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Resilience and diabetes-related distress as factors for future glycemic trajectories following insulin initiation in type 2 diabetes mellitus

Umit Cavdar[1], Mehmet Sercan Erturk[1], Ali Serol Erturk[2], Murat Golbasi[1], Derya Sema Yaman Kalender[1], Baris Onder Pamuk[1]

[1]Katip Çelebi University, Atatürk Training and Research Hospital, Department of Endocrinology and Metabolism, İzmir, Türkiye
[2]Adıyaman University, Faculty of Pharmacy, Department of Basic Pharmaceutical Sciences, Adıyaman, Türkiye

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Abstract

Psychosocial factors, particularly diabetes-related distress and resilience, play a crucial role in glycemic outcomes among individuals with type 2 diabetes (T2D). However, their impact during the initiation of insulin therapy remains underexplored. This study investigated whether baseline diabetes distress and psychological resilience predict longitudinal glycemic outcomes in insulin-naïve adults with T2D. A 24-month prospective observational study was conducted among 60 adults with T2D initiating insulin for the first time. Diabetes distress and resilience were assessed using the Problem Areas in Diabetes (PAID) and the Connor–Davidson Resilience Scale-10 (CD-RISC-10), respectively. HbA1c was measured at baseline and every 3 months. Linear mixed-effects models were used to examine associations between psychosocial variables and HbA1c trajectories, adjusting for baseline resilience and using clustered standard errors. Participants had a mean age of 58±10 years and baseline HbA1c level of 10.6±1.9%. Mean PAID and resilience scores were 33.3±15.4 and 28.3±6.7, respectively. HbA1c improved significantly after insulin initiation (mean decline=−2.2%, p<0.001). Distress, whether modeled dichotomously (PAID≥40 vs <40) or in tertiles, was not significantly associated with HbA1c slope (p>0.5). However, moderate distress (25.1–40.0) predicted persistently higher HbA1c compared with low distress (β=1.22, p<0.001). Resilience consistently predicted lower HbA1c across all models (β≈0.05 per point, p<0.001). While baseline diabetes distress independently did not predict the rate of HbA1c improvement, higher psychological resilience emerged as a consistent determinant of more favorable glycemic outcomes. Additionally, individuals with moderate levels of diabetes distress demonstrated the poorest long-term glycemic control, indicating that a tertile-based categorization of PAID scores may more effectively capture subgroups at risk for suboptimal outcomes.

Keywords: Diabetes mellitus, type 2, hemoglobin a, glycosylated, insulin therapy, psychosocial factors, resilience, psychological, diabetes distress

Introduction

Effective glycemic control targeting HbA1c below 7% is crucial to prevent complications for majority of patients with type 2 diabetes (T2D) [1]. While pharmacotherapy (including insulin) is central to lowering blood glucose, psychosocial factors can also significantly impact diabetes management and outcomes [2]. Diabetes-related distress refers to the negative emotional burdens and worries specific to living with and managing diabetes mellitus. It differs from general stress or clinical depression by diabetes-specific concerns such as fear of complications, regimen overwhelm, or feeling unsupported. High diabetes distress affects approximately one-third of adults with T2D [3]. Notably, greater distress has been consistently associated with poorer self-management and higher HbA1c levels [4]. Patients with severe distress show significantly higher and persistent HbA1c values than those with low distress (PAID<40) [5]. These findings underscore that diabetes distress rather than depressive symptoms is an important psychosocial factor tied to suboptimal glycemic control.

On the other hand, resilience is a positive psychological trait describing the ability to bounce back from stress or adversity. In the context of chronic illness, resilience can help individuals cope more effectively with disease demands [6]. Resilient individuals tend to maintain better mental health and may engage in adaptive

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Corresponding Author: Umit Cavdar, Katip Çelebi University, Atatürk Training and Research Hospital, Department of Endocrinology and Metabolism, İzmir, Türkiye
Email: umit.cavdar@ikc.edu.tr

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behaviors despite challenges. Psychological resilience has been proposed as a protective factor that could buffer the deleterious effects of diabetes stress on self-care [7]. In diabetes research, higher resilience has been linked to improved outcomes such as quality of life and potentially glycemic control [8]. These findings suggest that resilience might modulate how much diabetes-related stress translates into actual glycemic deterioration.

