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Anxiety Screening in Children & Adolescents with Type 1 Diabetes Using the GAD-7 Tool

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Anxiety Screening in Children & Adolescents with Type 1 Diabetes Using the GAD-7 Tool

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Nursing

Practice at the University of Kentucky

By

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Lexington, Kentucky

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Abstract

BACKGROUND: Children and adolescents with type 1 diabetes (T1DM) can encounter a variety of factors that affect proper management of their diabetes, including mental health. Youth with diabetes have significantly higher rates of depression, anxiety, and mental health problems compared to the general population. Anxiety is especially prevalent. **PURPOSE:** The objective of this project was to evaluate anxiety screening of children and adolescents with T1DM during their routine diabetes visits. Specifically, to assess for any trends in anxiety levels and patient characteristics including demographics, insulin regimen and A1C levels. **METHODS:** A cross-sectional, retrospective review of ambulatory electronic health records (AEHR) was conducted in the Pediatric Diabetes Clinic at the Barnstable Brown Diabetes Center (BBDC), University of Kentucky in Lexington, Kentucky. Records from October 1, 2019 to September 20, 2020 were evaluated for utilization of the GAD-7 screening tool in children and adolescents with T1DM during routine follow-up diabetes care. Patients from these records were on insulin therapy and had been seen for routine, follow-up diabetes care. **RESULTS:** Overall, it was found that the majority of adolescents screened were anxious. Statistically significant findings in association with GAD-7 scores were found related to sex, years with a diabetes diagnosis and insulin regimen. Females with T1DM were found to have higher GAD-7 scores compared to males with T1DM. Children and adolescents who have been diagnosed longer and those on insulin pump therapy were less anxious than those on multiple daily injection (MDI) therapy or shorter duration of T1DM. **CONCLUSIONS:** A majority of children and adolescents with T1DM screened for anxiety during routine follow-up of diabetes care were anxious. Findings support a need for increased awareness of anxiety in the T1DM adolescent population. A need for universal anxiety screening and interdisciplinary management is also supported.

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Dedication

I would like to dedicate this to some valuable people in my life; for without their support, encouragement and understanding I would not have completed this program. Firstly, my husband, Chris. He started his doctorate nursing program the same year as I, and our lives have been crazy ever since. I want to thank him for being my person – my sound board and encourager throughout school. Secondly, my wonderful family. My mom and dad have been there for me since day one and the valuable lessons they have taught me about hard work, dedication, medicine and caregiving have shaped me tremendously. It took a village to manage work, school and parenting and I cannot thank my family enough. Third, to my friends, for understanding that I have not been as present as I was before school but continuing to support me and celebrate this accomplishment. Lastly, I want to thank my two daughters Charlotte and Nora Kate. I started this program nine months pregnant, had Charlotte a week later and the rest is history. I want to thank them for being my driving factor, my reason to work hard and push in this program. I started this program for me but finished for them.

Table of Contents

Acknowledgments.....1

List of Tables.....5

List of Figures.....6

Introduction.....7

Background.....7

Objective.....8

Specific Aims.....9

The Iowa Model as the Theoretical Framework.....10

Generalized Anxiety Disorder 7 – Item Scale (GAD-7).....10

Literature Review.....11

Synthesis of Evidence.....12

Gaps in the Literature.....12

Methods.....13

 Design.....13

 Setting.....14

 Sample.....14

 Data Collection.....15

 Data Analysis.....16

Results.....16

 Demographics.....16

 Diabetes Regimen and A1C Levels.....16

 GAD-7 Results.....17

COVID-19 Pandemic.....	17
Discussion.....	17
Demographics.....	18
Diabetes Regimen, Glucose Monitoring and A1C Levels.....	18
COVID-19 Pandemic.....	19
Limitations.....	19
Implications for Future Practice	20
Conclusion.....	21
References.....	22

List of Tables

Table 1. “Synthesis Table to summarize findings”.....	25
Table 2. “Data gathered from AEHR”.....	27
Table 3. “Descriptive summary of record characteristics ($N = 81$)”.....	28
Table 4. “Correlations among continuous variables and GAD -7 Score”.....	29
Table 5. “Associations among nominal variables and GAD -7 score”.....	29

