Health Belief Model and Patient Adherence: Contextualizing in Middle Eastern Healthcare Systems

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ABSTRACT

Background: This study investigates the influence of Health Belief Model (HBM) constructs on patient adherence among individuals with Type 2 Diabetes Mellitus attending primary healthcare centers in Oman. Methods: Using a quantitative cross-sectional design, data from 140 patients were analysed for three adherence outcomes (diet, medication and appointment attendance) in relation to perceived susceptibility, severity and benefits. Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed for analysis. Results: Results revealed that perceived benefits showed the largest positive associations with appointment and diet adherence. Perceived susceptibility was positively associated with appointment attendance but not diet or medication adherence. Perceived severity was not significantly associated with any of the three outcomes. The model explained a moderate proportion of variance in adherence outcomes. Conclusion: These cross-sectional associations suggest that benefit beliefs may be particularly relevant to diet and appointment adherence within the sampled Omani primary-care setting. The study contributes context-specific evidence to behavioral health research and offers practical insights for patient-centered interventions in similar settings.

Keywords: Health Belief Model, Patient adherence, Type 2 diabetes, Oman, Perceived benefits

INTRODUCTION

Patient adherence is a fundamental determinant of successful chronic disease management. For individuals living with Type 2 Diabetes Mellitus (T2DM), consistent adherence to dietary recommendations, medication regimens, physical activity, and scheduled clinical appointments is essential for achieving glycemic control and preventing long-term complications. In Oman, the burden of T2DM is substantial and growing. Mathematical modelling projections suggest that the number of Omanis with T2DM could increase from approximately 190,000 in 2020 to over 570,000 by 2050, with the condition accounting for a rising proportion of national health expenditure (Awad et al., 2020). This epidemiological trend places considerable pressure on the primary healthcare system, which serves as the cornerstone of chronic disease management in the country.

Oman has made significant strides in expanding healthcare infrastructure and ensuring universal access to primary care services for its citizens. Under the Health Vision 2050 framework, the Ministry of Health has prioritized patient-centered care and the integration of preventive and chronic disease services. However, the effectiveness of these investments ultimately depends on patients' willingness and ability to follow recommended treatment plans over extended periods. While structural improvements have reduced financial and geographic barriers, behavioral and psychological factors influencing adherence have received comparatively less systematic attention in the Omani context. Recent Omani evidence likewise emphasizes the importance of medication beliefs, patient-centred care, and supported self-management in shaping chronic-disease behavior (Ibrahim et al., 2021; Al Mahrouqi et al., 2022, 2023).

The Health Belief Model (HBM) offers a well-established theoretical lens for understanding why individuals engage in or refrain from health-protective behaviors. The model proposes that health behavior is influenced by four core perceptions: perceived susceptibility to a health threat, perceived severity of the threat, perceived benefits of taking recommended action, and perceived barriers to action (Rosenstock et al., 1988). Over several decades, the HBM has been applied across a wide range of preventive and chronic disease behaviors, including medication adherence, dietary change, physical activity, and screening uptake. Meta-analyses and systematic reviews generally support the model's utility, although the relative strength of individual constructs varies considerably across studies and populations (Anuar et al., 2020). More recent diabetes research continues to show that HBM constructs can explain self-management behavior, while the relative influence of individual beliefs varies across settings and populations (Simegn et al., 2023; Wang et al., 2023). A recurring theme in the literature is that the predictive power of HBM constructs is context dependent. In healthcare systems characterized by high out-of-pocket costs or fragmented service delivery, threat appraisals (susceptibility and severity) often emerge as stronger predictors because patients must overcome significant economic or logistical hurdles. Conversely, in systems with universal coverage and strong primary care infrastructure, positive outcome expectations (perceived benefits) may play a more prominent role once initial access is secured. Cultural factors, social support networks, and trust in healthcare providers can further moderate these relationships.