Initiating insulin therapy in T2D patients may cause emotional responses such as fear, perceived failure, or anxiety about injections and hypoglycemia that, if unaddressed, can hinder treatment adherence and limit glycemic improvement [9]. However, psychosocial research in insulin-naïve T2D is relatively limited. The interplay between distress, resilience, and glycemic change in this context has not been thoroughly examined before.

This study aimed to investigate whether baseline levels of diabetes-related distress and resilience are associated with glycemic outcomes, in insulin-naïve patients with type 2 diabetes.

Material and Methods

Study Design and Participants

We conducted a prospective observational study of adults with type 2 diabetes mellitus (T2DM) initiating insulin for the first time. Participants were consecutively recruited from endocrinology clinic at Katip Çelebi University Hospital (2023–2025). Inclusion criteria were age ≥18 years, clinician-determined indication for insulin due to inadequate glycemic control on oral agents, and no prior insulin use. We excluded type 1 diabetes, latent autoimmune diabetes, secondary/specific diabetes types, and individuals with severe psychiatric disorders or cognitive impairment precluding informed consent or reliable self-report. All participants provided written informed consent. For the use of scales, the permission of the owners is obtained. The study was approved by the Institutional Review Board/ Ethics Committee of Katip Celebi University (approval number: 0035, date: 01.26.2023) and conducted in accordance with the Declaration of Helsinki.

Measurements

Glycemic Measurements

HbA1c values indicating the insulin treatment at first visit were defined as baseline A1c. Follow-up A1C measurement were designed for 3-month intervals at 3, 6, 12, 15, 18, and 24 months to explore longer-term trajectories. The primary outcome was to measure the effect of resiliency and distress status on longitudinal HbA1c trajectories. The secondary outcome was achievement of glycemic target of A1C<7% at any time within 24 months (coded as "ever achieved target" and "never achieved target").

The number of participants contributing data were 60,48,27,12,19,4,3 and 6 at each time points (0,3,6,9,12,15,18,24) and all available HbA1c values (totally 179) were analyzed under a missing-at-random assumption.

Diabetes Specific Distress

Diabetes-related emotional distress was assessed with the Problem Areas in Diabetes (PAID) scale after multiplying the raw sum by 1.25 (total ranges 0–100). We used the validated version for the Turkish population [10]. The PAID is a 20-item self-report measure of diabetes distress, with each item scored 0 (not a problem) to 4 (serious problem). Thresholds used in this manuscript are clinical binary cut-off PAID≥40 (high distress), and rank-based tertiles for some analyses.

Psychological Resilience

Resilience was measured using the Connor–Davidson Resilience Scale – Short Form (CD-RISC 10). This is a 10-item abbreviated version of the original 25-item CD-RISC, which has been validated in Turkish populations by Kaya and Odacı (2021) [11]. Each item is rated on a 5-point Likert scale (0–4; total points 0-40) with higher total scores indicating greater resilience. Our sample showed unidimensional structure and acceptable internal consistency (Cronbach's α~0.81).

Other Variables

Baseline covariates for sample characterization included demographics (age, sex, education level, marital status), clinical history (diabetes duration, presence of diabetes complications such as neuropathy or retinopathy, prior oral antidiabetic agents, smoking and alcohol consumption), and initial insulin doses.

Statistical Analysis

Descriptive Statistics

Analyses were performed in SPSS and Python/stats models. Continuous variables are reported as mean±SD (or median [IQR] if non-normal by Shapiro–Wilk); categorical variables as n (%). Group comparisons used t-tests or Mann–Whitney U for continuous variables and χ^2/Fisher's exact tests for categorical variables. Two-sided $p<0.05$ was considered significant.

Group Comparisons

We compared baseline PAID and resilience between those who had a significant A1C improvement (defined as ≥1.0% drop in A1C at 3 months) to those who had less improvement (<1% drop). Similarly, comparison between the groups who eventually reached A1C <7% to those who never did by 24 months is performed. Independent-samples t-tests (or nonparametric equivalents if needed) were used. Pearson correlations examined associations among baseline PAID, baseline resilience, early HbA1c change (0–3 months), and final HbA1c.

Longitudinal Modeling

HbA1c trajectories were modeled with linear mixed-effects models (random intercepts for subjects), fixed effects for time (months), distress, and resilience, and their prespecified interactions. Cluster-robust (subject-level) standard errors were used. Models were formulated as below:

Binary PAID model: HbA1c ~ months × PAID binary + RES total

Tertile PAID model: HbA1c ~ months × PAID tertile + RES total

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Multicollinearity was checked (all VIF <2) and clustered robust standard errors were used. Model assumptions were evaluated by residual diagnostics. Statistical significance was set at p<0.05. Time was coded in months since insulin initiation (0,3,6,9,12,15,18,24), allowing the slope to be interpreted as an average monthly HbA1c change.

