

Mental Health and Behavioral Screening in Pediatric Type 1 Diabetes

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Mental health comorbidities are increasingly being recognized in children and adolescents with type 1 or type 2 diabetes (1–3). Several studies have found increased rates of depressive symptoms (1), clinical depression (2), and anxiety disorders (3) in pediatric patients with type 1 diabetes when compared to healthy peers. Some studies have also identified an association between poor glycemic control and more severe depression scores (4,5). Additional mental health and behavioral issues have been described in this population, including disordered eating behaviors and attention-deficit hyperactivity disorder (ADHD) (3,6).

A wide variety of screening tools have been used in the diabetes population in attempts to identify patients with mental health comorbidities. These include the Patient Health Questionnaire-9 (4,7), the Children's Depression Inventory (1), Beck's Depression Inventory (5), and the Screen for Childhood Anxiety Related Emotional Disorders (5). However, a combination of several different screening tools is required to adequately identify the wide range of mental health and behavioral comorbidities that exist within the pediatric diabetes population.

The Strengths and Difficulties Questionnaire (SDQ) has emerged as a more comprehensive tool for assessing mental health comorbidities in children with a variety of chronic diseases, including asthma, chronic kidney disease, primary antibody

deficiency, and neurological disorders (8–10). The advantage of the SDQ is that it is a relatively short instrument that screens for a wider range of psychosocial and behavioral issues than other commonly used assessment tools, identifying symptoms of anxiety, depression, hyperactivity-inattention, conduct disorder, and peer relationship problems (11).

The aim of this study was to examine the results of routine mental health and behavioral screening in children and adolescents with type 1 diabetes using the SDQ Self-Reported Version when compared to screening results from children without chronic disease. Clinically, the purpose of screening with the SDQ was to identify not only children at risk for anxiety and depression, but also those who were struggling with a wider range of behavioral issues.

Although previous studies have described the existence of mental health issues such as depression, anxiety, and disordered eating behaviors within the pediatric population with diabetes (1–3,5,6), few have examined the burden of behavioral issues, such as difficulty interacting with peers and aggressive or deceitful behavior. This study adds to the body of knowledge by examining a full range of psychosocial and behavioral issues that children and adolescents with diabetes might experience.

Research Design and Methods

This retrospective chart review focused on children aged 11–17 years

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with type 1 diabetes who received care at the University of North Carolina (UNC) Pediatric Diabetes Center and completed the SDQ as part of routine care. Children with type 1 diabetes were screened between January and December 2016. Pediatric patients completed the SDQ Self-Reported Version and Impact Supplement on paper without the assistance of parents. The SDQ was reviewed and scored by one licensed clinical social worker (LCSW), and scores were recorded in the medical record. All patients aged 11–17 years with type 1 diabetes who presented to the clinic on the days in which the LCSW was available were screened with the SDQ. No additional selection or screening process was used.

The LCSW addressed identified concerns and brought them to the attention of the physician for follow-up as necessary. Follow-up measures included counseling and intervention with the LCSW, referral to a psychologist who is partnered with the diabetes clinic, or referral to psychiatric services in the community, depending on the degree of concerning symptoms identified. This study was exempted by the University of North Carolina institutional review board.

The SDQ is a brief behavioral screening questionnaire that has been widely validated in multiple countries, including the United States, and is used in both research and clinical settings (11). It includes 25 items and an impact supplement with 8 additional items (11,12). The initial 25 items are divided into the following five scales, each having five items: emotional symptoms, conduct problems, hyperactivity and inattention, peer relationship problems, and prosocial behaviors. Each scale is scored from 0 to 10, with higher scores indicating more difficulty with the item, with the exception of the prosocial scale in which lower scores indicate poorer functioning. A total difficulties score is generated by adding the score from

each of the subscales, excluding the prosocial behaviors score.

Elevated SDQ scores have previously been shown to predict a significantly increased probability of meeting criteria for a *Diagnostic and Statistical Manual of Mental Disorders* (DSM) diagnosis (11). Elevated emotional symptoms scores were associated with major depressive disorder or dysthymia; elevated conduct problems scores were associated with conduct disorder or oppositional defiant disorder; and elevated hyperactivity scale scores were associated with ADHD (11). Elevated total difficulties scores, low prosocial behavior scores, and elevated peer relationship scores were also predictive of increased probability of meeting criteria for any one of the previously mentioned psychiatric disorders (11).

