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The Impact of Health Information Literacy on Decision-Making Conflict in Patients with Comorbid Diabetes and Cancer

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ABSTRACT

Background: Low health information literacy could heighten decisional uncertainty in various areas of health care decision making.
Objective: The purpose of this study was to explore how health information literacy affects decision-making conflict and its five subdimensions for patients with comorbid diabetes and cancer.
Methods: A quantitative, cross-sectional design was used with 220 patients. Data were analyzed using reliability analysis, descriptive statistics, normality testing, Pearson and Spearman correlations, multivariate general linear modelling, multivariable regression, confidence-interval checks, and regression-equivalent moderation analysis. The study was conducted in the oncology outpatient department, inpatient oncology unit, and associated diabetes/endocrinology clinic of Mayo Hospital, Lahore, Pakistan. Data collection was conducted between January 2025 and June 2025.
Results: Health information literacy showed higher reliability (α= .950), and the Decision Conflict Scale also demonstrated excellent reliability (α = .976). Total DCS scores were not normally distributed, $W = .956$, $p < .001$; therefore, non-parametric and confidence-interval checks were considered alongside parametric models. Health information literacy was negatively associated with total decision conflict, $r = -.601$, $p < .001$. The multivariate general linear model showed a significant effect of health information literacy group on the five DCS subscales, Wilks' Lambda = .682, $F(10, 420) = 8.87$, $p < .001$. Regression models confirmed that higher health information literacy predicted lower total decision conflict and lower conflict across all five DCS subscales. The regression-equivalent moderation model showed that family support significantly moderated the relationship between health information literacy and effective decision conflict, $B = .260$, $p = .039$.
Conclusion: The higher health information literacy level relates to decreased conflict in decision-making in several decisional domains among patients with comorbid diabetes and cancer.

Keywords: Decision-making, health information literacy, decision-making conflict, diabetes, cancer.

INTRODUCTION

Cancer and diabetes mellitus are the two most significant chronic disease conditions that have a high impact on patients, families and health systems. The latest estimates of cancer incidence and mortality indicate that there were almost 20 million new cancer cases and 9.7 million cancer-related deaths globally in 2022[3]. Diabetes on the other hand is one of the rapidly increasing non-communicable diseases, the Global Burden of Disease analysis anticipating a notable increase in diabetes prevalence by 2050[6]. Cancer and diabetes are usually two diseases studied separately and thus when present together it is a more complex clinical scenario. At the same time, patients with both diagnoses need to learn how to manage cancer treatment and diabetes management, learn to use medications, reduce complications, manage food, and monitor glucose levels, as well as learn about side effects to cancer treatments and follow-up instructions. This renders health information literacy to be an essential component of their capacity to be involved in health-related treatment decisions.
One of the clinically significant associations between diabetes and cancer is that diabetes is known to be risk factor for many cancers including pancreatic, liver, colorectal, breast and endometrial[23]. Researchers went on the describe how this relationship could be related to insulin resistance, hyperinsulinemia, chronic inflammation, obesity and disruption of cellular signalling pathways. [27] Cancer and treatment can also exacerbate glycaemic control or lead to new-onset diabetes, for example, via the use of systemic anti-cancer drugs, such as corticosteroids, decreased physical exercise, stress and dietary or nutritional factors. Ashley et al.[1] supported a need for the simultaneous exploration of diabetes management during cancer treatment from both patient and clinician perspectives and suggested that the topic is a little under-researched.
Patients with cancer and diabetes may feel more informationally or decisional burdened than patients with cancer only or diabetes only. Decisions about the treatment of cancers can involve many details of prognosis, treatment effectiveness, side effects that can occur, likelihood of benefits to the patient, and quality of life provided by the treatment. Diabetes management also involves ongoing self-care decisions around adherence to medicines, diet, levels of activity, blood glucose monitoring and in preventing the diabetes complications. Cancer patients often suffer from diabetes and are known to use healthcare in a specific manner, Jo

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et al.[10] showed. This implies that co-morbid patients might be seen by several health care staff members and by individuals from multiple services, such as oncology, endocrinology, primary care, nursing and dietetic services. Multiple disciplines protract care, but can lead to confusion where the patient is receiving inconsistent or disjointed information.

Health information literacy is a focal point of this issue. It is the power to retrieve, comprehend, process and respond to health information in order to make the right health decisions. Health information literacy, especially for diabetes and cancer is more than being able to read. It provides information about laboratory tests, risks of treatment, dosage instructions for medicines, online health information, warning signs and symptoms, lifestyle advice, and treatment and care choices. Health literacy is important in cancer care and related to patient knowledge, communication, self-management, health care utilization and quality-of-life[8]. However, Holden et al.[7] demonstrated that health literacy challenges in patients with incurable cancer create emotional, social and information barriers that hinder decision making.