Result

Participant Characteristics and Glycemic Outcomes

A total of 60 patients with type 2 diabetes (insulin-naïve) were included. Mean age was 57.95±9.75 years (range 38–75), and 51.7 % (n=31) were female. The cohort had a long-standing history of diabetes with a mean duration of 9.13±5.78 years. 65.5% (n=36) of participants were on more than one oral antidiabetic agent before starting insulin (median=2 agents, IQR 1–3; mean=1.93±1.184 agents). Diabetes-related complications were present in some patients: neuropathy in 20%, retinopathy in 11.7%, and nephropathy in 31.7 %. Mean HbA1c at baseline was 10.55%±1.94 (Table 1). Participants flow is shown in Figure 1.

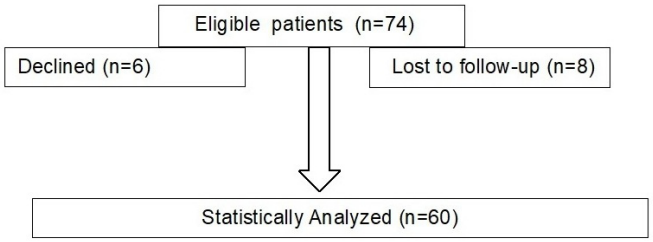

Figure 1. Patient flow diagram

Descriptive Statistics of Diabetes Distress, Resilience and Glycemic Control

At baseline, diabetes-specific distress levels, with a mean PAID score of 33.3±15.4 was consistent with moderate overall distress. Forty percent of patients (n=24) scored ≥40 (high distress), and 5% (n=3) scored ≥60 (very high distress).

Regarding resilience, baseline scores on the CD-RISC10 had a mean of 28.3±6.7 (on 0–40 scale) (Table 1).

By the 3 months of insulin therapy, glycemic control improved markedly. The mean HbA1c at 3 months was 8.20%±1.43, a significant reduction from baseline (mean change –2.22%, 95% CI –1.58% to –2.85%, p<0.001). Overall, 51.7% of patients achieved an A1C reduction of at least 1.0 percentage point, and 28.3% achieved a reduction of ≥3 percentage points. At 3 months, 16.7% of participants reached the target A1C<7%.

By 6 the months, 13.3% of participants reached target A1C. Over the 2-year follow-up, 38.3% had an A1C <7% at least once, while 61.7% never reached the target. Final A1C values tended to stabilize in the 7.5–8.5% range (Table 2).

Comparison of Glycemic Success by Distress Presence

Comparisons between groups defined by baseline diabetes distress (PAID100<40 vs PAID100≥40) and target HbA1c levels were performed using Fisher's exact test. Patients who had minimum HbA1c<7 at any time grouped as 'ever achieved' and those who reached HbA1c<7 at second measurement grouped as 'at target at 3rd month'.

Table 1. Baseline sociodemographic and clinical characteristics of the study population

Variable	Mean±SD / n (%)	Range (Min–Max)	n
PAID100 (Distress)	33.29±15.37	3.75 – 75.00	60
CD-RISC10 (Resilience)	28.28±6.70	10.00 – 39.00	60
Initial weight*	76.32±17.74	46.00 – 148.00	57
Diabetes mellitus duration*	9.08±5.86	0.00 – 25.00	60
Age	57.95±9.75	38.00 – 75.00	60
Initial A1c	10.55±1.94	7.10 – 15.60	60
A1c at month 3	8.20±1.43	5.60 – 12.90	48
Lowest A1c during follow up*	7.70±1.64	5.30 – 13.70	60
Gender	Female 31 (51.7%) - Male 29 (48.3%)		60
Complication	Present 32 (53.3%) – Absent 28 (46.7%)		60
Marital status	Married: 44 (73.3%); Widow: 10 (16.7%); Single: 6 (10.0%)		60
Smoking	No: 38 (63.3%); Yes: 22 (36.7%)		60
Alcohol/week	No: 57 (95%), Yes: 3 (5%), heavy drinker: 0		60
Income level (compared to minimal wage)	Lower 25 (41.7%); Higher 35 (58.3%)		60
Education level	Primary: 25 (41.7%); High: 18 (30.0%); Secondary: 8 (13.3%); University: 5 (8.3%); None: 4 (6.7%)		60