Despite the growing body of international research on the HBM, empirical applications in Middle Eastern healthcare settings remain relatively scarce. Most existing studies from the Gulf region have examined knowledge, attitudes, or self-reported barriers without grounding their analyses in established behavioral theory. This leaves healthcare managers and policymakers with limited evidence-based guidance on which perceptual factors to target when designing adherence interventions. Recent health communication research also indicates that adherence is shaped not only by what patients believe, but by how health information is communicated and understood. Patient-centered communication has been linked to adherence through patient understanding, agreement, trust, and motivation, while health-literacy interventions can strengthen diabetes self-management (Brown & Venetis, 2023; Butayeva et al., 2023). The present study addresses this gap by applying the HBM to a sample of T2DM patients receiving care in Oman's primary healthcare centers. The structural model evaluated the following hypotheses for diet, medication and appointment adherence:

- H1: Perceived susceptibility positively relates to diet, medication and appointment adherence.
- H2: Perceived severity positively relates to diet, medication and appointment adherence.
- H3: Perceived benefits positively relate to diet, medication and appointment adherence.

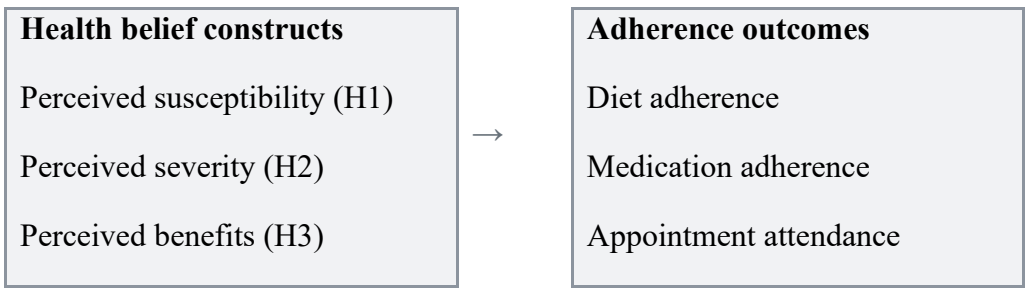


Figure 1: Conceptual framework based on the Health Belief Model

By examining these relationships in a setting defined by universal access and low financial barriers, the study aims to generate insights that can inform both the theoretical refinement of the HBM and the development of more effective patient engagement strategies in similar healthcare systems.

RESEARCH METHODOLOGY

The study employed a quantitative, cross-sectional survey design. This design was appropriate for testing hypothesized relationships between latent constructs and for evaluating associations in the surveyed primary-care population with T2DM (Creswell & Creswell, 2018). Cross-sectional data collection allowed for efficient

capture of current health beliefs and adherence behaviors at a single point in time.

Data were collected from six primary healthcare centers in Muscat Governorate. These centers were selected to provide reasonable geographic and socioeconomic diversity within the capital region. The target population consisted of adult patients (18 years and older) with a confirmed diagnosis of T2DM who were attending the centers for routine follow-up or medication refills. A convenience sampling approach was adopted due to logistical constraints associated with clinic operations and patient flow. While convenience sampling introduces potential selection bias, it is a widely accepted method in healthcare research when probability sampling is impractical (Etikan et al., 2016).

Of 150 questionnaires, 10 containing missing values were excluded, yielding a complete analytic sample of 140 patients. An a priori G*Power calculation for a broader eight-predictor regression specification ($f^2 = 0.15$, $\alpha = 0.05$, power = 0.80) indicated a minimum sample of 109. The 140 complete cases exceeded this benchmark and supported estimation of the three-predictor PLS-SEM paths (Hair et al., 2019; Hair & Alamer, 2022).

The questionnaire consisted of two main sections. The first section measured the four HBM constructs using items adapted from validated scales developed by Gregorio et al. (2016). Perceived susceptibility items assessed patients' beliefs about their personal risk of developing diabetes-related complications. Perceived severity items captured beliefs about the seriousness of potential complications. Perceived benefits items measured expectations that adherence would lead to positive health outcomes. Perceived barriers items assessed perceptions of obstacles to adherence, including time, effort, and side effects. Minor adaptations were made to ensure linguistic and cultural appropriateness for Omani respondents. In the preliminary 30-participant SPSS reliability assessment, the three perceived-barriers items (PBA1–PBA3) yielded Cronbach's alpha of 0.354, substantially below the conventional 0.70 internal-consistency benchmark. Accordingly, the subsequent SmartPLS structural model included perceived susceptibility, perceived severity and perceived benefits.