The SDQ impact supplement assesses whether a patient has had difficulties with emotions, concentration, behavior, or being able to get along with others due to issues addressed in the previous five scales, then asks further questions regarding the severity of these difficulties. The impact supplement provides important information regarding the burden of difficulties in a patient's life, which is pertinent given that symptoms causing "clinically significant distress or impairment in social, occupational, or other important areas of functioning" is one of the diagnostic criteria for many psychiatric disorders in the DSM 5th edition (13). Cutoffs for elevated scores are ≥ 15 for total difficulties, ≥ 5 for emotional problems, ≥ 4 for conduct problems, ≥ 6 for hyperactivity, ≥ 3 for peer problems, and ≥ 1 for the impact supplement (14). The cutoff for concerning scores in the prosocial domain is a score ≤ 6 (14).

Patient characteristics, including age, sex, and ethnicity, were collected. Secondary endpoints of the study included most recent A1C and duration of diabetes based on the year of diagnosis.

Scores from patient SDQs were compared to normative data from

parent-completed SDQs available from the National Health Interview Survey (15). Normative data were age-matched (either 11–14 or 15–17 years of age). Data analyses were performed with SAS version 9.4 (SAS Institute, Cary, N.C.). Means and SDs of the UNC sample and normative U.S. sample were compared using a *Z* test. Linear regression modeling was used to explore associations between SDQ scores and patient characteristics or secondary endpoints. Statistical significance was defined as $P \leq 0.05$.

Results

One hundred and thirty-five patients with type 1 diabetes aged 11–17 years were screened with the SDQ. Patient characteristics are listed in Table 1. The mean age was 14.2 years, mean duration of disease was 6.18 years, and mean most recent A1C was 9.49%. Impact supplement scores were not available for two subjects; otherwise, data from all SDQ domains were available for all subjects.

When considering only children aged 11–14 years, patients with type 1 diabetes ($n = 76$) had significantly higher or more concerning scores than the normative sample in the

TABLE 1. Characteristics of Patient Population

Regular Users	Screened Patients With Type 1 Diabetes ($n = 135$)
Age, years	14.2 \pm 1.90
Female sex	73 (54)
Ethnicity	
Non-Hispanic white	86 (63.7)
Black	35 (25.9)
Hispanic	9 (6.67)
Other	5 (3.7)
Duration of disease, years	6.18 \pm 3.91
A1C, %	9.49 \pm 2.06

Data are expressed as mean \pm SD or *n* (%).

following domains of the SDQ: total difficulties ($Z = 2.38, P < 0.05$), emotional difficulties ($Z = 3.79, P < 0.01$), and hyperactivity ($Z = 2.08, P < 0.05$) (Table 2). Among 15- to 17-year-olds, patients with type 1 diabetes ($n = 59$) scored significantly higher than the normative sample in all scales except conduct problems: total difficulties ($Z = 4.34, P < 0.01$), emotional problems ($Z = 5.46, P < 0.01$), hyperactivity ($Z = 2.44, P < 0.05$), peer problems ($Z = 4.08, P < 0.01$), prosocial behaviors ($Z = -4.66, P < 0.01$), and impact supplement ($Z = 2.07, P < 0.05$) (Table 2).

SDQ scores were not predictive of most recent A1C for patients with type 1 diabetes ($R^2 = -0.02, f[7,132] = 0.52, P > 0.05$). SDQ scores were also not predictive of duration of disease for patients with type 1 diabetes ($R^2 = -0.009, f[3,139] = 0.55, P > 0.05$).

Discussion

In this study of SDQ results within a population of children and adolescents with type 1 diabetes, we identified several mental health and behavioral domains in which this patient population has higher or more concerning scores than their peers without chronic disease. Both age-groups had higher scores than norms in the emotional problems scale, which screens for symptoms that are concerning for anxiety or depression.

This finding supports prior studies that have identified greater depressive symptoms and anxiety in this patient population (1–3,16). Both age-groups had more concerning scores in the hyperactivity scale, as well. This finding builds on associations that have been found previously between hyperactivity and type 1 diabetes (3). Identifying hyperactivity early and intervening with behavioral or medical management is important in the type 1 diabetes population, as prior studies have suggested that patients with type 1 diabetes and ADHD tend to have poorer metabolic control compared to those with type 1 diabetes without ADHD (17).

This study adds new information regarding behavioral and emotional problems, outside of mood disorders and ADHD, that affect teenagers with type 1 diabetes. In the older adolescent group (aged 15–17 years), SDQ scores were higher than norms across all domains except conduct problems. These findings suggest that this group exhibits less altruistic behaviors (as evidenced by lower scores for prosocial behaviors) and difficulty interacting with their peers in an age-appropriate manner (as evidenced by higher peer problems scores). One small prior study revealed a relationship between peer conflict and poor metabolic control or higher

A1C (18). Additionally, involving peers in treatment interventions has been associated with increased ratio of peer to family support and decreased parent-reported diabetes-related conflict (19).