Continuous variables are mean ± SD (or median [IQR]*); categorical variables are n (%). *Variables marked with an asterisk showed non-normal distributions by Shapiro–Wilk (p<0.05). Lowest HbA1c = minimum observed during follow-up. PAID = Problem Areas in Diabetes (0–100); CD-RISC-10 = 10-item Connor–Davidson Resilience Scale (0–40)

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Table 2. Comparison of patients according to success at 3rd month and at any time during the follow-up

Variable	3rd Month success according to ≥1% drop in A1c			Anytime success according to achieving A1c value <7		
	≥1% Drop (n=38)	<1% Drop (n=13)	p	v Reached (n=23)	Never (n=37)	p
PAID100	31.04±13.28	35.54±17.14	0.300	32.17±16.92	33.99±14.52	0.584
Resilience	28.47±7.62	28.10±5.76	0.813	28.96±6.50	27.86±6.87	0.726

Values are mean ± SD. P-values from independent-samples t-tests. "≥1% Drop" denotes HbA1c reduction ≥1.0% at month 3 vs <1.0%. "Reached" denotes achieving HbA1c <7% at any time within 24 months. PAID-100 = Problem Areas in Diabetes (0–100). Resilience = CD-RISC-10 (0–40)

When patients were categorized according to the presence of significant diabetes distress (PAID100≥40), no statistically significant difference was observed in glycemic success rates either at three months or at any time during follow-up (Table 3).

Among participants without clinically relevant distress (PAID100<40), 41.7% achieved HbA1c<7 % at some point during follow-up, compared with 33.3 % among those with high distress (p=0.594; OR=1.40, 95% CI 0.49–4.02). Similarly, at the 3-month visit, 13.9% of non-distressed patients and 16.7% of distressed patients reached the HbA1c<7 % threshold (p=1.000; OR=0.80, 95 % CI 0.20–3.11).

These findings indicate that the presence of baseline diabetes distress was not significantly associated with short-term or long-term glycemic goal attainment. In both distress groups, comparable proportions of patients achieved HbA1c targets, suggesting that distress alone did not substantially influence treatment success within the observed period (Table 3).

Table 3. Comparison of Glycemic Target Achievement According to Baseline Diabetes Distress (PAID < 40 vs ≥ 40)

Distress group (Baseline PAID100)	Ever achieved HbA1c<7%	Never achieved HbA1c<7%	At month-3 HbA1c<7%	At month-3 HbA1c≥7%
PAID100<40 (Low distress)	15 (41.7%)	21 (58.3%)	5 (13.9%)	31 (86.1%)
PAID100≥40 (High distress)	8 (33.3%)	16 (66.7%)	4 (16.7%)	20 (83.3%)
p value (Fisher's exact test)	0.594		1.000	

Footnote: Data are presented as n (%). Percentages are row-wise. Comparisons between groups defined by baseline diabetes distress (PAID100<40 vs PAID100≥40) were performed using Fisher's exact test. Effect sizes are reported as odds ratios (OR) with 95% confidence intervals computed using the Haldane–Anscombe correction and log-scale limits. Abbreviations: PAID, Problem Areas in Diabetes scale (0–100). OR (ever target)=1.40 (95% CI 0.49–4.02); Fisher's exact p=0.594 OR (month-3 target)=0.80 (95% CI 0.20–3.11); Fisher's exact p=1.000

Linear Mixed Models for PAID Distress and HbA1c Trajectories

Two alternative baseline parameterizations of diabetes-related emotional distress (PAID) are presented: a binary classification (PAID ≥40 vs <40) and tertiles (Low, Moderate, High; reference category=Low). Time was modeled as a continuous variable (months since baseline), and interaction terms between PAID and time were included to assess differential HbA1c trajectories across distress levels (Table 4).

Binary PAID Model (Table 4, Figure 2A)

When diabetes distress was analyzed as a binary variable (high vs. low), the linear mixed-effects model demonstrated a significant main effect of time on HbA1c values (β = –0.0949, SE=0.0295, t=–3.22, p=0.0013), indicating a steady decline in HbA1c across the 24-month follow-up period (Table 4). On average, HbA1c decreased by approximately 0.10% per month, equivalent to roughly 1.2% per year, independent of distress group.