The adherence measures entering the final structural model were diet adherence, medication adherence and appointment adherence, consistent with the preceding reliability screening. Items were developed to reflect key behaviors recommended in diabetes self-management guidelines. All items were rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Table 1: Demographic variables and coding used in the questionnaire

No.	Demographic Information	Item	Code
1	Gender	Male	A1
1	Gender	Female	A2
2	Age	18-30	B1
2	Age	31-40	B2
2	Age	41-50	B3
2	Age	51-60	B4
2	Age	Above 60	B5
3	Level of Education	No formal education	C1
3	Level of Education	School	C2
3	Level of Education	Diploma	C3
3	Level of Education	Bachelor	C4
3	Level of Education	Higher education	C5
4	Duration of Diabetes	Less than ten years	D1
4	Duration of Diabetes	More than ten years	D2
5	My Prescription	Oral medications	E1
5	My Prescription	Oral medications and insulin injections	E2
5	My Prescription	Insulin injections	E3

Initial questionnaire checks addressed item clarity and face validity. Preliminary SPSS reliability output was based on 30 observations and informed the assessment of measurement consistency. Final construct reliability

and validity were then assessed using the full analytic sample and are reported in the measurement-model results below.

Data collection was coordinated with clinic administrative staff. During regular clinic sessions, eligible patients were approached by trained research assistants who explained the study purpose and obtained informed consent. Questionnaires were self-administered in private areas to minimize social desirability bias. Participation was voluntary, and respondents were assured of confidentiality and anonymity. Ethical approval was obtained from the relevant institutional ethics committee prior to data collection. Eligibility was verified against the stated age and diagnosis criteria before questionnaire distribution, and incomplete questionnaires were excluded from the final analytic sample.

Data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) implemented in SmartPLS software. PLS-SEM was selected because the study is prediction-oriented and uses latent constructs, and because the method performs well with moderate samples and data that may depart from multivariate normality (Hair et al., 2019; Hair & Alamer, 2022). The analysis followed a two-stage procedure, with SPSS reliability screening informing the constructs entered into SmartPLS. First, the measurement model was assessed using indicator loadings, Cronbach's alpha, composite reliability (rho_a and rho_c), average variance extracted (AVE), sampling adequacy, and discriminant validity. HTMT and the Fornell-Larcker criterion were used to assess discriminant validity, consistent with variance-based SEM guidance (Henseler et al., 2015). Second, the structural model was evaluated using bootstrapped path coefficients, standard deviations, t-values, p-values, R^2, adjusted R^2, and Q^2predict. Bootstrapping used 5,000 resamples, and statistical significance was evaluated at $p < 0.05$.

FINDINGS

Sample Characteristics

The final sample of 140 respondents included 94 females (67.1%) and 46 males (32.9%). This gender distribution is consistent with higher rates of primary healthcare utilization among women for chronic disease management in Oman. The majority of participants were aged between 40 and 60 years, reflecting the typical age profile of T2DM patients in primary care settings. The demographic variables collected and their coding are summarized in Table 1.

Descriptive Statistics

Descriptive analysis revealed differences in adherence levels across behavioral domains. Appointment adherence exhibited the highest mean score (M = 4.23, SD = 0.87), suggesting strong compliance with scheduled clinic visits. Diet adherence also showed relatively high adherence (M = 3.93, SD = 0.66). Medication adherence was moderate (M = 3.53, SD = 0.94).

Health belief constructs displayed varying mean scores. Perceived benefits had the highest mean (M = 4.18, SD = 0.71), indicating that patients generally held favorable expectations regarding the outcomes of adherence. Perceived susceptibility was also relatively high (M = 3.90, SD = 0.81), reflecting awareness of personal vulnerability to complications. Perceived severity was moderate (M = 3.25, SD = 0.82). Diet adherence is a multidimensional self-management behavior that can be particularly difficult to sustain over time, which is also emphasized in Omani diabetes literature (Al-Salmi et al., 2022).

Table 2: Item-level skewness and kurtosis

Measurment Items	N	Skewness	Kurtosis
DA1	140	-.857	1.680
DA2	140	-.899	1.239
DA3	140	-.979	1.989
DA4	140	-.898	1.404
MA1	140	-.564	.002

MA2	140	-.506	-.670
AP1	140	-1.880	3.982
AP2	140	-1.632	2.346
PSU1	140	-1.298	1.861
PSU2	140	-1.061	.945
PSU3	140	-1.025	.804
PSU4	140	-.908	-.150
PSE1	140	-.469	-.829
PSE2	140	.415	-.808
PSE3	140	-1.044	.857
PSE4	140	-.469	-.973
PSE5	140	-.752	-.446
PBE1	140	-1.362	3.061
PBE2	140	-1.688	4.083
PBE3	140	-1.721	3.745
PBE4	140	-1.513	2.427
PBE5	140	-1.506	3.104
Valid N (listwise)	140		

Note. N = 140 for all listed measurement items.