List of Figures

Figure 1. “GAD-7 Screening Tool”.....	30
Figure 2. “Study Data Collection form”.....	31

Introduction

Children and adolescents with type 1 diabetes (T1DM) can encounter a variety of factors that affect proper management of their diabetes, including mental health. Youth with diabetes have significantly higher rates of depression, anxiety, and mental health problems compared to the general population (Gallagher, 2017; Kanner, Hamrin & Grey, 2003). Anxiety is especially prevalent. In the United States, among children aged 3-17 years, 7.1% (approximately 4.4 million) have been diagnosed with anxiety. Among children and adolescents with T1DM, rates are estimated to be between 13-17% (Center for Disease Control and Prevention, “CDC”, 2020). These statistics reinforce the importance of understanding anxiety and the impact it has on children and adolescents with T1DM. The American Diabetes Association (ADA) recommends addressing all psychosocial and mental health issues early to prevent complications in diabetes management (“American Diabetes Association, “ADA”, 2018). Recommendations for children diagnosed with diabetes include screening anxiety at diagnosis and yearly as part of their routine, follow-up care.

Background

Mental health issues commonly described by adolescents with diabetes include fear of hypoglycemia and hyperglycemia, anxiety, disordered eating behaviors and depressive symptoms (ADA, 2018). Poor management of mental health issues are linked with worsening diabetes outcomes including non-adherence, poor glycemic control, reduced quality of life and higher rates of long-term diabetes complications (ADA, 2018). Anxiety, including frequently worrying, in children and adolescents with T1DM can make diabetes self- management more

difficult. Proper management of T1DM requires a complex and often demanding treatment regimen. Daily requirements in self-management tasks can be overwhelming and stressful for the child or adolescent with T1DM and their family. Many children and adolescents with diabetes fear hypoglycemia in addition to common anxiety symptoms related to peer interactions and academic performance. Any level of increased anxiety can have a negative impact on diabetes control. Proper identification of mental health issues is extremely important.

With proper anxiety screening and identification, resources can be made available to optimally manage any psychosocial complications. Children and adolescents struggling with anxiety need available resources and support to properly care and manage their health into adulthood. Children and adolescents with T1DM are set up for success when their mental health and diabetes are managed together.

The Pediatric Diabetes Clinic at the University of Kentucky, Barnstable-Brown Diabetes Center (BBDC) see about 700 children with diabetes each year in any one of four clinics throughout the Commonwealth. Adolescents are a large portion of the population followed for management of diabetes. Children and adolescents with T1DM, on insulin therapy, are routinely seen at three month intervals for evaluation of current diabetes care and management. The Generalized Anxiety Disorder -7 (GAD-7) screening tool (Figure 1) is administered to children with diabetes, 11-21 years of age. This screening was implemented in 2019 and is provided at least annually as part of routine care and follow-up management of T1DM.

Objective

The objective of this project was to evaluate anxiety screening of children and adolescents with T1DM during their routine diabetes visits at University of Kentucky's BBDC. Screening for psychosocial distress and mental health problems is a prime component of proper

diabetes management and care. It is hoped that by assessing anxiety rates in this specific population, proper care will incur to not only better manage mental health but also diabetes control. It is furthermore important to utilize a multidisciplinary team of specialists trained in pediatric diabetes management, but also knowledgeable of the additional challenges for youth with T1DM. There is no current data on the rates of anxiety or severity of anxiety symptoms among children and adolescents with T1DM currently receiving care at UK's BBDC.

Specific Aims

At UK's Division of Pediatric Endocrinology, the specific aims of this study were to evaluate the following:

1. Trends in anxiety scores in children and adolescents with T1DM, aged 11 years to 21 years.
2. Demographic characteristics of children and adolescents with T1DM, aged 11 years - 21 years who screened positive for anxiety.
3. Duration of T1DM, age at diagnosis, years with T1DM, A1C levels, treatment regimen, and glucose monitoring activities of children and adolescents with T1DM, aged 11 years - 21 years who screened positive for anxiety.

This project is important to UK's Division of Pediatric Endocrinology because of the increasing prevalence of mental health concerns in the adolescent population with T1DM. Recent research has highlighted trends with depression in this specific group, however anxiety is less understood. Assessing trends between anxiety and diabetes management will provide better opportunities for early intervention and interdisciplinary care to improve patient quality of life as it relates to diabetes management and psychological health.