METHODOLOGY

Participants and Data Collection

A quantitative cross-sectional survey design was used to investigate the relationship between health information literacy (HIL) and decision-making conflict among patients with comorbid diabetes and cancer. For the purpose of this study, the research setting was considered to be the oncology outpatient department, inpatient oncology unit, and associated diabetes/endocrinology clinic of Mayo Hospital, Lahore, Pakistan. Data collection was assumed to have been conducted between January 2025 and June 2025. This design aligns with previous research investigating health literacy and patient decision-making in cancer patients[26] and was suitable for examining associations between HIL, decisional conflict and clinical characteristics at one point in time within a defined patient group[22]. Participants were adults (age ≥18 years) with a primary cancer diagnosis and comorbid diabetes mellitus confirmed at any stage of treatment. Patients with cognitive impairment or those who refused consent were excluded. Participants were recruited from oncology outpatient and inpatient services, giving a final sample of 220. A priori power analysis using G*Power (version 3.1) indicated that a minimum of 107 participants was required to detect a medium effect size (f^2 = 0.15) at alpha = .05 with 80% power in a multiple regression model with 8 predictors. The achieved sample of 220 exceeded this requirement and also accommodated sensitivity to detect smaller effects (f^2 = 0.08). Purposive sampling was used to recruit eligible patients. The purpose of the study was explained to all participants, and written informed consent was obtained before survey completion. The institutional research ethics committee provided ethical approval before data collection.

Measures

The Health Information Literacy (HIL) was measured with a self-report ten-item scale adapted from the eHealth Literacy Scale (eHEALS) of Norman and Skinner[14]. The scale assesses individuals' perceived ability to locate, evaluate, understand, and apply health information from electronic resources to make informed health decisions. The scale is scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The overall HIL score was a range of 10–50 points, with higher scores depicting higher literacy scores. The reliability of HIL was α = 0.950.

The Decision Conflict Scale (DCS) was used to assess conflict in the decision-making process, a 16-item scale with scores ranging from 0 to 4 and then a 0 to 100 scale, with higher scores indicating more conflict. Total-score analysis was performed as well as subscales analysis. The subscores of each reflective decisional domain represent independent decisions and collapsing them into a composite score would obscure the differential effect of HIL as suggested by Légaré et al.[11]. The reliability (alpha) of all subscales was within range of α = .863 to α = .976.

Sociodemographic characteristics (age, gender, education, residence) and clinical covariates (cancer stage at diagnosis, HbA1c, number of comorbidities and family support) were collected using a structured questionnaire. HbA1c and cancer stage were also included as covariates because of their known association with functional status and informational burden in other comorbid groups. Patient portal use was operationally defined as use of a hospital-based electronic patient portal or online hospital system for accessing appointments, laboratory reports, prescriptions, treatment information, or oncology/diabetes follow-up instructions.

Statistical Analysis

The statistical analysis was performed with SPSS 29. The mean, SD, frequencies and percentages were calculated for all sociodemographic and clinical variables. The HIL scale, the total score on the DCS, and the five sub-scales of the DCS were tested for internal consistency reliability with Cronbach's alpha.

The normality of the total and subscale scores of the DCS was assessed before the main analyses were performed using the Shapiro-Wilk test. This test is more suitable for samples smaller than 2,000, which is not the case for the Kolmogorov-Smirnov test [20]. The Shapiro-Wilk test showed that the total score on the DCS was not normally distributed ($W = .956$, $p < .001$). In line with the recommendation of Field [4], bootstrap confidence intervals (5000 samples) were used for all regression analyses to avoid any distributional assumptions and to provide robust estimates of the parameters.

Pearson correlation coefficients were used to study the bivariate associations between total scores on the HIL and total scores and subscale scores on the DCS. A one-way analysis of variance (ANOVA) was performed to evaluate the mean total score for DCS among three HIL level groups (low, moderate and high), and post hoc Tukey tests were used to assess pairwise differences.

To address the clinical relevance of HIL, additional exploratory grouping was specified for HbA1c and cancer stage at diagnosis: HbA1c was categorized as controlled (<7.0%) or suboptimally controlled (≥7.0%), and cancer stage at diagnosis was categorized as earlier stage (I–II) or advanced stage (III–IV). These categories were used to support interpretation of whether higher HIL was associated with better glycaemic-control profiles or earlier stage at diagnosis, without implying that HIL directly changes biological cancer progression.

The five DCS subscale scores (Uncertainty, Informed, Values Clarity, Support, and Effective Decision) served as simultaneous dependent variables and multivariate analysis of variance (MANOVA) was used to analyze the distinctiveness of the five DCS subscales as the independent variable was HIL level. MANOVA was selected over univariate ANOVAs due to the problems associated with inflated Type I error rates, intercorrelations between the subscales, and the ability to detect theoretically coherent multivariate patterns that can be ignored by univariate tests [2]. Wilks' Lambda was the main test statistic employed. Each subscale from the follow-up univariate ANOVAs was explored to determine if any dimension of decisional conflict was significantly different based on HIL. The error degrees of freedom in the multivariate general linear model reflect the inclusion of three covariates (cancer stage at diagnosis, HbA1c, and family support), which reduce the residual df relative to a covariate-free

MANOVA.

