Received: 10 September 2020 | Revised: 1 February 2021 | Accepted: 8 February 2021

DOI: 10.1111/pedi.13193

ORIGINAL ARTICLE

Comprehensive psychosocial screening in a pediatric diabetes clinic

Kaitlyn E. Brodar[1,2] | Eileen M. Davis[1] | Courtney Lynn[1] | Lolly Starr-Glass[1] | Joyce H. L. Lui[1] | Janine Sanchez[1] | Alan M. Delamater[1]

[1]Mailman Center for Child Development, Department of Pediatrics, University of Miami Miller School of Medicine, Miami, Florida, USA

[2]Department of Psychology, University of Miami, Coral Gables, Florida, USA

Correspondence
Alan M. Delamater, Mailman Center for Child Development, Department of Pediatrics, University of Miami Miller School of Medicine, Miami, FL 33101, USA.
Email: adelamater@med.miami.edu

Abstract

Objective: The ISPAD recommends routine, comprehensive psychosocial screening for adolescents with diabetes. However, few clinics have implemented procedures consistent with these guidelines. This study describes the results of a universal, comprehensive psychosocial screening program in an integrated pediatric diabetes clinic located within an academic medical center.

Research Design and Methods: Participants included 232 ethnically diverse adolescents with type 1 diabetes (55.5% female; M age = 14.85; 58.5% Hispanic; 20% Black). Adolescents completed screening measures on iPads in the waiting room before their medical visit. The proportion of adolescents screening positive on each psychosocial measure was assessed, and regression analyses evaluated how psychosocial variables accounted for variance in insulin non-adherence and glycemic control (measured by A1c).

Results: Psychosocial concerns were common and ranged from 7% of adolescents screening positive for disordered eating and suicide risk to 52% screening positive for low motivation to manage diabetes. A1c and insulin non-adherence were positively correlated with suicide risk, depressive symptoms, anxiety, disordered eating, diabetes stress, blood glucose monitoring stress, family conflict, and total number of elevations, and negatively correlated with intrinsic motivation. Insulin non-adherence, disordered eating, diabetes stress, and family conflict uniquely predicted A1c. Age, motivation, and family conflict uniquely predicted insulin non-adherence. Eighty-three percent of eligible youth completed the screener. Referrals by physicians to the team psychologist increased by 25% after the screening program was implemented.

Conclusions: Comprehensive psychosocial screening can be effectively implemented as part of routine pediatric diabetes care and can identify adolescents in need of additional supports.

KEYWORDS
adherence, adolescent, glycemic control, psychosocial, type 1 diabetes

1 | INTRODUCTION

Psychosocial concerns, such as depression, anxiety, and family conflict create barriers to effective management of type 1 diabetes, particularly for adolescents, as studies indicate worsening of glycemic control over the course of adolescence.[1-3] Psychosocial screening is an important tool for identifying youth with type 1 diabetes who would benefit from mental health supports[4] and who are at risk for

subsequent problems with diabetes self-management.[5] Standardized, routine screening may more effectively identify patients in need of psychosocial care than the observations of medical providers.[6 7] The International Society of Pediatric and Adolescent Diabetes (ISPAD) recommends for children and adolescents with type 1 diabetes that routine assessment of quality of life, adjustment problems, depression, anxiety, disordered eating, diabetes distress, and other psychosocial issues be conducted at planned intervals by mental health professionals.[8] Recent work suggests that screening should occur more often than annually and should ideally include both parent and child reports of functioning.[9]

Most published studies of psychosocial screening programs within pediatric type 1 diabetes care have focused on quality of life or depression. A survey of 156 pediatric diabetes providers, representing 47 countries, found that approximately half of clinics reported routine psychosocial screening in the clinic; of these, most screened for overall psychological functioning or global quality of life only.[10] A minority of clinics (15.4%) screened for depressive symptoms (15%) or family functioning (10%).

Recently, there has been a push to integrate depression screening within pediatric diabetes care for adolescents with type 1 diabetes and studies suggest it can be implemented effectively. Patients generally find screening to be acceptable, and it does not disrupt clinic flow for providers.[11] Screening rates in routine clinical care range from 75% - 89%.[11-13] The Patient Health Questionnaire (PHQ-9)[14] is used most frequently to screen for depressive symptoms. Using this tool, rates of positive screens have ranged widely, with 6.7–17.3% reporting at least mild symptoms (PHQ-9 $\geq$ 5) [13,15] and 4.9–14.3% reporting at least moderate symptoms (PHQ-9 $\geq$ 10 or 11).[11 15-17] One recent program used the Children's Depression Inventory and reported 12% of adolescents with moderate depressive symptoms.[12] Though most programs report exclusively on depressive symptoms, one study also reported routine screening for anxiety using the General Anxiety Disorder –7 (GAD-7) in addition to the PHQ-9 for depressive symptoms; however, they did not report prevalence data.[18]

Although progress has been made with depression screening, most clinics' screening procedures fall short of the ISPAD guidelines for screening. Namely, screening should extend beyond depression and quality of life to include such concerns as anxiety, disordered eating, diabetes stress, and family conflict; motivation for diabetes management could be considered another important factor to screen for routinely. Thus, the current study describes the implementation of a universal, comprehensive psychosocial screening program in an integrated pediatric diabetes clinic in South Florida that serves a diverse patient population. Our objective was to conduct a screen of several clinically relevant psychosocial factors for all patients 12 years of age and older with type 1 diabetes at their regularly scheduled outpatient visit.