The Iowa Model as the Theoretical Framework

The Iowa Model is a framework designed to address the implementation of evidence-based practice change to improve patient care and outcomes. The model helps to transition research findings into clinical practice in hopes of improving patient outcomes (Brown, 2014). The Iowa model allows providers to look at problem-focused or knowledge-focused triggers where evidence-based practice may help. Screening for anxiety in youth with diabetes is a knowledge focused idea, as new research findings are showing the alarming trend of mental health concerns in adolescents with T1DM (ADA, 2018). Most research has focused on depression rates in youth with T1DM, yet little has been explored regarding anxiety. The Iowa model works step by step to identify if the issue at hand is priority for endocrine clinics and can help to implement a plan for screening anxiety in such clinics. Therefore, by taking the steps of the Iowa Model, it was determined that an EBP project assessing GAD-7 scores was needed and important (Brown, 2014).

Generalized Anxiety Disorder 7 – Item Scale (GAD-7)

The Generalized Anxiety Disorder Assessment (GAD-7) is a seven-item screening tool (Figure 1) that is used to measure and assess the severity of generalized anxiety disorder (GAD). Each item asks individuals to rate the severity of their symptoms over the past two weeks. This tool has been utilized frequently in primary care patients, the general population and adolescents. Scoring allows providers to not only assess for presence of anxiety symptoms but also severity, differentiating from minimal, mild, moderate to severe.

This screening tool is available in various languages with free access to use online. Additionally, this is a self-administered tool and typically takes individuals one to two minutes to complete. The GAD-7 score is calculated by assigning scores of 0, 1, 2, and 3 to the responses

“not at all”, “several days”, “more than half the days”, and “nearly every day”. Scores are added together for the seven questions and then assessed for severity. Total scores from adding all seven answers range from 0-21. To interpret scores, 0–4 is minimal anxiety; 5–9 is mild anxiety 10–14 is moderate anxiety and 15–21 is severe anxiety. When used as a screening tool, further evaluation is recommended when the score is 10 or greater.

An additional portion of this screening tool is a final question asking individuals how difficult it is to do one’s work, take care of things at home, or get along with other people. Options include not difficult at all, somewhat difficult, very difficult or extremely difficult. This final portion serves as an adjunct to further assess for anxiety symptoms and severity. (Child Outcomes Research Consortium, 2021).

Literature Review

A keyword search was utilized on University of Kentucky’s (UK) online library. The university’s search function covers a large range of databases. Example keywords include “diabetic adolescents”, “adolescents with Type I diabetes”, “diabetic youth”, “type I diabetes” and “youth with type I diabetes”. Other keywords include “anxiety”, “mental health” and “psychiatric health”. UK’s library search additionally provides suggested titles and keywords to improve the search process. For example, “diabetic youth and anxiety” may have been searched while UK suggested a research article regarding adolescents with diabetes and mental health.

Articles were further narrowed down by selecting only English written articles. Additionally, articles were chosen that were published between 2005-2020, unless older articles resulted that are gold standard to this specific issue. This search resulted in overall good quality articles including case studies, cross-sectional studies, systematic reviews, population-based

studies as well as general informative articles. These study types are overall high to medium level evidence.

Synthesis of Evidence

There is an overwhelming amount of information supporting the link between higher anxiety rates in adolescents with T1DM (Table 1). In conjunction with this, youth with both diabetes and anxiety also show a strong tendency of having higher hemoglobin A1C levels, bad glycemic control and poor quality of life (Adal et al., 2015; Almeida et al., 2018; Delamater, 2009; Gonder-Frederick et al., 2006; Hood et al., 2006 & Stah-Pehe et al., 2015). Strength of this evidence is relatively strong. The only outlier with these results was one population-based cohort study (2014) that took place in Holland; they found no link between adolescent diabetes and increased rates of anxiety or any general mental health disorder (Silversten et al., 2014).