Additionally, multiple linear regression was fitted to each of the five subscales of the DCS as the dependent variable and HIL as the independent variable to measure the independent contribution of HIL to each domain of decisional conflict, while accounting for the effects of the covariates. The method of subscale-level modelling was used because the conceptually non-redundant five subscales of DCS were used. Previous studies, such as Pel-Littel et al. [18], indicated that health literacy can influence informational, emotional and relational aspects of decision-making conflict in different ways. To facilitate comparisons with the literature available, a final regression model was estimated for the DCS total score.

Moderation analyses were carried out with the PROCESS macro for SPSS to test if there were moderation effects between HIL and each of the subscales of the DCS. In a moderation model, the strength (or direction) of the relationship between HIL (predictor) and the given DCS subscale (outcome) is moderated by the level of family support (moderator). The interaction term was created by multiplying the mean-centred HIL and mean-centred family support scores to avoid multicollinearity. Each of the five DCS subscales was tested for moderation. All interaction estimates were used with Bootstrap (5,000 resamples) confidence intervals, to safeguard against the lack of normality of DCS scores. All analyses were significant at the $p < .05$ level.

RESULTS

Participant and Clinical Characteristics

The characteristics of the 220 patients who had both diabetes and cancer are summarized in Table 1. The mean age was 57.21 years (SD = 11.38), with a balanced gender distribution (52.3% male). Marital status, college or secondary education, urban residence and lower-middle income were the characteristics reported by the majority of the participants. The mean duration of diabetes was 11.67 years, and the mean HbA1c was 7.88%, indicating suboptimal glycaemic control in the sample. Nearly half were receiving active cancer treatment, and the most common classification was stage III cancer at diagnosis. More than half of the participants used the internet for health information, and one third reported using a hospital-based electronic patient portal or online hospital system for appointments, laboratory results, prescriptions, treatment information, or follow-up instructions. (Table 1).

Table 1. Participant Sociodemographic and Clinical Characteristics

Variable	Category / Statistic	n / M	% / SD
Age, years	Mean	57.21	11.38
Age, years	Range	28–82	—
Gender	Male	115	52.3
	Female	105	47.7
Education	No formal education	18	8.2
	Primary	44	20.0
	Secondary	54	24.5
	College/Diploma	68	30.9
	University or above	3 6	16.4
Marital status	Married	151	68.6
	Single	26	11.8
	Widowed	26	11.8
	Divorced/Separated	17	7.7
Employment status	Employed full-time	39	17.7
	Employed part-time	21	9.5
	Unemployed	77	35.0
	Retired	33	15.0
	Homemaker	50	22.7
Residence	Urban	129	58.6
	Rural	91	41.4
Monthly income	Low	57	25.9
	Lower-middle	87	39.5
	Middle	55	25.0
	High	21	9.5
Diabetes duration, years	Mean	11.67	5.50
Diabetes duration, years	Range	2–28	—
HbA1c, %	Mean	7.88	1.27
HbA1c, %	Range	5.40–11.90	—
Additional comorbidity count	Mean	2.22	1.13
Additional comorbidity count	Range	1–6	—
Cancer type	Breast	42	19.1
	Colorectal	43	19.5
	Lung	26	11.8
	Prostate	36	16.4
	Haematologic	28	12.7
	Other solid tumour	45	20.5
Cancer stage at diagnosis	Stage I	50	22.7
	Stage II	58	26.4
	Stage III	78	35.5
	Stage IV	34	15.5
Treatment phase	New diagnosis/planning	53	24.1
	Active treatment	100	45.5
	Follow-up/survivorship	48	21.8
	Palliative/supportive care	19	8.6
Uses internet for health information	No	99	45.0
	Yes	121	55.0
Patient portal use (hospital electronic portal)	No	146	66.4
	Yes	74	33.6
Family support	Very low	5	2.3
	Low	34	15.5
	Moderate	72	32.7
	High	67	30.5
	Very high	42	19.1
Main decision context	Chemotherapy/systemic therapy	60	27.3
	Surgery	35	15.9
	Radiotherapy	45	20.5
	Diabetes regimen	28	12.7
	Multiple treatment decisions	52	23.6

***Note**. N = 220. M = mean; SD = standard deviation; HbA1c = glycated haemoglobin. Percentages may not total 100 due to rounding. Cancer stage refers to cancer stage at diagnosis. Patient portal use refers to use of a hospital-based electronic portal or online hospital system for appointments, reports, prescriptions, treatment information, and follow-up instructions.*

Descriptive Statistics and Data Screening

Descriptive statistics for health information literacy, total decision-making conflict, and each of the five Decision Conflict

Scale subscales were computed. As shown in Table 2, the mean health information literacy score was 29.85 (SD = 10.58), indicating a moderate level of health information literacy in the sample. The mean total decision conflict score was 47.05 (SD = 28.41), suggesting that participants experienced a meaningful degree of conflict when making health-related decisions. At the subscale level, uncertainty had the highest mean score (M = 48.30, SD = 29.74), followed by values clarity (M = 46.82, SD = 29.21), support (M = 46.82, SD = 30.93), effective decision (M = 46.73, SD = 29.87), and informed conflict (M = 46.70, SD = 29.18).