Measurement Model Evaluation

The measurement model was evaluated using indicator loadings, internal consistency reliability, and convergent validity. As shown in Tables 3 and 4, indicator loadings ranged from 0.469 to 0.825. Cronbach's alpha was 0.825 for diet adherence (DA), 0.743 for medication adherence (MA), 0.637 for appointments (AP), 0.796 for perceived susceptibility (PSU), 0.680 for perceived severity (PSE), and 0.857 for perceived benefits (PBE). Composite reliability (rho_c) exceeded 0.75 for all reported constructs. AVE exceeded 0.50 for DA, MA, AP, PSU, and PBE, while PSE had an AVE of 0.449. This indicates that, on average, fewer than 50% of the indicators' variance was captured by perceived severity, weakening evidence of convergent validity and warranting caution when interpreting non-significant severity paths. Appointment adherence had a two-item Cronbach's alpha of 0.637, below the conventional 0.70 benchmark; although rho_c was 0.846, the lower alpha suggests limited internal consistency and calls for cautious interpretation of appointment-related associations.

Table 3: Measurement model indicator loadings

Constructs	Indicators	Loading
Diet Adherence	DA1	.718
Diet Adherence	DA2	.812
Diet Adherence	DA3	.682
Diet Adherence	DA4	.713
Medication Adherence	MA1	.703
Medication Adherence	MA2	.671
Appointments	AP1	.469
Appointments	AP2	.763
Perceived Susceptibility	PSU1	.692
Perceived Susceptibility	PSU2	.817
Perceived Susceptibility	PSU3	.781
Perceived Susceptibility	PSU4	.706
Perceived Severity	PSE1	.600
Perceived Severity	PSE2	.603
Perceived Severity	PSE3	.590
Perceived Severity	PSE4	.684

Perceived Severity	PSE5	.594
Perceived Benefits	PBE1	.581
Perceived Benefits	PBE2	.709
Perceived Benefits	PBE3	.730
Perceived Benefits	PBE4	.753
Perceived Benefits	PBE5	.825

Note. PBE1–PBE5 are perceived-benefits indicators. PIN designates personal interaction within value co-creation behaviour, a separate measurement construct.

Sampling adequacy was also assessed using the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests. The overall KMO value was 0.773, and Bartlett's test of sphericity was significant, $\chi^2(820) = 3355.401$, $p < .001$, supporting the factorability of the correlation matrix (Table 5).

Table 4: Reliability and convergent validity

Constructs	Cronbach's alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
DA	0.825	0.833	0.885	0.659
MA	0.743	0.771	0.885	0.794
AP	0.637	0.637	0.846	0.734
PSU	0.796	0.925	0.861	0.613
PSE	0.680	0.955	0.755	0.449
PBE	0.857	0.873	0.899	0.644

Note. rho_a = composite reliability estimate; rho_c = composite reliability; AVE = average variance extracted. PSE is the only reported construct with AVE below 0.50 (0.449).

Table 5: KMO and Bartlett's test

Test	Statistic	Value
Kaiser-Meyer-Olkin measure	Sampling adequacy	0.773
Bartlett's test of sphericity	Approx. chi-square	3355.401
Bartlett's test of sphericity	df	820
Bartlett's test of sphericity	p-value	<.001

Discriminant validity was assessed using both HTMT and the Fornell-Larcker criterion. The aggregate SmartPLS model reports HTMT = 0.490 between Health Perceptions and Patient Adherence, below commonly used 0.85–0.90 thresholds. In this aggregate assessment, Health Perceptions represents susceptibility, severity and benefit measures, while Patient Adherence encompasses diet, medication and appointment items. HTMT is the mean absolute correlation between indicators of the two constructs divided by the geometric mean of their within-construct indicator correlations; hence 0.490 is an aggregate estimate rather than an average of three individual HBM ratios. In the corresponding Fornell–Larcker matrix, the diagonal values are the square roots of aggregate AVE ($\sqrt{0.249} = 0.499$ for Health Perceptions and $\sqrt{0.450} \approx 0.670$ for Patient Adherence). Both exceed the reported inter-construct correlation of 0.411. These overall values describe the aggregate constructs and are distinct from discriminant-validity tests among the six separate first-order scales (Henseler et al., 2015).