Two articles reported parental roles and the influence of their mental health on their youths' diabetes (Gonder-Frederick et al., 2006 & Herzer et al., 2009). Studies found that adolescents are affected by their parents' and caregivers' personality, especially those who have a tendency to be generally anxious (Delamater, 2009; Delamater et al., 1987 & Gonder-Frederick et al., 2006). Primary recommendations from this literature review included the importance of routine screening for mental health disorders, specifically anxiety and depression, in primary care, but also diabetes clinics (Almedia et al., 2018; Delamater, 2009; Herzer et al., 2009, Hood et al., 2006 & Stahel-Pehe et al., 2014). Strength of this evidence is relatively strong.

Gaps in Literature

Consistent results and relationships have also led to some consistent gaps in the literature. Many highlighted the importance of utilizing a multi-disciplinary approach when caring for these specific patients (Delamater, 2009; Delamater et al., 1987; Herzer et al, 2009 & Hood et al.,

2006). However, no research exists delving into the results from such care. Therefore, literature is needed on the positive effects of care that involves many providers, including mental health specialists, primary care providers, endocrinologists and further.

Articles addressed parental involvement and influence on their adolescents' diabetes care but also tendency to have anxiety and other mental health issues. Further research is needed on parental involvement, specifically their negativity and personal anxiety levels related to degree of diabetes care (Gonder-Frederick et al., 2006). More research is also needed focusing on care that involves parents' and families' role in their child's overall care.

The largest literature gap involves routine screening of anxiety in the endocrine setting. With common knowledge regarding this relationship between adolescent diabetes care and higher rates of anxiety, studies are needed that assess the importance of anxiety screening and outcomes when routine screening occurs. With proper screening and early recognition, the relationship between anxiety in youth with T1DM and poor glycemic control can be better understood.

Methods

Design

A cross-sectional, retrospective review of ambulatory electronic health records (AEHR) was conducted. Records were reviewed for utilization of the GAD-7 screening tool and current anxiety screening practices for children and adolescents with T1DM. Patients from these records were on insulin therapy and had been seen for routine, follow-up diabetes care between October 1, 2019 to September 20, 2020 in the Pediatric Diabetes Clinic at the BBDC, University of Kentucky in Lexington, Kentucky. Additionally, records were accessed from any of the three

established, regional travel clinics. Only records obtained during this time period were reviewed following IRB approval.

This study involved data evaluation for quality improvement assessment purposes to determine additional needs for pediatric patients with T1DM and their support systems. Information gathered from AEHR included demographics, age at type I diabetes diagnosis, insulin therapy, glucose monitoring, A1C levels and co-existing conditions (Table 2). GAD-7 scores were also collected. Additionally, whether or not endocrine clinic visits occurred during the COVID-19 pandemic were noted (Table 2).

Setting

Retrospective chart reviews were conducted at the Barnstable-Brown Diabetes Center (BBDC) at UK Healthcare in Lexington, Kentucky. Initial establishment of pediatric diabetes care occurs in the pediatric diabetes clinic located at UK Healthcare's Turfland center. Routine follow-up diabetes care may occur in the pediatric diabetes clinic in Lexington, Kentucky or any of three regional travel clinics located throughout Appalachia in Kentucky (Monticello, Barbourville, or Pikeville).

Sample

The sample for this study included electronic health records of children and adolescents 11 years to 21 years with T1DM followed at BBDC for diabetes care. This age range was selected due to the validated age range associated with the GAD-7 screening tool. All electronic health records of children and adolescents with T1DM seen for routine, follow-up diabetes care between October 1, 2019 and September 20, 2020 were eligible for enrollment. The inclusion criteria required for enrollment included the following: 1) 11 years -21 years of age, 2) T1DM

diagnosis and use of insulin therapy, 3) documentation of completed GAD-7 screening tool in AEHR, and 4) English as primary language.

Exclusion criteria include the following: 1) Not on insulin therapy 2) Ages 0-10 years or greater than 21 years. 3) No evidence of completed GAD-7 screening tool available in AEHR, 4) Not capable of completing the GAD-7 for themselves due to impairment from other disabilities, 5) emancipated minors, 6) those who are ward of the state, or 7) non-English as primary language. No exclusions based on gender, A1C level, or duration of diabetes were made.

A total of 480 AEHR's were reviewed for inclusion into the study. There were 81 AEHR's who met criteria.