The main effect of baseline distress category was not statistically significant (β=0.1237, p=0.66), suggesting that overall glycemic levels did not differ between high- and low-distress individuals at study entry. Likewise, the distress-by-time interaction was not significant (β=–0.0287, p=0.53), implying that the rate of HbA1c improvement over time was comparable between groups.

A significant effect of baseline resilience was observed (β=0.0454, p<0.001), indicating that higher resilience scores were consistently associated with lower HbA1c values across time points, independent of distress category.

Although statistically non-significant, the model's predicted trajectories (Figure 2A) show that patients with higher baseline distress exhibited a slightly steeper decline in HbA1c, leading to marginally lower predicted HbA1c levels at the end of follow-up. This visual crossover pattern likely reflects greater clinical attention or behavioral compensation among highly distressed patients rather than a true differential effect, given the non-significant interaction term (Figure 2A).

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Overall, the binary PAID model supports that HbA1c improves significantly over time, whereas baseline distress alone does not predict glycemic trajectory, and psychological resilience remains a consistent protective factor for lower HbA1c levels throughout follow-up.

PAID Tertile Model (Table 4, Figure 2B)

When baseline diabetes distress was categorized into tertiles (low, moderate, and high), the linear mixed-effects model revealed a significant overall effect of distress level on HbA1c (Table 4). Compared with the low-distress group, patients in the moderate-distress tertile had markedly higher HbA1c values across the study period (β=1.22, SE=0.27, t=4.61, p<0.001). This corresponds to an approximately 1.2 percentage-point higher mean HbA1c in the moderate-distress group after adjustment for baseline resilience. In contrast, individuals in the high-distress tertile showed only a small, statistically nonsignificant difference from the low-distress group (β=0.39, p=0.24).

A significant time effect was again observed (β=–0.10, p<0.001), indicating progressive improvement in glycemic control over the 24-month follow-up in all groups. None of the interaction terms between distress tertile and time were significant (all p>0.7), suggesting that the rate of HbA1c decline was similar regardless of baseline distress intensity. The strong positive association between baseline resilience and lower HbA1c persisted (β=0.0505, p<0.001), confirming the protective role of resilience independent of distress level (Table 4).

Table 4. Binary and Tertile PAID models (N=60)

Predictor Variable	Effect	β (95% CI)	p
Binary Model	Months (per month)	-0.09(-0.15to -0.04)	<0.001*
	PAID100 binary	0.12(-0.42to0.67)	0.66
	Months X PAID100≥40	-0.03(-0.12to0.06)	0.53
	RES total	-0.045(-0.049to -0.042)	<0.001*
Tertile Model	Months (per month)	-0.10(-0.16to -0.05)	<0.001*
	[T.Moderate]	-0.00(-0.11 to 0.11)	0.95
	[T.High]	-0.02(-0.12to0.09)	0.78
	RES total	-0.05(-0.054to -0.047)	<0.001*

Footnote:Values are unstandardized regression coefficients (β) with 95% confidence intervals derived from linear mixed-effects models estimating longitudinal HbA1c trajectories. Two alternative baseline parameterizations of diabetes-related emotional distress (PAID) are presented: a binary classification (PAID ≥40 vs <40) and tertiles (Low, Moderate, High; reference category = Low). Time was modeled as a continuous variable (months since baseline), and interaction terms between PAID and time were included to assess differential HbA1c trajectories across distress levels. All models were adjusted for baseline resilience (RES total, continuous) and included subject-level fixed effects with cluster-robust standard errors. Negative β values indicate inverse associations with HbA1c. [n=36 in low-distress and n=24 in high-distress participants] [Low (≤ 25.0; n=23), Moderate (25.1–40.0; n=18), and High (>40.0; n=19)].