Although these prior studies have identified the importance of appropriate peer relationships for patients with type 1 diabetes, to our knowledge, the current study is the first to investigate a brief, clinically feasible screening tool for older teens that can identify these problems with peer interactions in the type 1 diabetes population. Further research is needed to identify mental health treatment strategies to appropriately address identified issues with peer conflict. Findings from this study suggest that peer conflicts are present in older adolescents with type 1 diabetes and should be considered as a component of routine mental and behavioral health screening in the adolescent population with type 1 diabetes.

Although the older adolescent group had more concerning scores across more domains than the younger group, there was no relationship between duration of disease and SDQ scores. We also found no association between A1C and SDQ scores. These findings suggest that emotional distress is present even early after diagnosis and in children who have

TABLE 2. Comparison of SDQ Mean Scale Scores for Normative Population and Patients

SDQ Domain	Normative Mean	Mean for Patients With Type 1 Diabetes, Aged 11–14 Years	Z	P	Normative Mean	Mean for Patients With Type 1 Diabetes, Aged 15–17 Years	Z	P
Total difficulties	7.10	8.79	2.38	<0.05*	6.40	9.34	4.34	<0.01*
Emotional problems	1.70	2.57	3.79	<0.01*	1.50	2.78	5.46	<0.01*
Conduct problems	1.40	1.45	0.24	>0.1	1.20	1.42	1.13	>0.1
Hyperactivity	2.70	3.32	2.08	<0.05*	2.30	3.00	2.44	<0.05*
Peer problems	1.40	1.54	0.76	>0.1	1.40	2.25	4.08	<0.01*
Prosocial behaviors	8.70	8.50	-0.97	>0.1	8.70	7.73	-4.66	<0.01*
Impact	0.5	0.85	1.88	<0.1	0.4	0.75	2.07	<0.05*

*Statistically significant.

relatively good glycemic control, supporting the argument that screening should be performed in all patients on a routine basis.

There are several limitations of this study that should be considered. First, because this was a retrospective chart review and SDQ questionnaires were collected as part of routine diabetes care, there is a potential for sampling bias. Given that the volume of patients with diabetes typically seen at our center during the study period is higher than the number of patients included in the study, there is no way to ensure that all patients with diabetes were screened in a consistent manner. Normative data available from the SDQ in the United States are limited to parent-reported SDQs, whereas the SDQs in this study were patient-reported. However, previous studies have shown relatively high parent-child agreement on SDQ measures, and the comparison between parent- and patient-reported SDQ measures was felt to be appropriate (20–22). Insufficient power due to small sample size likely limited our ability to detect differences in scores and detect relationships between SDQ scores and patient characteristics such as duration of disease. Although our studied patient population had an average A1C of 9.49%, which was well above the recommended goal, the T1D Exchange has found the average A1C for 13- to 17-year-old patients to be 9.0%, making our study population a relatively representative sample (23). Additionally, although the mean SDQ score was significantly higher in several domains in patients with type 1 diabetes compared to the normative sample, the mean in the type 1 diabetes group did not reach the clinical cut-off for concerning scores. Although there were several individuals within the group with type 1 diabetes whose scores in various domains met criteria as concerning for an underlying psychiatric disorder, the mean of the group did not reach this threshold. The risk of over-detection of psychiatric symptoms should

be taken into consideration when incorporating the findings of this study into clinical practice.

This study expands the body of available data regarding the broad range of mental health and behavioral issues that patients with type 1 diabetes more commonly face than their peers without chronic disease. Many diabetes programs currently screen for depression or anxiety, but results from this study suggest that a more comprehensive screening program that includes hyperactivity and issues related to interacting appropriately with peers may be warranted.

Although the SDQ screens for a wider range of behavioral issues, it does not screen for disordered eating behaviors, which have been documented in adolescents with diabetes (6), and therefore may not be the ideal screening tool. Further work is needed to create a diabetes-specific mental health and behavioral screening tool that could address this breadth of issues. Additional studies are also needed to investigate the most comprehensive, feasible, and cost-effective way to provide comprehensive mental health services to children and adolescents with diabetes when a broad range of behavioral issues are identified.

The findings from this study also underscore the importance of having behavioral health resources imbedded within multidisciplinary diabetes treatment programs to address mental and behavioral health comorbidities. Programs should have a streamlined system for promptly referring patients with high screening scores for further evaluation. Routine mental and behavioral health screening and access to appropriate resources for addressing these concerns should be considered part of multidisciplinary care for pediatric patients with type 1 diabetes.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

Author Contributions

S.H.D. designed the study, collected data, interpreted data, and wrote the manuscript. K.L.C. contributed to the collection of data. R.P.A. performed statistical analysis and edited the manuscript. N.J. contributed to study design and data interpretation and edited the manuscript. S.H.D. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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