We had four specific aims. Aim 1 evaluated the percentage of youth 12 years of age and older screening positive for a variety of psychosocial concerns important to diabetes management. Second, we assessed the extent to which those screening positive for psychosocial factors other than depression also demonstrated elevated depressive symptoms. We hypothesized that most youth with psychosocial concerns in other areas would not have been identified via depression screening alone. The third aim examined the extent to which these psychosocial factors were associated with important clinical measures (i.e., insulin regimen adherence and glycemic control). We hypothesized that higher levels of depressive symptoms, anxiety, disordered eating, diabetes stress, blood glucose monitoring stress, and family conflict would be associated with more insulin non-adherence and worse glycemic control (i.e., higher A1c), while higher intrinsic motivation would be associated with better insulin adherence and glycemic control (i.e., lower A1c). We also hypothesized that psychosocial factors would account for a substantial amount of variance in insulin adherence and glycemic control. The fourth aim evaluated the screening rate among eligible patients to determine reach of the program, as well as the rate of physician referrals to our psychology team, anticipating that physicians would request more consultations with the embedded psychology team after the screening program was implemented.

2 | METHODS

2.1 | Participants and procedures

This study included adolescent patients from an academic pediatric endocrinology clinic in South Florida. The clinic's patient population is diverse, with 58.5% of patients reporting their ethnicity as Hispanic and 19.9% reporting their race as Black. Just over half of patients identify as female (54%). The clinic staff included three pediatric endocrinologists, two diabetes educators, two medical assistants, and a psychologist and psychology trainees. As part of a standard clinic protocol, pediatric patients with diabetes who were 12 years and older were screened for insulin non-adherence, intrinsic motivation for diabetes management, life satisfaction, depressive symptoms, anxiety symptoms, disordered eating, diabetes stress, blood glucose monitoring stress, and family conflict.

All patients completed the screeners via a Qualtrics questionnaire on iPads in the waiting room before their appointment. Qualtrics was configured to score the patient's results, which were reviewed by the psychology team, shared with the patient's medical provider and entered into the medical chart. If patients screened positive for depression, suicide risk, anxiety, and/or eating disorders, they were offered a consult with the embedded psychology team. This process entailed the psychology team sharing the screening results with physicians and suggesting that the patient be seen by psychology for further assessment; however, physicians sometimes referred patients to psychology for other reasons that arose during the clinic visit. All patients who endorsed any suicidal ideation were flagged for immediate consultation and seen by psychology. Patients screening positive in at least one of these domains or on any three or more domains were re-evaluated at the next clinic visit; otherwise, patients were

rescreened 1 year later. This study includes only the first screen clinic-wide over a 1-year period.

From our initial sample of 280 adolescents seen over the first year of the program, we excluded 38 individuals for not having type 1 diabetes as their primary diagnosis (e.g., type 2 diabetes, prediabetes, cystic fibrosis, and MODY were excluded). We then excluded 10 individuals with missing screening data; we used listwise deletion since fewer than 5% of participants were missing data. This led to a final analytic sample of 232 adolescents with type 1 diabetes. Data were typically missing due to the individual not having sufficient time to complete the full screener during the clinic visit. This study reports the results of a medical chart review, thus patient consent was not required.

2.2 | Measures

As described below, the study focused on measurement of glycemic control, insulin adherence, and several psychosocial factors that have been shown important to diabetes management, including intrinsic motivation for diabetes management, depression and suicide risk, anxiety, disordered eating, diabetes stress, blood glucose monitoring stress, family conflict, and life satisfaction.[8] Our psychosocial screener used either established measures or select items from established measures, with a priori cut-points to determine risk status, based on either established cut-points or our consensus clinical judgment. Prior to beginning the study, we piloted the screener with several patients in the study age range to determine feasibility: it took a mean time of 12 min for youth to complete the screener.

2.2.1 | Glycemic control

Glycosylated hemoglobin A1c values were obtained from patients' medical charts at the time of the outpatient visit; a point-of-care test is conducted routinely in the clinic. An A1c value above 7.0% was considered elevated, and values above 9.0% were considered very elevated.

2.2.2 | Insulin non-adherence

The Diabetes Self-Management Profile self-report (DSMP-SR) was used to measure problems with adherence to the insulin regimen.[19] The DSMP-SR is a reliable and valid measure that consists of 24 items with five subscales (BG monitoring, insulin use, eating, exercise, and hypoglycemia). For the purposes of this screening study we used only two insulin items: one assessed change in insulin dose when eating less food than usual (scored 0 = "I give less insulin when I eat less," 1 = "I give more insulin when I eat less," or 1 = "I do not adjust my insulin") and the other assessed frequency of missed insulin doses (scored 0, "I never forgot, I always take insulin," to 3, "I forgot more than once a week." Scores from these two items were summed (range 0–4); higher scores indicate poorer adherence, with scores ≥2 considered elevated.

2.2.3 | Intrinsic motivation for diabetes management

Two items from the Intrinsic Motivation Inventory–Diabetes Management (IDI-DM)[20] measured youths' perceptions of the importance of managing their diabetes ("Overall, having good blood sugar control is very important to me, a priority in my life") and their confidence to do so ("Overall, I feel confident in being able to manage my diabetes so that my blood sugar is in good control"). The full measure has adequate internal consistency and test–retest reliability in adolescents with diabetes and correlates significantly with regimen adherence and glycemic control[20]; the two items used in the screener had a high correlation with the total scale score. Items were rated from 1 (not at all true) to 7 (very true) and summed (range 2–14). Lower scores represent less motivation; scores ≤8 were considered at-risk.

2.2.4 | Depressive symptoms

The Patient Health Questionnaire–9 modified for Adolescents (PHQ-A)[14] is a measure of depressive symptoms that shows good sensitivity and specificity for detecting depression in adolescents.[21] Adolescents rated the nine items from 0 (not at all) to 3 (nearly every day). Items are summed with total scores ≥5 classified as mildly elevated and ≥ 10 as moderately elevated.[15]

2.2.5 | Suicide risk

Three items from the PHQ-A[14] assessed suicide risk. The first overlaps with one of the depressive items above and asked about thoughts that one might be better off dead or of self-harm in the past 2 weeks and was rated from 0 (not at all) to 3 (nearly every day). The other two items asked about suicidal ideation in the past month and lifetime history of a suicide attempt; both were rated 0 (no) or 1 (yes). These three items were summed, and scores ≥1 were classified as elevated.

