal Component Analysis (PCA) with varimax rotation to identify latent constructs aligned with the six domains of the HBM. We retained factors with eigenvalues greater than 1 (Kaiser's criterion)²³ and performed a visual inspection of the scree plot.²⁴ We considered items with loadings of 0.5 or higher or –0.5 to be meaningful, and excluded items with low communalities or substantial cross-loadings (values of 0.32 or higher or –0.32 or lower) from the final model²⁵ (Supplementary Table 1). We performed EFA using the *psych* package in the R statistical environment. The R codes used to generate the findings are provided in the supplementary materials section.

Results

The study included 152 patients with OSCC, predominantly male (68.4%), with a mean age of 53.6 years (range: 21–90 years). Nearly three-fifths of the participants reported a monthly family income of 25,000 Pakistani Rupees (PKR) or less, while fewer than one-fifth reported income above 50,000 PKR. Most participants (65.7%) sought dental care only when symptoms occurred, while 26.9% had never had a dental checkup. Only about one-seventh of patients had prior knowledge about OC (Table 1). The responses for all HBM items concerning OC are detailed in Supplementary Table 2.

Table 1 General characteristics of the study participants (n = 152).

Variable	No. of patients (%)
Age group	
≤45	44 (28.9 %)
<45	108 (71.1 %)
Knowledge about oral cancer	
No knowledge	131 (86.2 %)
Had knowledge	21 (13.8 %)
Type of HCP consultation	
Dentist	54 (35.5 %)
General Practitioner	98 (64.5 %)
Patient delay^a in HCP consultation	
Delayed	116 (76.3 %)
Not delayed	36 (23.7 %)

HCP, healthcare provider.

^a Patient delay was defined as a delay exceeding 30 days in either the appraisal interval or the help-seeking interval.

Bartlett's Test of Sphericity for the HBM variables was statistically significant, indicating adequate intercorrelations among items for factor analysis. The determinant of the correlation matrix was 2.48×10^{-5} , suggesting no multicollinearity. The overall KMO value was 0.71, indicating moderate sampling adequacy. The item-level KMO values ranged from 0.31 to 0.87, and most items met the acceptable threshold. EFA with varimax rotation supported a six-factor solution, consistent with the HBM framework, which was confirmed by both the inflection point on the scree plot (Fig. 1) and the Kaiser criterion (eigenvalues >1). The six components had eigenvalues of 3.69, 2.19, 1.78, 1.50, 1.33, and 1.13. Following the item reduction process, 17 items were retained, while 14 items were excluded due to low factor loadings or substantial cross-loadings (Supplementary Table 1).

The final output explained 66% of the total variance (Table 2). The rotated output showed clear, distinct factors with no significant cross-loadings. A distinct religious beliefs factor (RC2) emerged, combining items from multiple original HBM domains. Similarly, the perceived severity factor (RC3) incorporated items across different domains. The economic barriers factor (RC1, $\alpha = 0.90$; 95% CI: 0.87–0.93) accounted for 18% of the variance and included items related to financial and transportation constraints. Religious beliefs (RC2, $\alpha = 0.63$, 95% CI: 0.51–0.72) accounted for 13% of the variance and reflected fatalistic health attributions. The perceived severity factor (RC3, $\alpha = 0.65$, 95% CI: 0.56–0.74) explained 11% of the variance and included items addressing beliefs in early treatment effectiveness. General susceptibility (RC4, $\alpha = 0.67$, 95% CI: 0.55–0.76) captured 9% of the variance with two items addressing perceived OC risk factors.