Data Collection

Approval from the University of Kentucky Institutional Review Board (IRB) and the Healthcare System's Office of Research and Administration was obtained prior to data collection. Providers at Barnstable Brown Diabetes Center (BBDC) annually screen for anxiety in adolescent patients with T1DM using the GAD-7 scale. This is current provider practice. Once adolescents have completed the scale, it is reviewed by the provider, discussed with the family, and scanned into the child's individual AEHR along with all other clinic visit documents. Office staff at BBDC assisted in enrolling eligible electronic health records into the study. Patient demographics, A1C levels, diabetes management regimen and GAD-7 scores were collected (Table 2). The collected data was de-identified by a provider with password-protected access to AEHR prior to being made available to the primary investigator.

Data available to the primary investigator did not include any of the 18 HIPAA personal identifiers information. Specific study numbers were utilized by the provider collecting data in lieu of patient names to ensure de-identification of protected health information (PHI) and

maintain confidentiality. Necessary documentation for the study were documented on a separate spreadsheet and all de-identified data was stored on a password protected computer (Figure 2).

Data Analysis

Data was evaluated by statistical analysis. The computer software program SPSS, version 25 was specifically used. Descriptive statistics including means, standard deviation and frequency distributions described patient demographics. Pearson's correlation coefficient was utilized to assess any correlation between two continuous variables. Selected variables that were assessed for correlation included age, years with a DM1 diagnosis, A1C levels and GAD-7 scores. A p level of 0.05 was used for statistical significance throughout. The two sample t-test was used to assess any associations among nominal variables and the GAD-7 score. This included sex, insulin therapy, glucose monitoring and whether GAD-7 was taken during the COVID-19 pandemic.

Results

Demographics

The average age of pediatric patients was 14.9 (SD=2.0; see Table 3). Ages ranged from 11 – 19 years old. The majority (57%) were female, with 43% male. Average age at DMI diagnosis was 8.62 (SD=2.03) with a range between 0-16 years. Length of diabetes diagnosis averaged at 6.19 years (SD = 4.21) and ranged 0-17 years.

Diabetes Regimen and A1C Levels

Multiple daily injection (MDI) was the more common insulin therapy (75.3%). Nearly 25% were using pump therapy (24.7%). Continuous glucose monitoring was used more frequently, at 51.9% compared to those who did not at 48.1%. The average A1C amongst adolescents was 9.08 (SD = 1.87) and ranged from 5.4 to the maximum read of 14%. Forty-one

records (50.6%) reported no coexisting conditions. A wide range of coexisting conditions were reviewed from the records, depression was highest at 14 (17.3%). Other conditions included celiac disease (6.2%), ADHD (4.9%) and other (13.6%). (Table 3).

GAD-7 Results

The majority (44.4%) of adolescents were considered to have mild anxiety with a score of 5-9. Almost 26% were considered moderately anxious, scoring between 10-12 on the GAD-7 screening tool. There were 12 (14.8%) who had minimal to no anxiety symptoms with a score between 0-4. Lastly, 14.8% scored severe anxiety with a range between 15-21. The majority (48.1%) of adolescents indicated they found it somewhat difficult to do work, take care of things and get along with others. Over 28% (28.4%) found it ‘not difficult at all’, while 19.8% found it ‘very difficult’. A small amount (3.7%) found this to be ‘extremely difficult’. (Table 3).

COVID – 19 Pandemic

The majority (69.1%) of records screened during the study time frame did not occur during the COVID-19 pandemic. Thirty percent (30.9%) were screened during COVID-19. (Table 3).

Discussion

The purpose of this study was to evaluate anxiety screening of children and adolescents with DM1 during their routine diabetes visit at University of Kentucky’s BBDC. Specifically, any trends in GAD-7 scores in adolescents with a type I diabetes diagnosis, ages 11 years to 21 years old. Additionally, to assess demographic characteristics in those who screened positive for anxiety. Information specific to T1DM was also evaluated in this study, including age at diagnosis, years with T1DM, and treatment regimen including glucose monitoring activities. Of the three objectives, statistical significance was found for gender, years with a diabetes

diagnosis, and treatment regimen in regard to anxiety scores. Additionally, some key findings were found. A major theme to note is the majority of these patients are anxious, only 14.8% of adolescent records were considered to have minimal to no anxiety. Eighty-five percent (85.2%) of the records scored mild to severe anxiety on the GAD-7 screening tool.