2.2.6 | Anxiety symptoms

The General Anxiety Disorder –7 (GAD-7)[22] was used to screen for symptoms of anxiety. Research indicates that this scale has acceptable sensitivity and specificity for detecting anxiety in adolescents.[23] The seven items are rated from 0 (not at all) to 3 (nearly every day) and summed, with total scores ≥5 classified as mildly elevated and ≥ 10 as moderately elevated.[18]

2.2.7 | Disordered eating

Adolescents completed two items to assess binge eating with loss of control (e.g., "Are you afraid to start eating because you think you would not be able to stop?"), and five items assessing extreme weight

control behaviors (e.g., vomiting, not taking insulin, taking less insulin than I should, skipping meals, dieting). Items were based on weight-related outcome measures used in previous research,[24] adjusted to be relevant to adolescents with diabetes (i.e., insulin item added). Each item was rated as 1 (yes) or 0 (no). Items were summed (range 0–7), and total scores ≥1 were considered elevated, indicating the presence of at least one disordered eating behavior.

2.2.8 | Diabetes stress

Adolescents completed 10 items from the Diabetes Stress Questionnaire for Youth (DSQY).[25] These 10 items constitute a short form of the measure that correlates well with the total score from the entire measure.[26] The DSQY has demonstrated measurement invariance across sex, age, and glycemic control.[27] Items included situations that may cause stress for adolescents, such as "having an insulin reaction while I am with my friends" and "thinking that it is unfair that I got diabetes," and are rated from 0 (not at all upsetting or difficult) to 3 (very upsetting or difficult). Items were summed (range 0–30) and scores ≥12 were considered to be elevated.

2.2.9 | Blood-glucose monitoring stress

Adolescents completed two items, "I am upset when I have a high blood sugar" and "I feel frustrated when I have a low blood sugar" as a measure of negative emotional reactions to results of blood-glucose monitoring from the Blood Glucose Monitoring Communication Questionnaire.[28] This questionnaire has been shown to be reliable and valid in adolescents with diabetes, with higher scores correlated with worse glycemic control. Items were rated from 0 (almost never) to 2 (almost always) and summed (range of 0–4); scores ≥3 were considered elevated.

2.2.10 | Family conflict

Adolescents rated how much their family has argued about four diabetes-related issues in the past month on a scale from 0 (never argue) to 2 (always argue), including blood sugar checks, shots or boluses, meals and snacks, and results of blood sugar monitoring. Items came from the Diabetes Family Conflict Scale,[29] which has good psychometric properties. Items are summed (range of 0–8) and scores ≥5 were classified as elevated.

2.2.11 | Life satisfaction

Patients rated the extent to which they feel satisfied in various life domains on the Brief Multidimensional Student Life Satisfaction Scale – PTPB version.[30] This questionnaire contains six items rated from 1 (very dissatisfied) to 5 (very satisfied), with one item assessing overall life satisfaction and the other five assessing specific domains (family, friends, school, self, place one lives) and a mean score obtained. Higher scores represent greater life satisfaction, and scores ≤3 were considered at-risk. Patient reports of life satisfaction are important to assess as a goal of diabetes management is to ensure good quality of life.[8]

2.3 | Data analytic plan

In preliminary analyses, we used analysis of variance to test whether variables differed by sex, and Pearson correlations to examine how they varied with age. To address Aim 1, frequencies, means, and standard deviations were calculated for each variable. For Aim 2, we cross-tabulated the frequencies of those elevated on depressive symptoms with those elevated on other psychosocial variables (e.g., number elevated on both depression and anxiety) to determine percent overlap.

For Aim 3, chi-square tests evaluated how elevations in A1c and insulin non-adherence were associated with elevations in psychosocial variables, while Pearson correlations examined the associations between A1c, insulin non-adherence, and psychosocial variables. These analyses allowed us to determine relationships between variables at a bivariate level. Next, we used two hierarchical linear regressions to examine how psychosocial factors accounted for variance in A1c and insulin non-adherence, controlling for relevant demographic variables. Suicide risk was not included as a predictor in the regression models because it shared an item with depressive symptoms.

In addition, we report on the process of implementing the program (Aim 4). To determine the screening program's reach, we calculated the number of patients who completed the screener among all eligible youth who had outpatient appointments over the 12-month study period. A chart review was conducted to determine the percent change in requests for psychology consultations from the endocrinologists across the 10 months prior to and after the screening program was implemented. Each referral was coded based on the primary referral concern and included adherence, mental health, health behavior (e.g., sleep, exercise), new patient introductions, or other (e.g., planning for transition to adult care). Descriptive analyses assessed changes in types of referral concerns and differences in individual provider referrals.

3 | RESULTS

3.1 | Screening outcomes

Preliminary analyses revealed that girls (M = 1.73, SD = 1.24) reported greater blood glucose monitoring stress than boys (M = 1.33, SD = 1.09; $F[1, 254] = 6.66$, $p < .05$). Age was positively correlated with blood glucose monitoring stress ($r = 0.16$, $p < .05$) and insulin non-adherence ($r = 0.19$, $p < .01$).