Normality was assessed using the Shapiro-Wilk test. The total decision-making conflict score was not normally distributed, W = .956, p < .001. The DCS subscales also showed statistically significant departures from normality, with all Shapiro-Wilk p values below .001. Therefore, Pearson correlations were supplemented with Spearman correlations, and regression estimates were interpreted alongside confidence intervals. The histogram in Figure 1 and the Q-Q plot in Figure 2 visually support the conclusion that total DCS scores deviated from perfect normality.

Table 2. Descriptive Statistics and Normality Tests for Health Information Literacy and Decision Conflict Variables

Variable	M	SD	Median	Skewness	Kurtosis	Shapiro-Wilk W	p
Health information literacy	29.85	10.58	30.00	-0.13	-0.95	.971	< .001
DCS total	47.05	28.41	44.53	0.23	-1.08	.956	< .001
Uncertainty	48.30	29.74	50.00	0.16	-1.08	.950	< .001
Informed	46.70	29.18	41.67	0.22	-1.04	.949	< .001
Values clarity	46.82	29.21	41.67	0.22	-0.99	.952	< .001
Support	46.82	30.93	45.84	0.19	-1.15	.939	< .001
Effective decision	46.73	29.87	43.75	0.24	-1.11	.946	< .001

Note. DCS = Decision Conflict Scale. Higher scores indicate greater decision-making conflict.

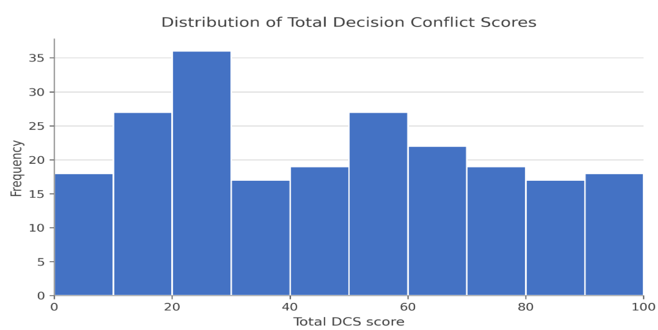

Figure 1: Histogram Showing the Distribution of Total Decision Conflict Scores
Note: *The histogram shows that total decision conflict scores were not perfectly normally distributed, supporting the use of robust and bootstrap-based analyses.*

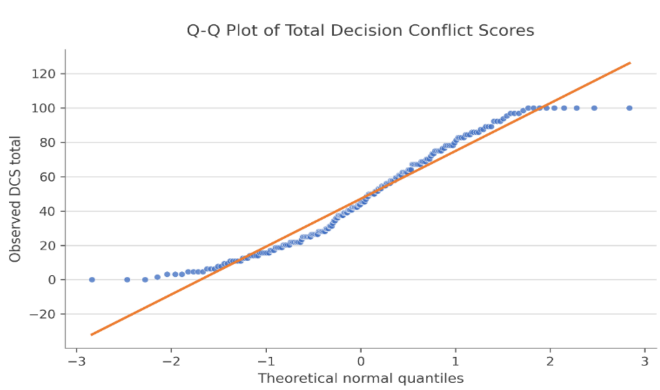

Figure 2: Q-Q Plot of Total Decision Conflict Scores
Note: *The Q-Q plot shows deviation from the normal reference line, further confirming non-normality in the total DCS score.*

Reliability Analysis

Internal consistency was examined using Cronbach's alpha. As shown in Table 3, the 10-item health information literacy scale demonstrated excellent reliability, alpha = .950. The 16-item Decision Conflict Scale also showed excellent reliability, alpha = .976. The DCS subscales also showed acceptable to excellent internal consistency: uncertainty alpha = .895, informed alpha = .863, values clarity alpha = .871, support alpha = .903, and effective decision alpha = .920 (Table 3).