Demographics

The objective of examining age and GAD-7 scores showed to have no statistical significance (p 0.46, see Table 4). This shows that no specific age has anxiety over others, but displays that as a whole, patients 11 years old to 21 years old have anxiety symptoms. Associations between sex and mean GAD-7 scores was statistically significant (p 0.04, see Table 5), with females' average GAD-7 score at 10.4, compared to males at 7.5. This strongly suggests that females are more anxious than males. Additionally, years of diabetes diagnosis was correlated with anxiety levels (p of 0.034), which is statistically significant. This suggests that those who have had a type I diabetes diagnosis longer are less likely to be anxious, and vice versa with a new diagnosis.

Diabetes Regimen, Glucose Monitoring and A1C Levels

A1C levels showed no correlation with GAD-7 anxiety scores (p 0.22, see Table 4). This suggests that regardless of how well controlled one's diabetes is, average adolescents have some level of anxiety. Associations between therapy and GAD-7 scores was statistically significant (p 0.009, see Table 5). Adolescents who utilized pump therapy had average GAD-7 scores of 7.57, versus children who utilized MDI averaging at 9.91. This association strongly suggests that adolescents who have insulin pumps are less likely to be anxious. Continuous glucose

monitoring showed to have no statistical significance in regards to GAD-7 scores and anxiety levels. Therefore, regardless if a child is able to continuously assess their glucose levels versus spot checking, average adolescents assessed had some level of anxiety.

COVID-19

It was important to consider the potential that some adolescents may be experiencing compounding anxiety due to the many life changes brought on by the COVID-19 pandemic. However, taking the GAD-7 screening tool during the pandemic showed no statistical significance (p 0.211, see table 5). The average score amongst records during COVID-19 was 8.75 compared to 10.12 of records before COVID-19. It is important to note that the majority (69.1%) of records screened during the study time frame did not occur during the COVID-19 pandemic.

Limitations

Several limitations were highlighted from this study. Firstly, this is a small sample size and records were reviewed from a single site. This potentially limits generalizability. Secondly, GAD-7 scores were not assessed in comparison records who do not have a diabetes diagnosis. Their scores would be a good correlation to assessing levels in solely adolescents with DMI.

Thirdly, it is hard to assess for and evaluate confounding factors. Adolescents may have many reasons as to why they are feeling anxious. It may not only be related to their type I diabetes diagnosis, but may be a result of their family environment, current school assignments and stressors, genetics and further. The level of support from family and support systems can further affect these children, as studies have shown that caregivers who are stressed about managing diabetes affect their children as well (Delamater, 2009; Delamater et al., 1987 & Gonder-Frederick et al., 2006).

Additionally, COVID-19 is a large source of stress and change. There was no statistical difference between records screened before and after the pandemic. However, only 25 of the 81 records took place during COVID-19. This is large limitation, as many are likely feeling compounding stress during this time, however the small number of records made this association hard to assess. Another limitation includes the GAD-7 screening tool itself; many adolescents may not feel comfortable being truthful on such surveys. It is possible that symptoms were not accurately accounted for as some youth may not want to discuss their mental health.

Implications for Future Practice

This study identifies recommendations for future research as well as care changes in endocrine clinics. Highlighting upon the limitations, it would be important to not only assess adolescents with T1DM, but also assess GAD-7 scores in children without a confounding diagnosis. The scores would allow one to juxtaposition and further assess what the high anxiety scores suggest. Additionally, it would be helpful to further assess anxiety by also administering the Fear of Hypoglycemia Survey (FOH). This survey assesses how blood glucose levels affect how adolescents behave as well as assesses their degree of worrying. With so many adolescents in this study (85.2%) scoring mild to severe anxiety on the GAD-7, it would be very helpful to assess if their worry stems mostly from their diagnosis or is a result of many factors.

As mentioned, it might further be helpful to assess parental roles, perceptions and influences regarding their child's diagnosis and compounding anxiety. The Screen for Child Anxiety Related Disorders assessment (SCARED) evaluates parental awareness of their child's anxiety symptoms. Not only assessing parental thoughts on anxiety, but also how the adolescent manages and handles their T1DM is important too. With proper support, it is hoped that children would feel less anxious.