TABLE 1 Frequencies, means, and standard deviations for study variables (*N* = 232)

	Elevated		Also elevated on depression (mild)			
	N	%	*N*	%	M	SD
A1c (%)	—	—	—	—	8.94	2.24
A1c > 7.0%	189	81.5	41	21.7	—	—
A1c > 9.0%	84	36.2	21	25.0	—	—
Insulin non-adherence	84	36.2	24	28.6	1.30	1.07
Low intrinsic motivation	120	51.7	37	30.8	11.62	2.51
Life satisfaction	12	5.2	4	33.3	4.46	0.80
Suicide risk	14	6.0	10	71.4	0.09	0.40
Depressive symptoms (≥ 5, mild)	49	21.1	—	—	2.48	3.63
Depressive symptoms (≥ 10, moderate)	9	3.9	—	—	2.48	3.63
Anxiety symptoms (≥ 5, mild)	42	18.1	29	69.0	2.34	3.90
Anxiety symptoms (≥ 10, moderate)	14	6.0	13	92.9	2.34	3.90
Disordered eating	16	6.9	8	50.0	0.09	0.38
Diabetes stress	50	21.6	27	54.0	7.11	6.09
Blood glucose monitoring stress	47	20.3	18	38.3	1.55	1.19
Family conflict	24	10.3	9	37.5	2.20	2.14
Total elevations	180	77.6	49	27.2	1.97	1.90

Note: For total elevations, *N* and % refer to the number of patients with at least one elevation on a psychosocial variable.

3.1.1 | Aims 1 and 2

Over half of patients were female (*n* = 126, 54.3%), and their mean age was 14.82 years (SD = 1.90). Table 1 contains the frequencies, means, and standard deviations of study variables. More than 80% of the sample had an A1c greater than 7.0% (*n* = 189, 81.5%), and 36.2% (*n* = 84) had an A1c greater than 9%. Over half of adolescents screened positive for low intrinsic motivation (*n* = 120, 51.7%) and over one-third screened positive for insulin non-adherence (*n* = 84, 36.2%). Additionally, over 20% of patients (*n* = 49, 21.1%) screened positive for mildly elevated symptoms of depression; 3.9% reported moderately elevated depressive symptoms, and 6% screened positive for suicide risk. Approximately one-fifth had elevated scores for diabetes stress (*n* = 50, 21.6%), while 18.1% reported mild anxiety symptoms and 6% reported moderate symptoms. As shown in Tables 1, 6.9% of youth screened positive for disordered eating, 10.3% for diabetes family conflict, 20.3% for blood glucose monitoring stress, and 5.2% for life satisfaction. Over three-quarters of adolescents screened positive in at least one area; of those elevated on at least one scale (*n* = 180), 27.2% screened positive for mild depressive symptoms and 5.0% screened positive for moderate depressive symptoms. Overlap between depressive symptoms and other variables ranged from 21.7 to 71.4%.

3.1.2 | Aim 3

In general, patients with elevations in A1c or insulin non-adherence were more likely to have elevations on psychosocial variables. Those with an A1c > 7.0% were more likely to screen positive for insulin non-adherence (χ^2 = 7.08, p < .01) and were more likely to be elevated on at least one psychosocial factor (χ^2 = 4.72, p < .05) compared to those with A1c ≤ 7.0%. These relationships were more dramatic for adolescents with an A1c > 9.0%, who were substantially more likely to have elevations on at least one of the psychosocial variables (χ^2 = 12.58, p < .001) than their counterparts with A1c ≤ 9.0%. Specifically, they were more likely to have screened positive for insulin non-adherence (χ^2 = 19.63, p < .001), low intrinsic motivation (χ^2 = 5.47, p < .02),, low life satisfaction (χ^2 = 5.07, p < .05), suicide risk (χ^2 = 22.63, p < .001), disordered eating (χ^2 = 7.88, p < .01), diabetes stress (χ^2 = 18.36, p < .001), blood glucose monitoring stress (χ^2 = 5.63, p < .05), and family conflict (χ^2 = 10.75, p < .01). Adolescents elevated on insulin non-adherence were more likely to have screened positive for low intrinsic motivation (χ^2 = 11.77, p < .01), depressive symptoms (χ^2 = 4.39, p < .05), anxiety (χ^2 = 5.81, p < .05), diabetes stress (χ^2 = 5.25, p < .05), and family conflict (χ^2 = 5.67, p < .05) compared to those not elevated on insulin non-adherence.

Table 2 reports intercorrelations among study variables. Both A1c and insulin non-adherence were significantly positively associated with suicide risk, anxiety, diabetes stress, blood glucose monitoring stress, family conflict, and total number of elevations, and they were significantly negatively associated with intrinsic motivation. A1c also correlated negatively with life satisfaction and positively with disordered eating, while insulin non-adherence correlated positively with depressive symptoms.

Tables 3 and 4 report results of hierarchical linear regressions predicting A1c (Table 3) and insulin non-adherence (Table 4). We

TABLE 2 Correlations among study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
Age (years)	1.00												
A1c	0.10	1.00											
Insulin non-adherence	0.19**	0.30***	1.00										
Motivation	−0.06	−0.18**	−0.23***	1.00									
Life satisfaction	−0.12	−0.19**	−0.04	0.29***	1.00								
Suicide risk	0.10	0.15*	0.14*	−0.22**	−0.16*	1.00							
Depressive symptoms	0.09	0.12	0.20**	−0.25***	−0.27***	0.62***	1.00						
Anxiety symptoms	0.06	0.15*	0.20**	−0.21**	−0.30***	0.48***	0.77***	1.00					
Disordered eating	−0.02	0.21**	0.10	−0.18**	−0.22**	0.35***	0.26***	0.20**	1.00				
Diabetes stress	0.05	0.34***	0.30***	−0.30***	−0.27***	0.38***	0.60***	0.63***	0.19**	1.00			
Blood glucose monitoring stress	0.16*	0.22**	0.17**	−0.06	−0.11	0.07	0.29***	0.35***	0.12	0.50***	1.00		
Family conflict	0.09	0.32***	0.33***	−0.22**	−0.09	0.27***	0.36***	0.36***	0.12	0.52***	0.38***	1.00	
Total elevations	0.12	0.37***	0.47***	−0.47***	−0.40***	0.49***	0.71***	0.70***	0.43***	0.74***	0.49***	0.55***	1.00

*$p < .05$.
**$p < .01$.
***$p < .001$.