Table 3 presents the associations between HBM components and patient delay. After adjusting for potential confounders (Model 3), perceived economic barriers (RC1) were positively associated with patient delay (AOR = 10.18; 95% CI: 2.00–62.50). A negative association

Scree plot for all factors

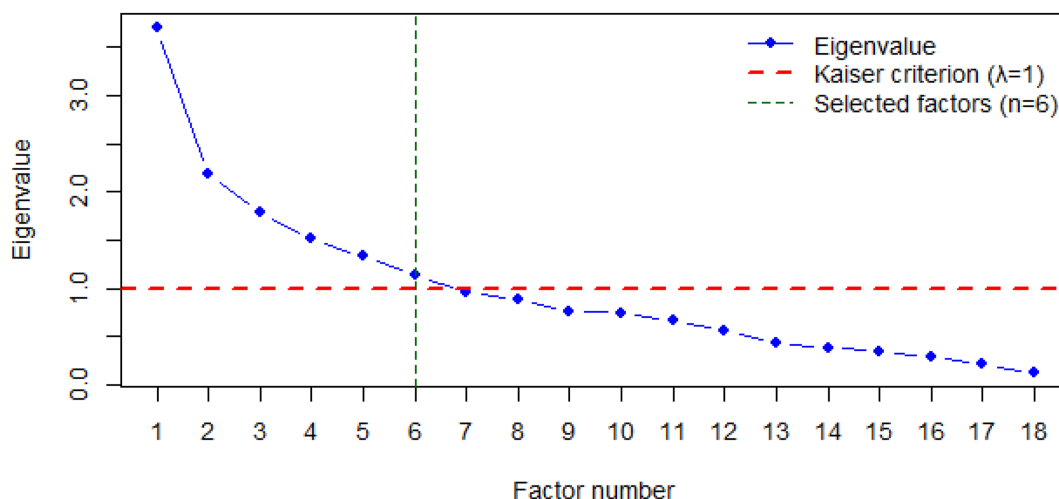


Figure 1 Scree plot from the exploratory factor analysis.

with patient delay was observed for perceived severity (RC3) (AOR = 0.13; 95 % CI: 0.03–0.49) and susceptibility (RC4) (AOR = 0.25; 95 % CI: 0.07–0.81).

Discussion

In this study, we described the association between patients' sociocultural perceptions, framed by the HBM, and patient delay in seeking OC care in Pakistan. We identified six factors that represented sociocultural perceptions, each of which had varying levels of association with patient delay. The findings of such a study contribute potentially useful information to stakeholders in oral health and health promotion.

This is the first study to use the HBM to examine the influence of sociocultural perceptions on delays in OC diagnosis. EFA identified six factors that largely aligned with the HBM framework: 1) perceived economic barriers, 2) perceived severity of OC, 3) perceived susceptibility to OC, 4) perceived psychological barriers to treatment, 5) cues to action, and 6) religious beliefs, the last of which emerged as an additional distinct factor. Notably, some factors, such as the perceived severity, incorporated items from multiple HBM domains, reflecting differences between patients' interpretations and the expert perspective.

Perceived economic barriers showed the strongest association with patient delay. In other low-resource settings, OC patients reported constraints related to healthcare financing and transportation.^{18,26} These barriers include, but are not limited to, direct medical costs, indirect expenses (such as transportation, lodging, and lost income), and psychological distress associated with anticipated financial burden.²⁷ Concerns about affordability may reduce perceived access, increase decisional conflict, and delay care-seeking and help-seeking behaviors. Comparable findings have been reported in other cancers, where economic barriers hindered early screening and diagnosis.^{10,11,28,29}

The perceived severity factor also included patients' knowledge of early treatment benefits and access to healthcare, which belonged to other domains of the HBM. Limited awareness often led patients to misinterpret initial symptoms as minor illnesses, resulting in help-seeking delays.^{5,6} Limited access also explains the link between fewer dental visits and delayed OC diagnosis in similar settings.¹⁵ A study on breast cancer patient delay using the HBM similarly reported an association between low perceived severity and delayed care-seeking.¹⁰

Patients with higher perceived susceptibility were less likely to experience patient delay. This aligns with findings from other cancer studies, where increased awareness of cancer symptoms correlates with reduced delays in seeking care.^{30,31} Perceived susceptibility highlighted the misconceptions that risky habits, such as naswar and tobacco uses, do not increase the risk of OC. Similar misunderstandings regarding the dangers of smoking³² and betel quid chewing⁸ have been reported in other studies.