Table 6: Discriminant validity: HTMT

	HEALTH PERCEPTIONS	PATIENT ADHERENCE
HEALTH PERCEPTIONS		
PATIENT ADHERENCE	0.490	

Note. HTMT = heterotrait-monotrait ratio of correlations; the reported value between Health Perceptions and Patient Adherence is 0.490.

Table 7: Discriminant validity: Fornell-Larcker criterion

	HEALTH PERCEPTIONS	PATIENT ADHERENCE
HEALTH PERCEPTIONS	0.499	
PATIENT ADHERENCE	0.411	0.670

Note. Diagonal entries are the reported square roots of AVE; the off-diagonal entry is the inter-construct correlation.

Structural Model and Hypothesis Testing

The structural model demonstrated moderate explanatory power. R^2 values were 0.435 for diet adherence, 0.484 for medication adherence, and 0.440 for appointment adherence, with adjusted R^2 values of 0.346, 0.403, and 0.356, respectively (Table 9). Q^2 predict was positive for medication adherence (0.134) and appointment adherence (0.094), but slightly negative for diet adherence (-0.011), indicating that predictive relevance was not uniform across the three reported outcomes.

Bootstrapping results for the reported structural paths are summarized in Table 8. The estimates support a selective pattern in which perceived susceptibility was significantly associated with appointment adherence, while perceived benefits were significantly associated with diet and appointment adherence.

H1 – Perceived susceptibility → Patient adherence: Partially supported. The path to appointment adherence was significant ($\beta = 0.176$, $t = 2.280$, $p = 0.023$), whereas the paths to diet adherence ($\beta = 0.007$, $p = 0.946$) and medication adherence ($\beta = -0.044$, $p = 0.718$) were not significant.

H2 – Perceived severity → Patient adherence: Not supported for the reported outcomes. Paths to diet adherence ($\beta = 0.242$, $p = 0.113$), medication adherence ($\beta = 0.173$, $p = 0.141$), and appointment adherence ($\beta = -0.082$, $p = 0.505$) were non-significant.

H3 – Perceived benefits → Patient adherence: Supported for diet and appointment adherence. Perceived benefits were significantly associated with diet adherence ($\beta = 0.227$, $t = 2.426$, $p = 0.015$) and appointment adherence ($\beta = 0.515$, $t = 5.167$, $p < 0.001$). The path to medication adherence was positive but not statistically significant at the 0.05 level ($\beta = 0.145$, $t = 1.797$, $p = 0.072$).

Table 8: Structural model path coefficients

	Path coefficients	Bootstrap standard error (SE)	t-value (|β/SE|)	p-value
PSU -> DA	0.007	0.108	0.067	0.946
PSU -> MA	-0.044	0.121	0.361	0.718
PSU -> AP	0.176	0.077	2.280	0.023
PSE -> DA	0.242	0.152	1.586	0.113
PSE -> MA	0.173	0.117	1.474	0.141
PSE -> AP	-0.082	0.123	0.666	0.505
PBE -> DA	0.227	0.093	2.426	0.015
PBE -> MA	0.145	0.080	1.797	0.072
PBE -> AP	0.515	0.100	5.167	<0.001

Note. PSU = perceived susceptibility; PSE = perceived severity; PBE = perceived benefits; DA = diet adherence; MA = medication adherence; AP = appointment adherence; SE = standard deviation of the bootstrapped coefficient, used as its estimated standard error. Nine paths were estimated for the three screened HBM constructs. Perceived barriers did not meet the pilot reliability criterion ($\alpha = 0.354$; $n = 30$) and was therefore not entered into the SmartPLS structural model; no perceived-barriers path coefficients or bootstrapped tests were estimated.

Table 9: Explanatory and predictive performance

Constructs	R-square	R-square adjusted	Q2 predict
DA	0.435	0.346	-0.011
MA	0.484	0.403	0.134
AP	0.440	0.356	0.094

Note. Q^2 predict values above zero indicate predictive relevance for the corresponding outcome; DA has a slightly negative value (-0.011).