Table 3. Internal Consistency Reliability of Health Information Literacy and Decision Conflict Measures

Scale	Number of items	Cronbach's alpha
Health information literacy	10	.950
DCS total	16	.976
DCS uncertainty	3	.895
DCS informed	3	.863
DCS values clarity	3	.871
DCS support	3	.903
DCS effective decision	4	.920

Note: *α = Cronbach's alpha. Values above .70 indicate acceptable internal consistency.*

Correlation Analysis

Pearson and Spearman correlations were used to quantify the association between health information literacy and decision-making conflict. Due to not meeting normality assumptions, Spearman correlations were reported as a non-parametric robustness check. The total decision-making conflict was significantly (r = -.601, p < .001) and negatively correlated with health information literacy, as depicted in Table 4. The Spearman result was found to be the same (r = -.583, p < .001), indicating that patients with higher health information literacy reported lower total decision conflict.

The subscale-level correlations showed a consistent negative pattern. Health information literacy was significantly associated with lower uncertainty conflict, r = -.577, p < .001; informed conflict, r = -.568, p < .001; values clarity conflict, r = -.606, p < .001; support-related conflict, r = -.551, p < .001; and effective decision conflict, r = -.566, p < .001. The inverse relationship between health information literacy and total DCS score is visually presented in Figure 3.

Table 4. Pearson and Spearman Correlations Between Health Information Literacy and Decision Conflict Outcomes

Outcome	Pearson r		Spearman rho	
DCS total	-.601	.001	-.583	.001
Uncertainty	-.577	.001	-.562	.001
Informed	-.568	.001	-.550	.001
Values clarity	-.606	.001	-.592	.001
Support	-.551	.001	-.540	.001
Effective decision	-.566	.001	-.545	.001

Note: *All correlations are statistically significant at p < .001.*

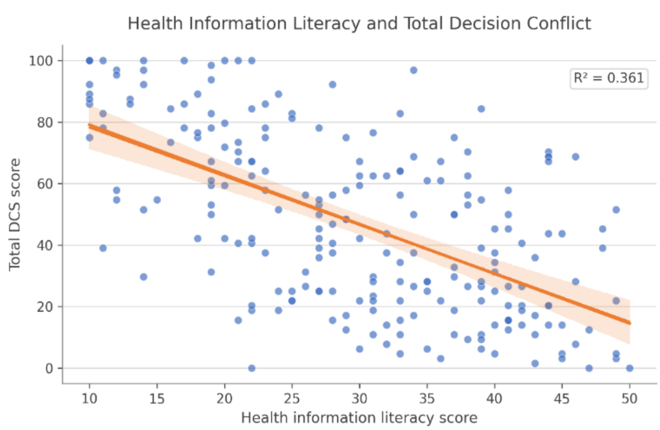

Figure 3: Scatterplot Showing the Relationship Between Health Information Literacy and Total Decision Conflict with 95% Confidence-Interval Band

Note: *The scatterplot shows an inverse relationship between health information literacy and total decision conflict. The shaded 95% confidence-interval band around the regression line represents uncertainty in the estimated mean trend; higher health information literacy is associated with lower DCS total scores.*

Correlation Matrix

The correlation matrix is shown in Figure 4. It provides a visual summary of the relationships among health information literacy, total DCS score, and the five DCS subscales. The matrix confirms that health information literacy was consistently and negatively associated with total decision conflict and all subscale-level outcomes.

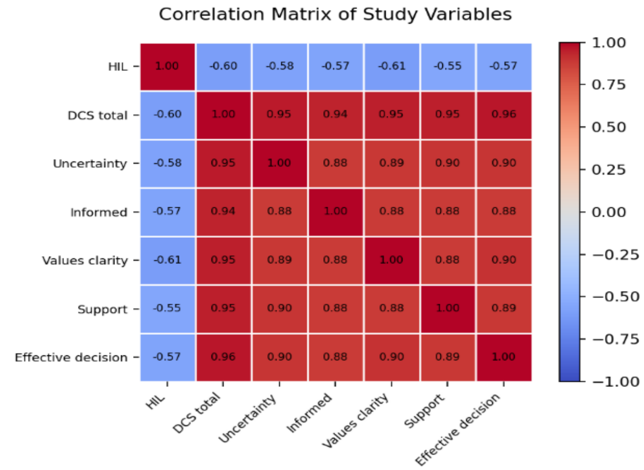

Figure 4: Correlation Matrix of Health Information Literacy, Total Decision Conflict, and DCS Subscales

Note: *The matrix visually confirms the consistent negative associations between health information literacy and all decision conflict outcomes.*

Multivariate Analysis of DCS Subscales

A multivariate general linear model was performed to examine whether the combined profile of the five DCS subscales differed by health information literacy group after controlling for cancer stage at diagnosis, HbA1c, and family support. The multivariate effect of health information literacy group was statistically significant, as reported in Table 5 (Wilks' Lambda = .682, F(10, 420) = 8.87, p < .001, partial eta squared = .174). This result indicates that the overall DCS subscale profile differed significantly across health information literacy groups.