The EFA revealed that HBM items related to religious beliefs, despite originating from different HBM domains, strongly correlated with one another and formed a distinct factor. Descriptive analyses indicated high homogeneity in responses, as most participants strongly endorsed the notion of *Taqdeer* (divine destiny). This belief has also been reported among OC patients³³ and populations at high risk of oral cancer.⁸ The lack of heterogeneity in the measurement suggests that the wording of the statements in the domain should be further revised to better capture the diversity of perceptions within the study population.

This study offers several notable strengths. It is the first to quantitatively examine the influence of sociocultural perceptions, grounded in the HBM, on patient delay in OC diagnosis. Recruitment of participants at multiple health facilities helped to enhance the generalizability of the findings to other populations with comparable backgrounds. Employing EFA enabled the identification of culturally relevant constructs, providing novel insights into how beliefs and barriers aggregated and shaped care-seeking

Table 2 Exploratory factor analysis of health belief model components related to oral cancer.

Items	Factor and Item statement	Item loadings ^a	SS loading rotated	Eigenvalue unrotated ^b	Variance explained (%)	Cumulative variance (%)	Cronbach's alpha (α) (95 % CI)
RC1	Perceived economic barriers to treatment		3.23	3.69	18 %	18 %	0.90 (0.87 –0.93)
PB6	I cannot afford to pay for dental checkup.	+0.92					
PB5	I cannot arrange transportation to get a dental checkup.	+0.91					
PB11	I cannot afford to pay for the treatment of oral cancer.	+0.86					
SE1	I can manage to go for a dental checkup.	-0.78					
RC2	Religious beliefs		2.00	2.19	13 %	31 %	0.63 (0.51 –0.72)
PB12	If a disease is destined to happen, it will occur, no matter what.	+0.83					
SD4	I think this disease will go away by the will of God.	+0.78					
DR4	I got oral cancer because it is my destiny.	+0.59					
CA3	I will be following a sunnah if I go for dental treatment.	+0.53					
RC3	Perceived severity of oral cancer		2.26	1.78	11 %	42 %	0.65 (0.56 –0.74)
SD1	Oral cancer can be treated if the disease is in early stage.	+0.83					
BT1	Mouth diseases can be cured if I go to the dentist early.	+0.79					
SE3	I want to have dental checkup because my mouth problem may be something serious.	+0.63					
PB8	I do not know where I could go if I want to check for the changes in mouth.	-0.58					
RC4	Perceived susceptibility to oral cancer		1.54	1.50	9 %	51 %	0.67 (0.55 –0.76)
DR3	I can have oral cancer even without using naswar and cigarette smoking.	+0.87					
DR2	Anyone can get oral cancer.	+0.84					
RC5	Perceived psychological barriers to treatment		1.37	1.33	8 %	59 %	0.34 (0.10 –0.52)
PB10	Dental checkup can be painful.	+0.80					
PB1	I am afraid of dental checkup.	+0.71					
RC6	Cues to action		1.25	1.13	7 %	66 %	0.26 (-0.02 – 0.46)
DR1	Before getting diagnosed, I had a chance to get oral cancer.	-0.77					
CA1	My family or people around me encouraged me to go to doctor/dentist.	+0.60					

CI, confidence interval; RC, rotated component; SS, sum of squared.

^a Negative loadings indicate inverse association with the factor. Items retained after item reduction process.

^b Unrotated eigenvalues reflect variance explained before rotation, while SS loadings show variance attributed to each factor after rotation.

behavior. In that regard, a number of limitations should be acknowledged in the interpretation of the study findings. As data were collected after OC diagnosis, patients' current experiences may have influenced their responses. Additionally, the findings of the study may not be fully generalizable to contexts where individual decision-making

predominates over the collective, family-oriented health-care choices typical in South Asian cultures.