SUMMARY OF KEY FINDINGS

Among the three tested HBM constructs, perceived benefits had the largest observed positive associations with diet and appointment adherence in the sampled Omani primary-care patients. The diet and appointment pathways met the $p < 0.05$ criterion, whereas the medication pathway did not ($p = 0.072$). These associations are consistent with the relevance of positive outcome expectations, including anticipated improvements in quality of life and diabetes management, to particular adherence behaviours.

In contrast, perceived susceptibility demonstrated a more outcome-specific pattern of association. The appointment pathway alone was significant, suggesting an association between awareness of personal risk and clinic attendance rather than diet or medication adherence. Risk perception may serve as a cue for healthcare contact, although this cross-sectional association does not demonstrate that susceptibility beliefs precede appointment attendance.

Perceived severity was not significantly associated with diet, medication or appointment adherence ($p = 0.113$, 0.141 and 0.505, respectively). Adaptation to long-term illness, social support and clinical experiences may be relevant contextual explanations, but the observed pattern cannot identify their respective contributions. Interpretation of these non-significant results also takes account of the perceived-severity scale's borderline internal consistency ($\alpha = 0.680$) and AVE of 0.449.

Collectively, the reported HBM predictors explained a moderate proportion of variance in adherence outcomes ($R^2 = 0.435–0.484$). Predictive relevance was positive for medication and appointment adherence, whereas diet adherence had a slightly negative Q^2 predict value (-0.011). This pattern suggests that additional contextual influences on dietary behavior may not be fully captured by the current model, consistent with the broader complexity of diet adherence in T2DM (Al-Salmi et al., 2022).

DISCUSSION

The pattern of stronger associations observed for perceived benefits aligns with the fundamental logic of the Health Belief Model but reveals important contextual variations that have both theoretical and practical significance. In healthcare systems where financial and geographic barriers are minimal, reported adherence may be more closely associated with positive outcome expectations—such as improved daily functioning, better disease control, and reduced risk of long-term complications—than with perceived disease severity or susceptibility. This pattern contrasts with findings from studies conducted in cost-sensitive or fragmented healthcare systems, where threat appraisals (particularly perceived susceptibility and severity) frequently emerge as stronger drivers of initial health-seeking behavior (Chauke et al., 2022; Kamran et al., 2014). The pattern is compatible with context-dependent HBM associations, although healthcare-system characteristics were not assessed as moderators of the reported paths. This emphasis on benefit beliefs is consistent with recent HBM-based diabetes research showing that perceived benefits can be important for self-care behavior, although the strength of specific constructs differs by context (Simegn et al., 2023; Wang et al., 2023). The selective association between perceived susceptibility and appointment adherence, but not diet or medication adherence, is particularly noteworthy. It raises the possibility that risk awareness may accompany engagement with formal healthcare services more closely than daily self-management behaviours. Within the measured domains, diet and appointment adherence showed clearer associations with tangible benefit beliefs than medication adherence. This insight has direct implications for intervention design. Appointment visits represent critical touchpoints at

which healthcare providers can reinforce benefit-oriented messaging, address any emerging doubts about treatment efficacy, and provide practical support for translating positive intentions into sustained behavior change. In practice, appointment attendance offers an opportunity to discuss and support other aspects of diabetes self-management. In Oman, related research has also highlighted the importance of individualized, patient-centred support for self-management rather than relying on information provision alone (Al Mahrouqi et al., 2022, 2023).

The non-significant perceived-severity pathways warrant a measured interpretation. Although adaptation to chronic disease and family or professional support may shape how patients interpret severity, these mechanisms were not directly assessed in the structural model. Perceived severity also showed weaker convergent validity (AVE = 0.449), which may affect the precision of its associations with adherence. Healthcare access and sociocultural factors remain relevant areas for future comparative investigation; evidence from Oman indicates that medication experiences and beliefs are associated with adherence across social contexts (Ibrahim et al., 2021).

From a theoretical perspective, this study contributes to the ongoing refinement of the Health Belief Model by identifying construct-specific associations within an Omani primary-care setting. In environments offering universal access and low direct costs to patients, benefit beliefs showed clearer associations with diet and appointment adherence than perceived severity. This suggests that future extensions or adaptations of the HBM should explicitly include healthcare system characteristics, such as financial protection, continuity of care, and provider accessibility, as potential moderators for testing in longitudinal and multisite designs. The study also adds valuable empirical evidence from an under-researched Middle Eastern context, thereby addressing calls for greater geographic and cultural diversity in behavioral health research.