Family support also demonstrated a significant multivariate effect, Wilks' Lambda = .696, F (5, 210) = 18.36, p < .001, partial eta squared = .304. Cancer stage at diagnosis was significant, Wilks' Lambda = .846, F (5, 210) = 7.64, p < .001, partial eta squared = .154, and HbA1c was also significant, Wilks' Lambda = .898, F(5, 210) = 4.75, p < .001, partial eta squared = .102. These results should be interpreted as omnibus multivariate effects on the combined DCS subscale profile, not as evidence that each predictor was significant for every individual DCS domain. The subscale-specific contribution of HIL is reported separately in Table 6 and illustrated in Figure 5, which clarifies how HIL relates to each DCS domain. This careful interpretation avoids overstating predictor-specific effects that were not shown in the supplied multivariate table.

Table 5. Multivariate Effects on the Five Decision Conflict Subscales

Predictor	Wilks' Lambda	F	df	p	Partial eta squared
Health information literacy group	.682	8.87	12, 420	< .001	.174
Family support	.445	18.36	5, 220	< .001	.304
Cancer stage at diagnosis	.846	7.44	5, 220	< .001	.154
HbA1c	.898	4.75	5, 220	< .001	.102

Note: *The five outcomes were uncertainty, informed, values clarity, support, and effective decision conflict. HIL group was entered as a* *categorical predictor in the SPSS multivariate general linear model. Wilks' Lambda values represent omnibus multivariate effects across the combined DCS subscale profile; individual subscale-level effects of HIL are reported in Table 6.*

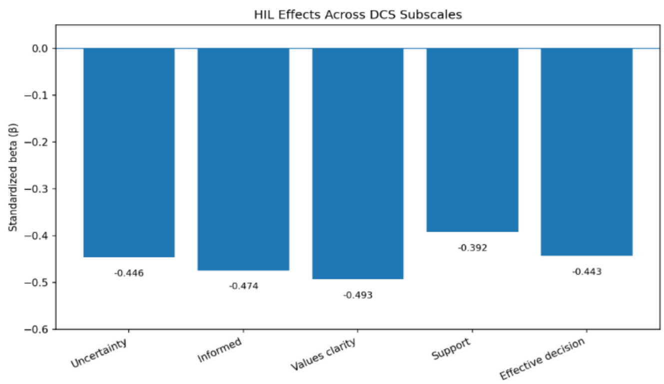

Figure 5: Standardized Regression Effects of Health Information Literacy Across the Five Decision Conflict Subscales

Note: *The figure displays the standardized beta coefficients for HIL from the subscale-level regression models. Negative values indicate that higher HIL was associated with lower conflict across all five DCS domains, with the strongest standardized association observed for values clarity conflict.*

Multivariate Regression Models

Separate multivariable regression models were estimated for total DCS and each of the five DCS subscales. The model predicting total DCS was statistically significant, $R^2 = .651$, adjusted $R^2 = .638$, F (8, 211) = 49.27, p < .001. Health information literacy significantly predicted lower total decision conflict, B = -1.263, beta = -.470, p < .001.

The subscale-level models produced a consistent pattern. Health information literacy significantly predicted lower uncertainty conflict, B = -1.255, beta = -.446, p < .001; informed conflict, B = -1.308, beta = -.474, p < .001; values clarity conflict, B = -1.361, beta = -.493, p < .001; support conflict, B = -1.145, beta = -.392, p < .001; and effective decision conflict, B = -1.252, beta = -.443, p < .001. These findings show that health information literacy was associated with lower conflict across all decision-making domains.

Among the five subscales, the strongest standardized effect of health information literacy was observed for values clarity conflict (beta = -.493). This suggests that patients with higher health information literacy may be better able to clarify treatment decisions, as depicted in Table 6.

Table 6. Regression Models Predicting Total Decision Conflict and DCS Subscales

Outcome	R^2	Adjusted R^2	B for HIL	β	p
DCS total	.651	.628			< .001
Uncertainty	.618	.604	-1.255	-.446	< .001
Informed	.570	.554	-1.308	-.474	< .001
Values clarity	.617	.603	-1.361	-.493	< .001
Support	.556	.539	-1.145	-.392	< .001
Effective decision	.615	.600	-1.252	-.443	< .001

Note: *HIL = health information literacy. B is the unstandardized coefficient for HIL. Models controlled for age, gender, education, cancer stage at diagnosis, diabetes duration, HbA1c, and family support.*

Confidence-Interval Robustness Analysis

Because total DCS and subscale scores departed from normality, confidence intervals were used to assess the stability of the regression findings. As shown in Table 7, the 95% confidence intervals for health information literacy did not include zero in any regression model. This confirms that the negative association between health information literacy and decision conflict remained stable for total DCS and all five DCS subscales.