TABLE 3 Hierarchical linear regression with psychosocial variables and insulin non-adherence predicting A1c

	b	SE b	β	FΔ	F model	R^2Δ	R^2
Step 1				2.37	2.37	0.010	0.01
Age	0.12	0.08	0.10				
Step 2				21.33***	11.96***	0.084	0.10
Age	0.05	0.08	0.04				
Insulin non-adherence	0.62	0.14	0.30***				
Step 3				4.94***	6.68***	0.137	0.23
Age	0.05	0.07	0.04				
Insulin non-adherence	0.38	0.14	0.18**				
Intrinsic motivation	−0.01	0.06	−0.02				
Life satisfaction	−0.31	0.18	−0.11				
Depressive symptoms	−0.12	0.06	−0.19				
Anxiety	−0.02	0.06	−0.04				
Disordered eating	0.89	0.37	0.15*				
Diabetes stress	0.10	0.03	0.26**				
Blood glucose monitoring stress	0.05	0.13	0.03				
Family conflict	0.16	0.08	0.15*				

*$p < .05$.
**$p < .01$.
***$p < .001$.

TABLE 4 Hierarchical linear regression with psychosocial variables predicting insulin non-adherence

	b	SE b	β	FΔ	F model	R^2Δ	R^2
Step 1				8.73**	8.73**	0.04	0.04
Age	0.11	0.04	0.19**				
Step 2				4.87***	5.43***	0.14	0.18
Age	0.10	0.04	0.17**				
Intrinsic motivation	−0.06	0.03	−0.14*				
Life satisfaction	0.12	0.09	0.09				
Depressive symptoms	−0.01	0.03	−0.04				
Anxiety	0.01	0.03	0.04				
Disordered eating	0.13	0.18	0.05				
Diabetes stress	0.03	0.02	0.17				
Blood glucose monitoring stress	−0.02	0.07	−0.02				
Family conflict	0.10	0.04	0.20**				

*$p < .05$.
**$p < .01$.
***$p < .001$.

controlled for age due to its significant correlation with insulin non-adherence. Psychosocial variables accounted for an additional 13.7% of the variance in A1c, after age and insulin non-adherence were controlled. The full model accounted for 23.2% of the variance in A1c (F [8, 221] = 6.68, $p < .001$), with insulin non-adherence (β = 0.18, $p < .01$), disordered eating (β = 0.15, $p < .05$), diabetes stress (β = 0.26, $p < .01$), and family conflict (β = 0.16, $p < .05$) emerging as unique predictors of the variance in A1c. In the second regression, psychosocial variables accounted for an additional 14.4% of variance in insulin non-adherence after age was controlled. The full model accounted for 18.0% of the variance in insulin non-adherence (F [8, 222] = 5.43, $p < .001$). Age (β = 0.17, $p < .01$), intrinsic motivation (β = −0.14, $p < .05$), and family conflict (β = 0.20, $p < .01$) uniquely predicted insulin non-adherence.

3.2 | Process outcomes

3.2.1 | Aim 4

In the first 12 months of the screening program, from May 2018 to April 2019, among all patients seen (including those with type 2 diabetes and pre-diabetes), 280 youth were screened during their diabetes care visits, achieving an 83.1% screening rate (N = 338 eligible for screening). Ten months after the screening program was implemented, the total number of psychological consultations increased by 24.9% (*n* = 181 pre-screening vs. 226 post-screening), compared to the 10 months prior. This included a 71.9% increase in consultations related to mental health concerns (57 vs. 98) and a 62.5% increase in new patient introductions (16 vs. 26). Consultations for health behavior concerns (e.g., sleep problems) and treatment adherence concerns were similar before and after the screener was implemented. Additionally, all physicians requested more psychological consultations with the screening program in place. Physician 1, who made the highest number of referrals overall, had a 15.2% increase in referral rate (138 vs. 159); Physician 2 and Physician 3 had increases of 54.2% (24 vs. 37) and 57.9% (19 vs. 30), respectively.

4 | DISCUSSION

The primary objective of this study was to determine the proportion of adolescents with type 1 diabetes who screened positive for psychosocial concerns assessed via a comprehensive screening process integrated into routine clinical care. Consistent with past work, we found that such concerns were common.[31] We found high rates of positive screens for a variety of psychosocial concerns: over half of youth in our clinic endorsed low intrinsic motivation to manage their diabetes, and approximately one-fifth screened positive for at least mild symptoms of anxiety, depression, and/or diabetes stress.

Importantly, this study identified psychosocial concerns in a diverse clinic population where nearly 60% of patients are Hispanic. Studies in the general population (i.e., without diabetes) document higher rates of depressive symptoms in Hispanic adolescents comparison to their non-Hispanic White and Black counterparts.[32] Psychosocial screening may be particularly critical in clinics that serve diverse patient populations, as minority youth are considerably less likely to access mental health services.[33]

Few studies of psychosocial screening in other clinics exist, making comparisons of prevalence rates difficult, especially for issues other than depression. Comparing rates is further complicated by differences in age range and cut-off values across studies. However, our study identified similar proportions of youth with anxiety and disordered eating reported in other studies.[31] Rates of moderate depressive symptoms were somewhat lower than what has been reported in other clinics, [11,15-17] but rates of mild depressive symptoms were somewhat higher.[13 15] Notably, only 27.2% of adolescents with an elevation on at least one psychosocial variable were elevated for mild depressive symptoms, highlighting the importance of screening for other psychosocial concerns. Based on our results, if clinics only flag adolescents reporting at least moderate symptoms of depression, they may only capture relatively few of those with psychosocial concerns. By lowering cut-offs and screening for a wider set of concerns, clinics may be better situated to identify adolescents at risk for both current and future problems with diabetes management. Identifying and addressing a variety of psychosocial concerns occurring even at mild levels may serve an important preventative function.