With the knowledge gained from this project, an assessment of next steps in the endocrine setting is also needed. A large goal to work towards is multidisciplinary care with not only endocrine providers but also mental health specialists. Adolescent patients are set up for success when mental health and diabetes are managed together, as youth feel empowered to recognize their feelings and ask for help. Therefore, recommendations for future research would not only involve further assessment of anxiety in the adolescent population, but also involved other disciplines to best manage young patients. As mental health is incorporated, it is hoped that these young patients will feel more supported and able to best manage their diabetes.

Conclusion

This study hopes to increase awareness of anxiety in the adolescent population with T1DM. The main purpose was to assess trends between characteristics of adolescent patients with a T1DM diagnosis and their GAD-7 scores. Females were found to be more anxious than males while youth who have been diagnosed longer than others showed less anxiety. Additionally, adolescents who utilized an insulin pump were on average less anxious than youth who used MDI. Some expected correlations were not found to be statistically significant. However, the large key theme acknowledged from this study was that the vast majority of adolescent patients with T1DM are anxious. Therefore, goals from this project suggest the need of further anxiety screening and interdisciplinary management. With mental health properly managed as well, it is believed that there will be an improvement in diabetes care by adolescents with T1DM. Most importantly, with better coping mechanisms and diabetes management, there will ideally be a great boost in quality of life, leading to a healthy adulthood.

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Table 1. Synthesis Table to summarize findings

Study author	Year	Mean Age	Study Type	Intervention or Relationship (between DMI and HA or DMI/HA and poor glycemic control)	Major Finding that Addresses your Question
Adal et al.	2015	14.7	CS	R1, R2	SL
Almeida et al.	2018	14	CCS	R1	SL (NSL for R2)
Banks et al.	2018	Between 18-28	Literature review of RCTs	R1	SL (in African American young adults)
Bernstein et al.	2013	17.1	CS	R1, R2	SL
Delamater, A.M.	2009	NA	N/A -- guideline	R1, R2	SL – developed suggestions for screening
Delamater et al.	1987	15.4	CCS	R1, R2, additionally assessed difference in coping mechanisms	SL – also found commonalities with how those with and without anxiety cope with DM1
Gonder-Frederick et al.	2006	15.36, plus parental involvement	CCS	R1, R2, additionally parental influence / perception	SL – also found link with parental anxiety

Hackworth et al.	2013	Between 13-18	RCT	Nothing Ventured Nothing Gained online tool	Positive intervention for DMI QOL
Herzer et al.	2009	15.6 plus primary caregivers	CCS	R1, R2	NSL in R1, SL in R2
Hood et al.	2006	14.9	CS	R2	SL
Silversten et al.	2014	19.9	PBC	R1	NSL
Stah-Pehe et al.	2014	Between 11-13	PBC	R1, R2	SL as well as SL with QOL

ABBREVIATION KEY: CCS = case control study; CS = cross-sectional; DMI = Type I Diabetes diagnosis; HA= history of / or diagnosis of anxiety; NA = not applicable; NSL = no significant relationship link; PBC = population based cohort; R1 = Relationship of DMI and anxiety; R2 = Relationship of DMI and anxiety with poor glycemic control; RCT = Randomized Controlled Trial; SL = strong relationship link (either RI or R2); QOL = quality of life

Table 2. Data gathered from AEHR

Measures	Description	Level of Measurement	Data Source
Demographics			
Gender	Male, Female	Nominal	Medical Records
Age	Age in years	Interval/Ratio	Medical Records
Type I Diabetes Information			
Age at diagnosis	Age in years when diagnosed with Type I diabetes	Interval/Ratio	Medical Records
Years with DM1	Length of current Type I diabetes diagnosis	Interval/Ratio	Medical Records
Type of therapy	Insulin pump or multiple dose insulin	Nominal	Medical Records
Continuous Glucose monitoring	Yes or no	Binary	Medical Records
Hemoglobin A1C Levels	A1C = average blood glucose levels for past 2-3 months, as a percentage	Interval/Ratio	Medical Records
Anxiety Scoring			
Generalized anxiety disorder (GAD-7) survey	The GAD-7 score is calculated by assigning scores of 0, 1, 2, and 3 to the responses “not at all”, “several days”, “more than half the days”, and “nearly every day”. Scores are added together for the seven questions and then assessed for severity. Total scores from adding all seven answers range from 0-21. To interpret scores, 0–4 is minimal anxiety; 5–9 is mild anxiety 10–14 is moderate anxiety and 15–21 is severe anxiety. When used as a screening tool, further evaluation is recommended when the score is 10 or greater.	Ordinal	Medical Records
COVID-19 Pandemic			
Was routine endocrine visit during the pandemic?	Yes or no	Binary	Medical Records