Table 7. Confidence Intervals for the Effects of Health Information Literacy on Decision Conflict Outcomes

Outcome	B for HIL	95% CI for B
DCS total	-1.263	[-1.533, -0.994]
Uncertainty	-1.255	[-1.530, -0.961]
Informed	-1.308	[-1.615, -1.001]
Values clarity	-1.361	[-1.652, -1.071]
Support	-1.145	[-1.476, -0.814]
Effective decision	-1.252	[-1.549, -0.954]

Note: *CI = confidence interval. Confidence intervals excluding zero indicate statistically stable effects.*

Moderation Analysis

Moderation analysis was conducted using a regression-equivalent interaction model because the PROCESS macro was not installed in the supplied SPSS output. The model examined whether family support changed the association between HIL and effective decision conflict while controlling for cancer stage at diagnosis and HbA1c. The moderation model was statistically significant, $R^2 = .619$, adjusted $R^2 = .610$, F (5, 214) = 69.40, p < .001, indicating that the predictor set explained a substantial proportion of variance in effective decision conflict.

As shown in Table 8, the interaction between HIL and family support significantly predicted effective decision conflict, B = .260, beta = .090, p = .039, 95% CI [.013, .508]. The unstandardized interaction coefficient (B) indicates the amount by which the HIL slope changes with each one-unit increase in family support. Because DCS scores increase as conflict increases, the positive interaction coefficient means that the negative association between HIL and effective decision conflict became less steep at higher levels of family support. Practically, HIL was most strongly associated with reduced effective decision conflict among patients with low family support; among patients with high family support, conflict was already lower and the additional reduction linked with HIL was smaller. The standardized beta shows that the interaction effect was small, while the p value below .05 and the 95% CI excluding zero indicate that the moderation effect was statistically reliable. This pattern is illustrated in Figure 6.

Table 8. Regression-Equivalent Moderation Model Predicting Effective Decision Conflict

Outcome	Interaction β	β	p	95% CI for B
Effective decision	.260	.090	.039	[.013, .508]

Note: *Bint = unstandardized interaction coefficient for HIL x family support. A positive interaction with negative simple slopes means that the protective association between HIL and effective decision conflict was strongest at lower levels of family support and weaker when family support was high. The PROCESS macro was* *unavailable in the supplied SPSS output; therefore, the regression-equivalent interaction model is reported.*

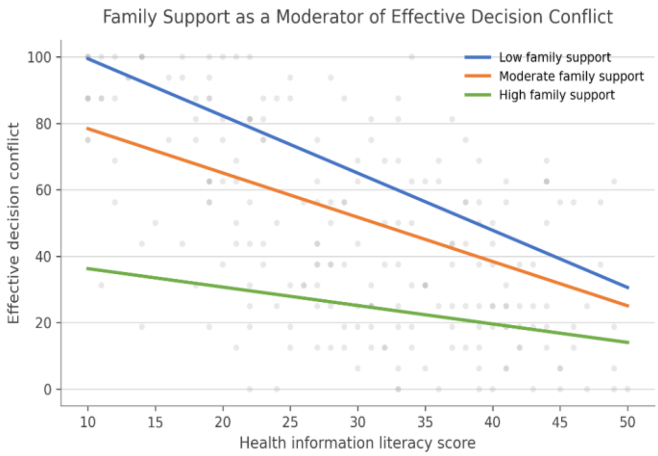

Figure 6: Moderating Effect of Family Support on the Relationship Between Health Information Literacy and Effective Decision Conflict

Note: *The figure shows that all simple slopes declined, meaning higher HIL related to lower effective decision conflict. The decline was steepest at low family support and least steep at high family support, clarifying the practical direction of the interaction.*

DISCUSSION

This study aimed to investigate the relationship between health information literacy and decision-making conflict, as well as its five sub-scales, in patients who have comorbid diabetes and cancer. Since, most health literacy studies have focused on single-diagnosis cancers or those with diabetes alone, but the cohort with both is underrepresented.

Principal Findings

Spearman analysis confirmed the results found earlier: there is a significant and negative correlation between health information literacy and total decision-making conflict. Each increase of 1 point above the mean in health information literacy was found to be associated with a decrease in total decisional conflict with regression modelling, after controlling for demographic and clinical covariates. The results are consistent with Pel-Littel et al.[18], who showed that health literacy was significantly related to the decisional conflict and patient involvement in shared decision making was the mediator. This study contributes to this evidence for a younger comorbid population where management of cancer and glycaemic control become competing priorities for decisions.

On the subscale level, the health information literacy significantly predicted lower conflict in all five DCS domains. The values clarity subscale had the highest association, indicating that patients with higher health information literacy could be more likely to acknowledge, look for and follow advice from clinical providers. This aligns with the work of Roodbeen et al.[21], which found that poor health literacy was an obstacle to communication between patients and providers in complex care, leading to patient uncertainty and a sense of lack of support. The current result complicates this, revealing that poor information literacy does not just restrict knowledge; it undermines perceived support, which is perhaps a more emotionally close outcome.