From a practical and managerial standpoint, the results carry several actionable implications for healthcare organizations and policymakers in Oman and comparable settings. First, communication strategies and patient education programmes should priorities benefit-focused messaging. Rather than relying predominantly on fear-based appeals that emphasize the risks of complications, interventions should consistently highlight the positive outcomes of adherence, including improved energy levels, better daily functioning, enhanced quality of life, and greater independence. Second, primary care providers should be trained to elicit and reinforce patients' benefit beliefs during routine consultations. Simple techniques such as motivational interviewing, goal setting around quality-of-life improvements, and regular feedback on clinical progress can strengthen outcome expectations and sustain motivation. Third, appointment attendance should be strategically leveraged as a gateway behavior. Given the positive association between susceptibility beliefs and clinic attendance, these visits should be used as opportunities to build benefit beliefs and support the more challenging daily self-management behaviors. Finally, chronic disease management policies should integrate behavioral science insights into staff training, patient education materials, and follow-up protocols to create a more supportive environment for long-term adherence.

From a health and risk communication perspective, these findings suggest that communication design should be treated as part of adherence support rather than as a separate educational activity. Research should examine how benefit-focused messages interact with health literacy, trust, and patient activation in Middle Eastern populations; policy should embed evidence-based communication principles in diabetes education materials and primary-care protocols; and practice should support clinicians in using clear, culturally responsive messages while checking patient understanding. Diabetes communication research shows that message framing can improve self-management outcomes, while patient-centered communication can influence adherence through understanding, trust, agreement, and motivation (Gao et al., 2023; Zhang et al., 2025; Brown & Venetis, 2023).

Convenience recruitment across six primary healthcare centres in Muscat means that the respondents may differ from patients attending rural facilities, other Omani governorates or non-participating clinics; geographic and socioeconomic representation cannot be assumed. Self-reported diet, medication and appointment adherence may be influenced by inaccurate recall or answers considered socially acceptable, potentially inflating reported adherence. The cross-sectional survey establishes associations at one time point rather than the temporal order or causation of health beliefs and behaviour. Finally, the two-item appointment scale showed comparatively low internal consistency ($\alpha = 0.637$), while perceived severity showed $\alpha = 0.680$ and AVE = 0.449, warranting cautious interpretation of the corresponding paths and further validation of these measures.

CONCLUSION AND RECOMMENDATIONS

This cross-sectional study examined associations between three Health Belief Model constructs and diet, medication and appointment adherence among adults with T2DM attending primary healthcare centres in Muscat, Oman. Perceived benefits were positively associated with diet and appointment adherence, and perceived susceptibility was positively associated with appointment attendance. Associations involving medication adherence and perceived severity did not reach statistical significance. These findings identify patterns of co-occurring beliefs and reported behaviour rather than cause-and-effect relationships.

The results carry several practical implications for healthcare managers, clinicians, and policymakers. Communication strategies should shift toward benefit-focused education that emphasizes positive health outcomes and quality-of-life improvements. Regular clinic appointments should be leveraged as strategic opportunities to reinforce these benefit beliefs and to provide ongoing support for self-management. Chronic disease management policies and staff training programmes should integrate behavioral science principles to enhance patient engagement and long-term adherence. Future longitudinal and multisite research with more diverse samples and objectively recorded adherence indicators could assess temporal patterns and test whether the associations observed here persist across healthcare settings. These implications also emphasize the communication process itself: diabetes care should use understandable, culturally responsive, and patient-centered communication that reinforces motivation and supports sustained self-management (Brown & Venetis, 2023; Butayeva et al., 2023).

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DISCLOSURES

Ethics: Ethical approval was obtained from the appropriate institutional ethics committee before data collection. Participation was voluntary, informed consent was obtained from all participants, and confidentiality and anonymity were maintained throughout the study.

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Conflict of Interest: The authors declare no conflict of interest related to this manuscript.

Authors Contribution: Both authors contributed to the conception and development of the study, interpretation of the findings, preparation of the manuscript, and review and approval of the final version.

Data Availability: The data supporting the findings of this study may be made available by the authors upon reasonable request, subject to applicable ethical and institutional requirements.

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