We found that elevations on psychosocial variables were associated with greater difficulties with insulin adherence and worse glycemic control. These findings are consistent with past research[2 16 31] and underscore the need for routine psychosocial screening, which can identify youth who are struggling and direct them to appropriate support. This is significant because research indicates that psychosocial concerns can have a long-term impact on important diabetes outcomes. For example, one study found that friendship conflict and psychological distress at age 12 years predicted poor trajectories of glycemic control in young adulthood,[3] while other work suggests that adolescents with higher depression scores monitored their blood glucose less frequently 1 year later.[5] Identifying adolescents at risk for psychosocial problems and referring them to appropriate intervention should be a key priority for pediatric diabetes care providers.

While nearly all psychosocial variables were significantly associated with A1c and insulin non-adherence in bivariate analyses, some demonstrated unique contributions in multivariate analyses. Insulin non-adherence, disordered eating, diabetes stress, and family conflict uniquely predicted A1c, while age, motivation, and family conflict uniquely predicted insulin non-adherence. These findings again underscore the need for comprehensive screening: when clinics screen for depression alone, they may miss other concerns that impact critical diabetes outcomes. For example, we found that approximately half of adolescents reporting disordered eating behavior, diabetes stress, low motivation, and family conflict also had elevated depressive symptoms. Likewise, less than one-third of those who were elevated on insulin non-adherence had depressive symptoms. Given that over half the sample reported low intrinsic motivation and nearly one-quarter had high diabetes stress, these seem particularly important to include in a screening program.

Clinicians often attribute low motivation as a factor in poor diabetes management. Our finding that 51.7% of youth had low motivation for diabetes management underscores this point. In bivariate analyses, low motivation was associated with poor glycemic control and insulin non-adherence; multivariate analysis showed low motivation uniquely predicted insulin non-adherence. Several controlled intervention studies demonstrate that increasing motivation for self-care in youth with type 1 diabetes has beneficial effects. For example, one study showed that motivational interviewing improved glycemic control and quality of life,[34] while another study targeted motivation with an individualized personal trainer approach and showed improved long-term glycemic control in older adolescents.[35] Meta-analytic reviews also support the use of motivational interviewing with various pediatric populations in terms of improved health outcomes.[36 37] Thus, it seems reasonable to identify patients at risk for low intrinsic motivation for diabetes management and provide them appropriate motivational

interventions. More research is needed to validate the cut-point used to identify low motivation, and to demonstrate the efficacy of motivational interventions, particularly for patients who have multiple risk factors for poor diabetes outcomes.

Another interesting finding was that disordered eating and diabetes stress uniquely predicted A1c. Psychosocial screening that includes questions about eating behaviors may be an important tool to alert medical providers to include diabetes educators, nutritionists, and behavioral health specialists in the patient's care.[8] These individuals can support healthier strategies related to weight management and help patients to cope more effectively with stress.

Additionally, our results indicate that family conflict is associated with poorer insulin adherence and glycemic control, consistent with past research.[2 16 31] One study found that family conflict mediated the relationship between difficulties with self-regulation and glycemic control, suggesting that family conflict exacerbates a teen's difficulties with following their diabetes treatment regimen.[38] Family members may play an especially important role in our largely Hispanic clinic sample, as past work documents that family support is associated with better adherence in this population and that it mediates the relationship between adolescent responsibility for diabetes management and adherence.[2] The current study also found that insulin non-adherence was positively correlated with age; it may be that family conflict presents a barrier to adolescents' transition to self-management.

Study findings suggest that comprehensive psychosocial screening can be successfully integrated into routine clinical care for adolescents with diabetes. Our program achieved a screening rate of 83.1% of eligible youth screened, and we found that of those who were screened, 96% were able to complete the screener in its entirety (i.e., no missing data) while waiting for their medical visit to begin. Moreover, having the screening process in place appeared to impact clinical care as a whole: all endocrinologists in the clinic made more referrals after the screener was implemented, particularly for mental health-related concerns. This suggests that the screening program can help physicians more readily identify when it is appropriate to make a referral to psychology. However, we cannot be certain that it was the screening program that accounted for the observed increase in referrals after the program was initiated, as sometimes physicians referred patients for a psychology consult for other reasons. While we did not precisely measure whether all patients with elevations actually received a psychology consultation, the majority of patients who screened positive were seen by the psychology team. There were some cases in which patients with elevations may have left their clinic appointment without having been seen by psychology: in the course of a busy clinic, psychology team members were sometimes busy with other consults and by the time they were free, the patient had left.

Although routine psychosocial screening in pediatric diabetes clinics may be an effective tool to identify youth who are struggling with psychosocial problems and refer them to appropriate resources for care, screening and referral alone are not sufficient to ensure that care is actually received. One study found that less than one-quarter of youth with diabetes enrolled in community-based outpatient mental health services after receiving a referral during a diabetes clinic visit.[39] Another found that 22% of pediatric patients with diabetes scheduled a visit with a mental health provider who worked as part of the diabetes care team in their clinic, and 82% of those who scheduled a visit followed through,[40] underscoring the critical role of integrated care models for ensuring that youth with diabetes access mental health care.[41] It is clear that if screening programs are initiated, there must be a process for appropriate referrals to address those concerns that are identified.

4.1 | Strengths and limitations

To our knowledge, this is the first study to report the results of a comprehensive psychosocial screening program implemented as a routine part of clinical care for a large and diverse group of adolescents with diabetes. It offers a blueprint for other clinics seeking to implement screening in accordance with the ISPAD guidelines.[8]

Study limitations include the cross-sectional design and self-reported data; future research should incorporate parent reports of youth functioning, prospective study of patients screening positive for various psychosocial problems, as well as evaluate psychosocial and behavioral factors in youth with type 2 diabetes. Because of the small number of youth with type 2 diabetes seen in our clinic during the study period, we excluded them from the current analyses, thus limiting our ability to assess for moderation by diabetes type. While we found that psychology referrals increased after implementation of the screening program, it should be noted that this was only for within-clinic consults to our psychology team; we did not track outcomes with regard to patients referred by our team to community mental health providers.

