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Depressive Symptoms in Adolescents with Type 1 Diabetes: Associations with Longitudinal Outcomes

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Abstract

Associations between depressive symptoms, blood glucose monitoring (BGM) frequency, and glycemic control (A1c values) were examined in adolescents with type 1 diabetes. Increased depressive symptoms were associated with lower BGM frequency and higher A1c values. Symptoms of ineffectiveness and negative mood were most commonly endorsed, representing targets for clinical interventions.

Keywords

Adolescents with type 1 diabetes are at an increased risk for depression, with prevalence rates in this population estimated to be at least twice those in medically-well adolescents [1;2;3;4]. While increased depressive symptoms have been linked to decreased blood glucose monitoring (BGM) frequency and suboptimal glycemic control, the pattern of depressive symptoms in this population remains unknown [5]. Specifically, it is unclear whether certain symptoms are more common and more closely linked to diabetes management and glycemic control. Thus, we aimed to examine symptom patterns across two study visits, separated by six months.

Method

Participants

A total of 144 adolescents (ages 13-18) receiving care at a pediatric diabetes clinic and their caregivers participated in this study. All participants had a diagnosis of type 1 diabetes according to the practice guidelines of the American Diabetes Association (ADA). Exclusion criteria included the presence of a major psychiatric or neurocognitive disorder; an additional medical disease other than treated thyroid disorders or celiac disease; and the inability to read or understand English. Of the eligible adolescents approached, 90% agreed to participate.

Procedures

All study procedures were approved by our Institutional Review Board, and appropriate consent was obtained. A research assistant administered questionnaires before or after clinic appointments. Follow-up questionnaires were administered six months after the initial appointment. The data for this study are a part of a larger dataset examining psychological, family, and disease factors in children and adolescents with type 1 diabetes.

Measures

Depression—Adolescent's depressive symptoms were assessed using the Children's Depression Inventory (CDI), a 27 item self-report questionnaire [6]. Items are rated on a scale of 0 (no symptoms) to 2 (distinct symptom). Total scores of 13 or higher are suggestive of "clinically significant" symptoms of depression warranting further evaluation [3;6]. The CDI also provides scores for subscales examining negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem. The CDI demonstrated a high degree of internal consistency in this sample (α=.84).

Adherence—BGM frequency was obtained through meter download at the time of the clinic appointment. Data was downloaded from the past two weeks and used to calculate a daily average. If a meter was not available, medical chart or adolescent self-report value was used. Self-report values were adjusted to reflect the relationship between meter and self-report values for adolescents who provided both. Based on the relationship in this sample, the self-report value was multiplied by 0.84 at time one, and 0.89 at time two. This method has previously been used to calculate BGM frequency [5].

Hemoglobin A1c—Hemoglobin A1c values were determined using the DCA 2000+ (reference range 4.3-5.7%, Bayer Inc.; Tarrytown, NY).

Demographics and diabetes variables—Demographic variables including the adolescent's age, ethnicity, and gender, and caregiver's education level, marital status, and insurance status were obtained from a self-report questionnaire completed by the caregiver. Duration of diabetes and mode of insulin administration were ascertained through chart review.

Statistical Analyses

Prior to analysis, data were double entered and cross-checked for accuracy. Descriptive statistics and frequencies were calculated for the total sample. To account for the differing number of items on each of the CDI subscales, an item mean was obtained for each subscale. Bivariate correlations were used to examine the relationships between CDI subscales, BGM frequency, and A1c. Analyses were conducted in SAS v9.1.

Results

Participants were primarily white (87%), female (69%), and from a two-caregiver household (76%, see Table 1). The majority of participants used pumps for insulin delivery and engaged in BGM at least three times a day, 3.56±1.52.

Participants had a mean CDI total score of 7.92±7.14 at baseline, with 33 (23%) scoring above the clinical cutoff. Adolescents reported the most symptoms on the Ineffectiveness subscale, 0.38±0.41, followed by the Negative Mood, 0.34±0.36, Anhedonia, 0.32±0.30, Negative Self-Esteem, 0.24±0.30, and Interpersonal Problems, 0.15±0.23, subscales.

CDI scores and all individual subscales were related to BGM frequency at baseline (see Table 2). The CDI total score, and Negative Mood, Ineffectiveness, and Negative Self-Esteem subscales were related to BGM frequency at follow-up ($p<.05$).

CDI scores on the Negative Mood, Ineffectiveness, and Interpersonal Problems subscales were related to A1c at the same time point. None of the CDI scores were related to measures of A1c six months later ($p>.05$).

Discussion

Nearly a quarter of participants endorsed "clinically significant" levels of depressive symptoms. Commonly endorsed clusters of symptoms related to negative mood, anhedonia, and ineffectiveness. Symptoms of negative mood included sadness and indecisiveness, while anhedonia is characterized by a loss of energy and appetite disturbances. These symptoms may inhibit adolescents from initiating and following through with diabetes management. Ineffectiveness indicates feelings of poor self-efficacy, which has been linked to decreased adherence [7].

The Ineffectiveness and Negative Mood subscales also predicted BGM frequency six months later. Based on the high rates of endorsement, these symptoms would likely be important targets in clinical interventions aimed at improving adherence. By diminishing negative mood and promoting self-efficacy, there may be immediate and sustained improvements in adherence.

Similar clusters of symptoms were correlated with present, but not future, A1c. This supports previous findings which suggest that A1c is largely impacted by depression through a mediating variable such as adherence [5].

There are several limitations. First, depressive symptoms were measured through self-report, and clinician assessments may reveal a more comprehensive picture of the adolescent's depression. Second, the sociodemographic characteristics of the sample suggest caution when generalizing to other samples. Finally, examination of changes in depressive symptoms over time was beyond the scope of this study, and should be included in future research.

In summary, this paper is the first to examine the responses on CDI subscales in adolescents with type 1 diabetes. Symptoms of ineffectiveness and negative mood were most commonly endorsed and linked to both BGM and A1c. They may represent targets for future clinical interventions.

Acknowledgments

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Table 1

Participant Characteristics

Characteristic	Total Sample $n = 144$
Age (years)	15.45 ± 1.39
Gender, N (% male)	69 (48%)
Ethnicity, N (% white, not of Hispanic origin)	125 (87%)
Caregiver marital status, N (% married)	109 (76%)
Education level of primary caregiver, N (% with at least a college degree)	68 (47%)
Insurance Status, N (% private)	123 (85%)
Type 1 diabetes duration (years)	5.94 ± 3.78
Hemoglobin A1c (%)	3.57 ± 1.52
Blood glucose monitoring frequency (times daily)	3.91 ± 1.64
Method of insulin delivery	
Multiple daily injections, N (%)	36%
CSII, N (%)	64%

Table 2

Correlations Between Depressive Symptoms at Time One and Outcomes

	Time 1		Time 2	
	BGMF	**A1c**	**BGMF**	**A1c**
CDI Total Score	-.29***	.26**	-.16*	.12
Negative Mood	-.27**	.23**	-.17*	.14
Interpersonal Problems	-.21*	.20*	-.07	.11
Ineffectiveness	-.23**	.32****	-.17*	.15
Anhedonia	-.23**	.16	-.07	.02
Negative Self-Esteem	-.23**	.15	-.17*	.11

Note.

*
p < .05;

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p < .01;

***
p < .001;

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p < .0001