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The Nutritional Management and Glycemic control in Adolescents with Diabetes

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NURS 498VH: Honors Literature Review

Abstract

The purpose of this literature review is to explore the relationship of nutritional management on glycemic control amongst adolescents who have diabetes. The adolescent population has significant negative or positive peer influence on the management of their diabetes (Yang, 2018, p.104). These peer perceptions can include empathy, curiosity, knowledge seeking, enthusiasm, fearfulness, and bullying (Yang, 2018, p.104). These influences directly affect nutritional management, blood glucose levels, and insulin management. When the peer influence is negative the individual is less inclined to acknowledge their medical condition (Yang, 2018, p.105). Other influences on the management of diabetes include technology, physical exercise, and the individual's diet. A literature review was performed on 20 peer reviewed journal articles exploring the different influences of the management of diabetes in adolescents. This was done by using two databases PubMed and Wiley plus using PICOT phrases as well as inclusion and exclusion criteria. The different influences of technology include telehealth appointments, communication with healthcare workers via apps, and tracking blood glucose and insulin levels. The impact of physical exercise and nutrition on the individual also plays an important role in the overall control of the individual's management.

Background

In the past twenty years diabetes has been increasing in adolescents. Diabetes Mellitus can be diagnosed in adolescents as Type I or Type II. Type I diabetes is when the pancreas does not produce enough insulin and therefore the sugar cannot enter the cell to regulate blood glucose (“Type I,” 2021). Type II diabetes occurs when cells are insulin resistant. Insulin is a hormone which contributes in helping blood sugar enter cells in the body that is used for energy (“Type I,” 2021). Therefore, the lack of insulin results in an excessive buildup of the glucose outside of the cell resulting in high blood sugar. Managing diabetes includes continually monitoring blood glucose levels, receiving insulin injections, and maintaining a healthy diet to control blood pressure and blood glucose levels. Obtaining a glycated hemoglobin test known as HbA1c provides information for three months of the individual's blood sugars levels. The normal percentage for a HbA1c level is below 5.7% and if it is above 6.5% then it is a higher risk for developing diabetes (“All About,” 2018).

Between the ages 11 to 21 of an adolescent's life is a time in which independence is emerging and they are not as reliant on parents for managing doctors' appointments, medication, and nutritional needs. Parent involvement in the management of their adolescent's diabetes decreases as they get older. The adolescents are going to school during this time period and are transitioning into a period of self-managing their diabetes. The impact on parent involvement can affect the child's mental health, stress levels, and confidence in self-management (Zhao, 2019, p.1). The current treatments and management for adolescents include physical exercise, nutritional influence on blood glucose levels, technological influence, and mental health with peer influences. Although these studies can improve patient education for pediatricians and physicians to improve nutritional management amongst adolescents to improve glycemic control,

more research should be done regarding the management of Type I and II diabetes in adolescents in reference to nutritional control.

Methods

In gathering a total of 20 articles that are used in this literature review, two databases were searched to gather information regarding the current nutritional management and influences of diabetes in adolescents. A systematic review was conducted using articles from Wiley and PubMed databases using inclusion and exclusion criteria. The purpose of this review was to compile relevant information regarding the challenges of nutritional management of diabetes in adolescents and the implications of the management being done. Twenty peer-reviewed articles from two databases, PubMed and Wiley plus, were used for examination in this review. Initially before using phrases and incorporating exclusion criteria for these articles, there were a total of 2,029 articles. In the results of these studies, it was found that specifically in the pediatric population there is lack of management in diabetes and of ways to improve nutritional management.

Studies were conducted amongst adolescents and the types of management that is being utilized. These studies can be divided into main categories regarding the type of management of diabetes: technology usage related to medical management, nutritional diet and blood glucose levels, and physical exercise with weight management.

There are two major types of diabetes. Type I diabetes is caused from the lack of insulin produced from the pancreas. Type II diabetes is when the cells are insulin resistant and there is an increased amount of insulin in the body making it hard to regulate blood glucose levels. Type I diabetes is an autoimmune disease where insulin producing beta cells located in the pancreas are being destroyed. Between the two types of diabetes, Type I diabetes is less commonly

diagnosed (“Type I,” 2021). Type II diabetes is caused by many factors including a poorly managed diet, lack of physical exercise, high blood glucose levels, and obesity.

Study Design

A systematic review was done over diabetic adolescents’ diets regarding the glycemic control and medication regimens. This review was done over the two databases PubMed and Wiley in collecting the most relevant articles. See Appendix A.

Information Sources

The information sources of Wiley and PubMed were searched to look for my research articles in relevance to my research question. In finding the most relevant information for the articles the criteria that was used in my exclusion criteria included: within the past 5 years, peer reviewed articles, and included relevant information regarding my research question.

Search Study

The PICOT question was used on the two databases PubMed and Wiley to find articles describing the adolescent management of diabetes. Before using the PICOT question in total between PubMed and Wiley there were a total of 2,029 articles. The phrases that were used in Wiley included “Diabetic Adolescents” and “Glycemic Control”. The phrases that were used in PubMed included “Glycemic Control” and “Nutritional Management” and “Pediatric care with Diabetes”. Additionally, in limiting the search for articles, limiting the search to full text and English only.

Inclusion/Exclusion

In searching for related articles for my literature review I used my PICOT question and exclusion criteria. What are the current influences and management in young adolescents regarding the management in diabetes mellitus and glycemic control? In excluding articles, the

criteria was within five years from 2016 to 2021, systematic review, and pertained to the pediatric population.