We utilized validated screening measures for depression, anxiety, disordered eating, diabetes stress, and life satisfaction; however, we modified validated measures of diabetes family conflict, intrinsic motivation, and blood glucose monitoring stress for screening purposes, and then determined the cut-points used for these measures in our screening program on an a priori basis considering previous research as well as clinical significance. Further study is needed to validate these brief scales and cut-points, but the current findings documenting significant associations with insulin regimen adherence and glycemic control provide support for their use. Our screening protocol was comprehensive, but it proved feasible and generally took less than 12 min for youths to complete prior to their medical visit. Further work to reduce the screening protocol is ongoing. Finally, while our clinic's diversity is a strength, our results may not generalize to adolescents in other locations. Likewise, our clinic is located within a large academic medical center that hosts a psychology internship training program. Clinics with less access to psychologists or other mental health professionals may have more difficulty implementing a similar protocol.

5 | CONCLUSIONS

These findings underscore the importance of comprehensive psychosocial screening as a part of routine clinical care for adolescents with

type 1 diabetes, in line with the guidelines promoted by ISPAD.[8] The results of this study indicate that comprehensive screening can be implemented effectively and offers initial support for a preventive psychosocial screening program for identifying patients' unmet psychosocial needs. Future research is needed to determine how to best facilitate connections to mental health services once needs are identified. Integrated care models, with psychologists or other behavioral health specialists as members of diabetes teams, are essential to promote access to psychological services in youth with diabetes.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Alan M. Delamater, Eileen M. Davis, and Janine Sanchez conceived the study and designed the screening program, with input from Courtney Lynn and Joyce H. L. Lui. Kaitlyn E. Broda conducted final statistical analyses and prepared a first draft of the manuscript. Eileen M. Davis, Courtney Lynn, Lolly Starr-Glass, and Joyce H. L. Lui conducted the chart review and preliminary statistical analyses. All authors provided critical feedback on the manuscript.

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1111/pedi.13193.

DATA AVAILABILITY STATEMENT

Data available on request from the authors. The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This study was approved by the Institutional Review Board at the University of Miami.

ORCID

Alan M. Delamater https://orcid.org/0000-0003-2320-4164

REFERENCES

1. Baucom KJW, Turner SL, Tracy EL, Berg CA, Wiebe DJ. Depressive symptoms and diabetes management from late adolescence to emerging adulthood. *Health Psychol*. 2018;37(8):716-724.
2. Hsin O, La Greca AM, Valenzuela J, Moine CT, Delamater A. Adherence and glycemic control among Hispanic youth with type 1 diabetes: role of family involvement and acculturation. *J Pediatr Psychol*. 2010;35(2):156-166.
3. Helgeson VS, Vaughn AK, Seltman H, Orchard T, Libman I, Becker D. Trajectories of glycemic control over adolescence and emerging adulthood: an 11-year longitudinal study of youth with type 1 diabetes. *J Pediatr Psychol*. 2017;43(1):8-18.
4. American Diabetes Association. Children and adolescents: standards of medical care in diabetes - 2019. *Diabetes Care*. 2019;42:S148-S164.
5. Hilliard ME, Herzer M, Dolan LM, Hood KK. Psychological screening in adolescents with type 1 diabetes predicts outcomes one year later. *Diabetes Res Clin Pract*. 2011;94(1):39-44.
6. Silverstein J, Cheng P, Ruedy KJ, et al. Depressive symptoms in youth with type 1 or type 2 diabetes: results of the pediatric diabetes consortium screening assessment of depression in diabetes study. *Diabetes Care*. 2015;38(12):2341-2343.
7. Boogerd EA, Damhuis AM, van Alfen-van der Velden JA, et al. Assessment of psychosocial problems in children with type 1 diabetes and their families: the added value of using standardised questionnaires in addition to clinical estimations of nurses and paediatricians. *J Clin Nurs*. 2015;24(15–16):2143-2151.
8. Delamater AM, de Wit M, McDarby V, et al. ISPAD clinical practice consensus guidelines 2018: psychological care of children and adolescents with type 1 diabetes. *Pediatr Diabetes*. 2018;19:237-249.
9. Barry-Menkhaus SA, Stoner AM, MacGregor KL, Soyka LA. Special considerations in the systematic psychosocial screening of youth with type 1 diabetes. *J Pediatr Psychol*. 2020;45(3):299-310.
10. de Wit M, Pulgaron ER, Pattino-Fernandez AM, Delamater AM. Psychological support for children with diabetes: are the guidelines being met? *J Clin Psychol Med Settings*. 2014;21(2):190-199.
11. Iturralde E, Adams RN, Barley RC, et al. Implementation of depression screening and global health assessment in pediatric subspecialty clinics. *J Adolesc Health*. 2017;61(5):591-598.
12. Corathers SD, Kichler J, N-HY J, et al. Improving depression screening for adolescents with type 1 diabetes. *Pediatrics*. 2013;132(5):e1395.
13. Marker AM, Patton SR, McDonough RJ, Feingold H, Simon L, Clements MA. Implementing clinic-wide depresion screening for pediatric diabetes: an initiative to improve healthcare processes. *Pediatr Diabetes*. 2019;20:964-973.
14. Johnson JG, Harris ES, Spitzer RL, Williams JB. The patient health questionnaire for adolescents: validation of an instrument for the assessment of mental disorders among adolescent primary care patients. *J Adolesc Health*. 2002;30(3):196-204.
15. Mulvaney SA, Mara CA, Kichler JC, et al. A retrospective multisite examination of depression screening practices, scores, and correlates in pediatric diabetes care. *Transl Behav Med*. 2019;11(1):122-131.
16. Wolfgram P, Zhang L, Simpson P, Fiallo-Scharer R. Clinical associations of quarterly patient health Questionnaire-9 depression screening results in adolescents with type 1 diabetes. *Pediatr Diabetes*. 2020;21(5):871-877.
17. Wong JJ, Addala A, Abujaradeh H, et al. Depression in context: important considerations for youth with type 1 vs type 2 diabetes. *Pediatr Diabetes*. 2020;21(1):135-142.
18. Watson SE, Spurling SE, Fieldhouse AM, Montgomery VL, Wintergerst KA. Depression and anxiety screening in adolescents with diabetes. *Clin Pediatr*. 2020;59(4–5):445-449.
19. Wysocki T, Buckloh LM, Antal H, Lochrie A, Taylor A. Validation of a self-report version of the diabetes self-management profile. *Pediatr Diabetes*. 2012;13(5):438-443.
20. Delamater AM, Daigre AL, Marchante AN, Pulgarón ER, Patiño-Fernandez AM, Sanchez J. Intrinsic motivation in ethnic minority youth with type 1 diabetes. *Child Health Care*. 2017;46(3):215-229.
21. Richardson LP, McCauley E, Grossman DC, et al. Evaluation of the patient health Questionnaire-9 item for detecting major depression among adolescents. *Pediatrics*. 2010;126(6):1117-1123.
22. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166(10):1092-1097.
23. Mossman SA, Luft MJ, Schroeder HK, et al. The generalized anxiety disorder 7-item scale in adolescents with generalized anxiety disorder: signal detection and validation. *Ann Clin Psychiatry*. 2017;29(4):227-34A.
24. Neumark-Sztainer DR, Wall MM, Haines JI, Story MT, Sherwood NE, van den Berg PA. Shared risk and protective factors for overweight and disordered eating in adolescents. *Am J Prev Med*. 2007;33(5):359-369.
25. Delamater AM, Patiño-Fernández AM, Smith KE, Bubb J. Measurement of diabetes stress in older children and adolescents with type 1 diabetes mellitus. *Pediatr Diabetes*. 2013;14(1):50-56.