This study demonstrates that sociocultural perceptions significantly influence patient delay in oral cancer diagnosis. Culturally tailored sensitive interventions that enhance risk perception, improve awareness, and address structural

Table 3 Association between components of the health belief model and patient delay among oral cancer patients (n = 152).

Item ^a	No delay	Delay	Model 1: crude OR (95 % CI)	Model 2: adjusted OR (95 % CI) ^b	Model 3: adjusted OR (95 % CI) ^c
Perceived economic barriers					
Low (n = 61)	22 (36.1)	39 (63.9)	Reference	Reference	Reference
Medium (n = 30)	6 (20.0)	24 (80.0)	2.26 (0.84–6.84)	1.92 (0.59–6.86)	2.56 (0.58–12.27)
High (n = 61)	8 (13.1)	53 (86.9)	3.74 (1.56–9.76)	4.92 (1.72–15.78)	10.18 (2.00–62.50)
Religious beliefs					
Low (n = 61)	11 (18.0)	50 (82.0)	Reference	Reference	Reference
Medium (n = 30)	11 (36.7)	19 (63.3)	0.38 (0.14–1.02)	0.77 (0.22–2.80)	0.61 (0.14–2.58)
High (n = 61)	14 (23.0)	47 (77.0)	0.74 (0.30–1.78)	0.76 (0.27–2.06)	0.59 (0.18–1.85)
Perceived severity of oral cancer					
Low (n = 61)	8 (13.1)	53 (86.9)	Reference	Reference	Reference
Medium (n = 30)	4 (13.3)	26 (86.7)	0.98 (0.28–3.95)	0.95 (0.23–4.32)	1.20 (0.24–6.69)
High (n = 61)	24 (39.3)	37 (60.7)	0.23 (0.09–0.55)	0.14 (0.04–0.39)	0.13 (0.03–0.49)
Perceived susceptibility to oral cancer					
Low (n = 61)	9 (14.7)	52 (85.2)	Reference	Reference	Reference
Medium (n = 30)	8 (26.7)	22 (73.3)	0.48 (0.16–1.42)	0.20 (0.05–0.72)	0.11 (0.02–0.51)
High (n = 61)	19 (31.1)	42 (68.9)	0.38 (0.15–0.91)	0.30 (0.10–0.84)	0.25 (0.07–0.81)
Perceived psychological barriers to treatment					
Low (n = 61)	15 (24.6)	46 (75.4)	Reference	Reference	Reference
Medium (n = 30)	5 (16.7)	25 (83.3)	1.63 (0.56–5.49)	1.26 (0.35–5.00)	0.99 (0.25–4.33)
High (n = 61)	16 (26.2)	45 (73.8)	0.92 (0.40–2.08)	0.77 (0.29–2.05)	1.17 (0.33–4.29)
Cues to action					
Low (n = 61)	16 (26.2)	45 (73.8)	Reference	Reference	Reference
Medium (n = 30)	4 (13.3)	26 (86.7)	2.31 (0.75–8.73)	2.93 (0.79–13.22)	2.55 (0.57–14.04)
High (n = 61)	16 (26.2)	45 (73.8)	1.00 (0.44–2.25)	0.73 (0.26–1.94)	0.53 (0.15–1.73)

CI, confidence interval; OR, odds ratio.

^a Items category divisions: Low = below 40th percentile; Medium = 40th to 60th percentile; High = above 60th percentile.

^b Model 2: Adjusted for other health belief model components.

^c Model 3: Adjusted for other health belief model components, sociodemographic factors, healthcare utilization patterns, and other health beliefs and practice.

barriers should be explored in order to help reduce delays in oral cancer diagnosis, which can then improve outcomes. Future studies should consider expanding the data collection settings and locations to improve the generalizability of the study findings.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jds.2025.10.004>.

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