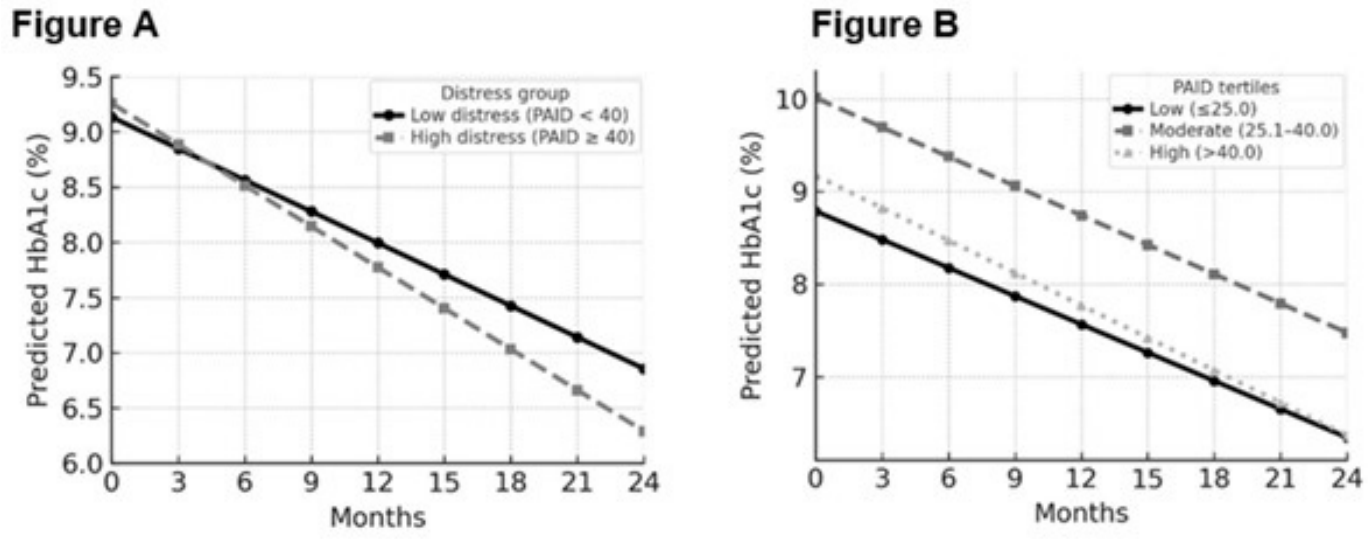

Figure 2. Predicted HbA1c by Binary and Tertile Models (Adjusted for Baseline Resilience)

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As illustrated in Figure 2, participants with moderate baseline distress maintained higher predicted HbA1c trajectories throughout the study, whereas those with low or high distress followed nearly parallel and partially overlapping curves. This pattern implies a potential non-linear relationship between distress and glycemic control. Collectively, the tertile model demonstrates that while HbA1c significantly improves over time across all groups, only moderate baseline distress is independently associated with persistently higher HbA1c, whereas resilience remains a consistent determinant of better long-term glycemic outcomes.

Discussion

In this prospective cohort of insulin-naïve adults with type 2 diabetes mellitus (T2DM), HbA1c levels declined substantially following insulin initiation, confirming the expected metabolic benefit of treatment intensification. However, baseline psychosocial characteristics demonstrated differential associations with longitudinal glycemic trajectories. Across all statistical models, higher psychological resilience was independently associated with more favorable HbA1c outcomes, whereas baseline diabetes-specific distress—whether modeled as a binary (PAID≥40 vs <40) or tertile variable—did not significantly predict the slope of HbA1c improvement.

These findings are consistent with prior evidence underscoring the central role of psychosocial factors in diabetes outcomes. The landmark DAWN study first reported that psychological distress, treatment dissatisfaction, and perceived lack of support are common among people with diabetes and strongly linked to suboptimal self-care [12]. Subsequent meta-analyses and longitudinal studies have clarified that diabetes-specific distress, rather than general depressive symptoms, exerts the strongest and most consistent influence on glycemic outcomes [13,14]. When both constructs are modeled simultaneously, the effect of depression on HbA1c typically diminishes, supporting the notion that diabetes distress captures disease-specific emotional challenges more directly relevant to glycemic control. Distress in our study remained clinically relevant as a marker of patient burden and potential behavioral barriers to optimal self-management.

The current study adds to this literature by demonstrating that while severe distress (PAID≥40) was not independently associated with poorer metabolic trajectories, patients in the moderate-distress tertile (PAID 25–40) exhibited persistently higher HbA1c levels over the 24-month period, even after adjustment for resilience. This pattern suggests a non-linear relationship between distress intensity and glycemic outcomes, where individuals with moderate distress may experience sufficient emotional strain to impair self-care but not enough to prompt intensified clinical attention. In practical terms, this supports the utility of tertile-based categorization of PAID scores to identify at-risk patients who might otherwise remain undetected by the conventional binary threshold (≥40). Such refinement aligns with prior studies recommending a three-level classification (low, moderate, high distress) to improve clinical screening sensitivity and guide early psychosocial interventions [15,16].