26. Delamater AM, Pulgaron E, Niel K. *Evaluation of the Diabetes Stress Questionnaire - Short Form in Ethnic Minority Children with Type 1 Diabetes*. Innsbruck, Austria: Annual Meeting of the International Society of Pediatric and Adolescent Diabetes; 2017.
27. Kamody RC, Berlin KS, Hains AA, et al. Assessing measurement invariance of the diabetes stress questionnaire in youth with type 1 diabetes. *J Pediatr Psychol*. 2014;39(10):1138-1148.
28. Hood KK, Butler DA, Volkening LK, Anderson BJ, Laffel LM. The blood glucose monitoring communication questionnaire: an instrument to measure affect specific to blood glucose monitoring. *Diabetes Care*. 2004;27(11):2610-2615.
29. Hood KK, Butler DA, Anderson BJ, Laffel LM. Updated and revised diabetes family conflict scale. *Diabetes Care*. 2007;30(7):1764-1769.
30. Athay MM, Kelley SD, Dew-Reeves SE. Brief multidimensional students' life satisfaction scale-PTPB version (BMSLSS-PTPB): psychometric properties and relationship with mental health symptom severity over time. *Adm Policy Ment Health*. 2012;39(1–2):30-40.
31. Bernstein CM, Stockwell MS, Gallagher MP, Rosenthal SL, Soren K. Mental health issues in adolescents and young adults with type 1 diabetes: prevalence and impact on glycemic control. *Clin Pediatr*. 2013;52(1):10-15.
32. Kann L, McManus T, Harris WA, et al. Youth risk behavior surveillance—United States, 2017. *MMWR Surveill Summ*. 2018;67(8):1-114.
33. Merikangas KR, He J-p, Burstein M, et al. Service utilization for lifetime mental disorders in U.S. adolescents: results of the National Comorbidity Survey–Adolescent Supplement (NCS-A). *J Am Acad Child Adolesc Psychiatry*. 2011;50(1):32-45.
34. Channon SJ, Huws-Thomas MV, Rollnick S, et al. A multicenter randomized controlled trial of motivational interviewing in teenagers with diabetes. *Diabetes Care*. 2007;30(6):1390-1395.
35. Nansel TR, Iannotti RJ, Simons-Morton BG, Plotnick LP, Clark LM, Zeitzoff L. Long-term maintenance of treatment outcomes: diabetes personal trainer intervention for youth with type 1 diabetes. *Diabetes Care*. 2009;32(5):807-809.
36. Gayes LA, Steele RG. A meta-analysis of motivational interviewing interventions for pediatric health behavior change. *J Consult Clin Psychol*. 2014;82(3):521-535.
37. Borrelli B, Tooley EM, Scott-Sheldon LA. Motivational interviewing for parent-child health interventions: a systematic review and meta-analysis. *Pediatr Dent*. 2015;37(3):254-265.
38. Vaid E, Lansing AH, Stanger C. Problems with self-regulation, family conflict, and glycemic control in adolescents experiencing challenges with managing type 1 diabetes. *J Pediatr Psychol*. 2018;43(5):525-533.
39. Vassilopoulos A, Valenzuela JM, Tsikis J, et al. Pediatric diabetes patients infrequently access outpatient psychology services following screening and referral: implications for practice. *Child Health Care*. 2019;49(2):202-217.
40. Markowitz JT, Volkening LK, Laffel LMB. Care utilization in a pediatric diabetes clinic: cancellations, parental attendance, and mental health appointments. *J Pediatr*. 2014;164(6):1384-1389.
41. Delamater AM, Guzman A, Aparicio K. Mental health issues in children and adolescents with chronic illness. *Int J Hum Rights Healthc*. 2017;10(3):163-173.

How to cite this article: Brodar KE, Davis EM, Lynn C, et al. Comprehensive psychosocial screening in a pediatric diabetes clinic. *Pediatr Diabetes*. 2021;1–11. https://doi.org/10.1111/pedi.13193