Table 3. Descriptive summary of record characteristics (N = 81)

	Mean (SD); range or n (%)
Age, years	14.9 (2.0); 11-19
Sex	
Male	35 (43.2%)
Female	46 (56.8%)
Age at diagnosis	8.62 (2.03); 0-16
Year with diabetes	6.19 (4.21); 0-17
Therapy	
Multiple Dose Insulin (MDI)	61 (75.3%)
Pump	20 (24.7%)
Continuous Glucose Monitoring (CGM)	
Yes	42 (51.9%)
No	39 (48.1%)
A1C	9.08 (1.87); 5.4-14.0
Coexisting Conditions	
ADHD	4 (4.9%)
Asthma	1 (1.2%)
Celiac disease	5 (6.2%)
Depression	14 (17.3%)
Growth Hormone Deficiency	2 (2.5%)
Hyperthyroidism	1 (1.2%)
Hypothyroidism	2 (2.5%)
None	41 (50.6%)
Other	11 (13.6%)
Post-traumatic stress disorder	1 (1.2%)
Seizures	1 (1.2%)
GAD-7 Questions	
1. Feeling nervous, anxious or on edge	1.48 (1.01)
2. Not being able to stop or control worrying	1.02 (1.06)
3. Worrying too much about different things	1.31 (1.08)
4. Trouble relaxing	1.14 (0.89)
5. Being so restless that it is hard to sit still	1.05 (1.13)
6. Becoming easily annoyed or irritable	2.01 (0.99)
7. Feeling afraid, as if something awful might happen	1.20 (1.08)
GAD-7 score	
Minimal	12 (14.8%)
Mild	36 (44.4%)
Moderate	21 (25.9%)
Severe	12 (14.8%)
Difficulty with doing your work, take care of things, get along with others:	

Not difficult at all	23 (28.4%)
Somewhat difficult	39 (48.1%)
Very difficult	16 (19.8%)
Extremely difficult	3 (3.7%)
Patient seen during Covid-19 pandemic	
Yes	25 (30.9%)
No	56 (69.1%)

Table 4. Correlations among continuous variables and GAD score

	Correlation coefficient r (p)
Age	-0.08 (.46)
Years with diabetes	-0.24 (.034)
A1C	0.22 (.053)

Table 5. Associations among nominal variables and GAD -7 score

	Mean GAD-7 Score (SD)	p
Sex		.004
Female	10.4 (4.7)	
Male	7.6 (3.9)	
Therapy		.009
Multiple Dose Insulin	9.92 (4.67)	
Pump	7.57 (3.85)	
Continuous Glucose Monitoring (CGM)		.126
Yes	8.43 (3.98)	
No	9.97 (4.99)	
Patient seen during Covid-19 pandemic		.211
Yes	10.12 (4.81)	
No	8.75 (4.38)	

Figure 1. GAD-7 Screening Tool

GAD-7				
Over the <u>last 2 weeks</u> , how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3

Total Score = Add Columns + +

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all <input type="checkbox"/>	Somewhat difficult <input type="checkbox"/>	Very difficult <input type="checkbox"/>	Extremely difficult <input type="checkbox"/>
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(Anxiety & Depression Association of America, 2021)

Figure 2. Study Data Collection form

Case # _____

Age _____ **Gender** _____

Age at Dx _____ **Years with T1DM** _____

Therapy: Pump _____ **MDI** _____ **CGM use** _____

Co-existing conditions/meds _____

A1c's during collection period _____; _____; _____; _____

GAD responses:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Total: _____/21

Difficulty with doing your work, take care of things, get along with others:

Not at all _____

Somewhat difficult _____

Very difficult _____

Extremely difficult _____