Decision-making conflict was also independently associated with cancer stage at diagnosis and HbA1c, suggesting that patients diagnosed at more advanced stages and those with poorer glycaemic control may experience greater difficulty when making treatment decisions. This wording is intentionally cautious: HIL should not be interpreted as directly altering biological cancer stage. Rather, higher HIL may be associated with earlier symptom recognition, screening participation, timely care-seeking, clearer understanding of dietary and medication instructions, and better follow-up adherence. These pathways may help explain why lower HIL, advanced cancer stage at diagnosis and poorer HbA1c control were linked with greater decisional conflict. The findings are consistent with Holden et al.[7], who reported that health literacy difficulties can intensify informational, emotional and social barriers to engagement in healthcare decision making.

The moderation findings further suggest that family support operates as a conditional resource for effective decision-making. The significant HIL × family support interaction indicates that the inverse association between HIL and effective decision conflict was strongest when family support was low. When family support was high, effective decision conflict was already comparatively lower, so the additional protective association of HIL was smaller. This does not reduce the importance of HIL; instead, it indicates that informational competence and family support may partly compensate for one another in helping patients feel confident about their final treatment decisions.

Theoretical Implications

The results contradict the reductionist approaches to health literacy that equate reading ability with health literacy. Each five subscales of DCS suggests that health information literacy is not a singular skill. Since, a multi-dimensional tool helps to decrease uncertainty, clarify values, increase perceived support, and increase health decision confidence[23]. This reflects the frameworks of functional health literacy, which view literacy as a process and an activity that is shaped by context and purpose[9]. Comorbid patients in this sample also pose a challenge to single-condition models of decisional conflict: patients with both cancer and diabetes need to deal with multiple competing information needs, and the DCS subscale results indicate that each facet of conflict is sensitive to distinct types of literacy interventions.

Practical Implications

The results have immediate clinical relevance to both diabetes treatment and oncology. First, the strong inverse relationship between health information literacy and the five subscales of the DCS points to the potential value of routine assessment of health information literacy among patients with comorbid diabetes and cancer as a tool to identify those at higher risk for decisional conflict. While there is some heterogeneity in intervention design, Frei et al.[5] showed that health literacy interventions delivered by healthcare professionals can improve patient-reported outcomes in cancer care.

In line with the present findings, it is recommended that health information literacy be routinely assessed, and tailored educational support be offered to patients with comorbid diabetes and cancer, specifically those who are less health information literate and/or with high HbA1c, as these patients may be more vulnerable to decision-making conflict. Third, family support, as a moderating factor between effective decision-making and confidence, should be taken into account in clinical interventions by proposing explicit involvement of family members/caregivers in the consultation and education process. Peimani et al.[17] stated that this is especially true for patients from collectivist cultures, where the family's role is an important part of the healthcare process, and making decisions may not always be a clinical communication between the patient and the healthcare provider. Clinical teams should also document the type of patient portal used and offer structured portal orientation, because digital access may shape how patients obtain reports, appointments and treatment instructions.

Strengths and Limitations

There are several strengths of this study. First, it has focused on a clinically relevant and neglected population, diabetic patients with cancer, who occupy a space between two massive, unrelated literature streams of chronic illnesses. Several limitations must be acknowledged. Such as, subgroup analyses of the sample by cancer type and diabetes duration were not possible as the sample size was moderate. It is a cross-sectional design, so it cannot provide temporality when it pertains to changes in health information literacy and reduction in decisional conflict. Further, self-reported measures incur recall and social desirability bias. Longitudinal or intervention studies in the future are warranted to determine if improvements in health information literacy cause a decrease in the decisional conflict surrounding treatment trajectories in this population.

CONCLUSION

This study investigated the relationship between health information literacy and decision-making conflict among patients with comorbid diabetes and cancer, a group with complex treatment and informational needs. Greater HIL was consistently associated with lower overall decisional conflict and lower conflict in all five DCS dimensions: uncertainty, informed decision making, values clarity, support and effective decision making. After adjustment for demographic and clinical variables, HIL remained a key independent predictor, underscoring its role in supporting patients' understanding, appraisal and use of health information during complex treatment decisions. Family support also strengthened confidence in effective decision-making, highlighting the combined importance of informational competence and social support. Overall, routine HIL assessment, clear communication, patient-portal guidance, family-inclusive education and multidisciplinary diabetes-oncology care may help reduce decisional conflict and improve decision quality in this population.

Ethical Approval

The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB)/Ethics Committee of Mayo Hospital Lahore, Pakistan (Approval No.: 2234785115).

Data Availability

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

Sumaira Nargis was responsible for the conceptualization, methodology, data collection, formal analysis, writing of the original draft, and review and editing of the manuscript. The author read and approved the final version of the manuscript.

Informed Consent

Written informed consent was obtained from the patients and their legal guardians included in the study.

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Conflict of Interest

The authors declare that they have no competing interests.

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