The Turkish-validated PAID scale has previously demonstrated good reliability, with elevated distress (PAID≥33) identified in approximately 15% of adults with T2DM and modestly correlated with higher HbA1c values [17]. In our cohort (with PAID100 scoring), the trend was directionally similar, though not statistically significant, likely reflecting sample size limitations and treatment intensification effects following insulin initiation. Indeed, intensive clinical monitoring during early insulin therapy may transiently buffer the behavioral impact of distress on glycemic indices [5].

It is noteworthy that in our cohort, resilience exerted a consistent and independent association with glycemic outcomes. This pattern suggests that resilience may influence the broader psychosocial and behavioral context of diabetes management rather than directly modulating glucose metabolism [18]. The significant main effect of resilience in our mixed-effects models ($\beta \approx -0.05$, $p<0.001$) supports its role as a stable protective factor throughout follow-up. These findings are in line with recent evidence from the Look AHEAD and in a study of patients with type 1 diabetes mellitus [19], where higher resilience scores predicted better mental health, sustained self-care engagement, and modestly lower HbA1c [20]. Prior interventions such as the Promoting Resilience in Stress Management (PRISM) program have demonstrated improvements in psychological outcomes including quality of life, optimism, and stress reduction, although their effects on glycemic indices have been modest and variable [21]. In line with these findings, our results imply that resilience primarily serves as a psychological buffer, mitigating the adverse impact of distress on self-care behaviors rather than directly lowering HbA1c. Longitudinal evidence from younger and newly diagnosed populations similarly indicates that higher resilience is associated with slower HbA1c deterioration over time, even after controlling for baseline distress and other confounders [22]. Collectively, these observations reinforce the notion that fostering resilience may enhance the emotional and behavioral capacity required to maintain glycemic stability in patients initiating insulin therapy.

It is plausible that the reciprocal relationship between distress and glycemic control complicates causal inference: elevated distress can impair adherence and glycemic outcomes, while worsening glucose levels can, in turn, heighten distress [23]. Randomized controlled trials have demonstrated that structured cognitive-behavioral or problem-solving therapies can meaningfully reduce diabetes distress and modestly improve HbA1c, emphasizing the bidirectional nature of psychosocial and metabolic processes [24,25].

Several limitations should be acknowledged. First, the modest sample size from a single-country cohort limits statistical power and generalizability to broader and culturally diverse populations.

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Second, the observational design precludes causal inference and residual confounding cannot be fully excluded, despite longitudinal modeling and adjustment for key psychosocial factors. Finally, while resilience showed a consistent inverse association with HbA1c, the per-point effect size was modest, and the clinical implications for resilience-targeted interventions warrant further investigation in larger, interventional studies.

From a clinical standpoint, our findings support routine screening for both moderate and high distress and highlight the importance of resilience-oriented interventions during transitions such as insulin initiation. The American Diabetes Association's psychosocial care guidelines already recommend standardized distress screening and individualized behavioral strategies as components of comprehensive diabetes management [1]

Addressing both distress and resilience should be integral to diabetes care. Cognitive-behavioral or problem-solving therapies tailored to diabetes related emotional contexts have proven efficacy in reducing distress and, in some cases, improving glycemic outcomes [26]. In summary, resilience appears to operate as a stabilizing factor that mitigates the detrimental impact of emotional distress on diabetes self-management. Clinicians should be confident in initiating insulin therapy regardless of initial distress levels but should also implement structured psychosocial support to sustain engagement and improve long-term outcomes.

Conclusion

Diabetes-specific distress remained a clinically relevant indicator of patient burden and self-management challenges, although it did not independently predict the rate of glycemic improvement following insulin initiation. Higher baseline psychological resilience was associated with lower HbA1c levels over the 24-month follow-up; however, this relationship should be interpreted as correlational rather than causal and may reflect broader psychosocial or behavioral factors influencing diabetes management. The observation on tertile model that individuals with moderate levels of distress exhibited persistently poorer glycemic trajectories suggests a possible non-linear association between distress and metabolic outcomes, which may not be fully captured by conventional binary distress thresholds. Given the observational design and the absence of adjustment for depressive symptoms, socioeconomic context, and treatment adherence, further longitudinal and interventional studies are required to clarify the interplay between distress, resilience, and glycemic control.

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Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This study was approved by the Institutional Review Board/Ethics Committee of Katip Celebi University (approval number: 0035, date: 01.26.2023).

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