Results

Physical Exercise

Physical exercise is a common management and treatment in Type II diabetes. Exerting energy through physical exercise will aid in reducing blood glucose levels. In Kriska's (2018) clinical trial the cohort of 15 centers across the U.S. measured physical exercise treatment options of Type II diabetes. This trial observed 699 participants with ages ranging from 10 to 17 years old over a time span of six months. These treatment options measured the cardiovascular fitness assessed using a submaximal cycle ergometer bike test (Kriska, 2018, p.38). The submaximal cycle ergometer bike test determines the physical work capacity by predicting the workload of the heart with the heart rate consisting of 170 beats per minute (bpm). In performing this test, a total of six participants were excluded due to bike weight limitations weighing over 355 pounds, 22 participants were excluded due to not being able to maintain the minimal speed during warm-up, and 92 participants discontinued the test due to not being able to complete it (Kriska, 2018, p.38). This study also measured the participants fiber intake, HbA1c levels, saturated fat intake, and beverages that were consumed. The assessment of dietary intake for the participants included today's food frequency questionnaire. In each food category the participants were asked the food that they have consumed in the past week, if the participant did eat this category, then they were asked to describe it in portion sizes with small, medium, large, and very large (Kriska, 2018, p.38). In the results of their research over the six months the individuals whose diet and fitness improved showed an improvement in glycemic control.

In the article, "Exploring Pediatric Obesity Training, Perspectives, and Management Patterns Among Pediatric Primary Care Physicians" written by Campoverde-Reyes (2020) it

discusses important information regarding the educational training of pediatric physicians with management of diabetes. This information was obtained from anonymous emails that incorporated a survey sent in February 2020 through March 2020 conducted through a large academic system. Collecting the data for this study included variables that were studied such as age, weight, racial background/height, country of origin, type of medical degree, and primary medical specialty. Pediatricians were asked to disclose if they had a history of being overweight and personal eating habits (Campoverde-Reyes, 2020, p.160). The total number of obesity-related training hours by qualities, demographics, physicians clinical practice patterns, and physicians' knowledge of pediatric management. Analyzing the data included a multiple variable analysis that was performed to use a logistic regression mode. Physicians who had more obesity training felt more successful and confident when they are treating a patient who are obese (Campoverde-Reyes, 2020, p.165). It is clear that further efforts are necessary to address the gaps in obesity training that are received by residents and fellows who provide care throughout pediatric care (Campoverde-Reyes, 2020, p.168).

Nutritional Management and the influence of Blood Glucose Levels

Nutritional therapy is a major factor in the management of Type II diabetes. Certain food categories such as carbohydrates can play a major role in decreasing Blood Glucose Levels. Carbohydrates in the body get metabolized as energy and turn into sugar therefore having an excess in carbohydrates can increase the blood glucose levels in the body. In the article written by Eisenbergs (2018), a cross sectional study was performed over the course of 18 months conducted with 136 participants above 13 years old. This study was based on behavioral nutritional intervention among youth with Type I diabetes. Baseline HbA1cs were measured at 6, 12, and 18 months along with the assessment of the individual's diet and pattern of eating. In this

study a diabetes eating problem survey revised (DEBS-R) assessment was conducted amongst the participants with the association of glycemic control (Eisenberg, 2018, p.871). At the end of the 18 months the findings indicated that the higher DEBS-R scores were associated with poor glycemic control over the course of 18 months with a higher HbA1c. This study shows that disordered eating affects the blood glucose levels.

In the Article, “Impact of Fat Intake on Blood Glucose Control and Cardiovascular Risk Factors in Children and Adolescents with Type I Diabetes” done by Garonzi (2021) it examines how the diet affects glycemic control. The diet is an essential part of the immune system and with a large amount of fat and carbohydrate intake elicits inflammatory responses. This inflammatory response increases the risk for cardiovascular diseases. A high-fat intake influences the glucose control in children and adolescents with Type I diabetes as the HbA1c levels in these individuals were increased. A meal with a high fat intake can lead to a prolonged increase in postprandial glycemia lasting up to 2 to 6 hours after the meal (Garonzi, 2021, p.3). This article highlights the importance of the diet and glucose monitoring, more education in children and adolescents regarding foods that have high fats should be incorporated into the management of their diabetes.

In a systematic review by Gow (2021) with 674 participants with ages ranging from five to eighteen years old. These participants were involved in the VLED, Very-Low-Energy-Diets, program in the management of obesity and Type II diabetes. The duration of this program was 8 to 12 weeks with trained healthcare professionals observing the participants. The VLED diet consists of energy intake that is less than or equal to 800 kcal per day to achieve rapid weight loss (Gow, 2021, p.216). The carbohydrate intake is less than 50 grams per day and high protein intake of 0.8-1.5g/kg body weight per day (Gow, 2021, p.216). The low carbohydrate intake

results in a state of ketosis leading to the appetite to be decreased. This diet is not a long-term solution but is used as a short-term approach in achieving rapid weight loss. This study followed up with the participants to measure their glycemic control after one year and one half of the participants experienced glycemic control failure.

In Levitt Katz (2018) multi trial study with 699 participants with Type II diabetes to determine the influence of atherogenic dyslipidemia and the inflammation of profile with the effect of insulin therapy. These participants had Type II diabetes for at least more than two years using the American Diabetes Association, a body mass index greater than the 85th percentile for age and sex, and negative pancreatic autoantibodies (Levitt, 2018, p.2). Medications for these participants that were used included Statins used for low-density lipoprotein cholesterol of lower 130 mg/dL with reaching the primary outcome and insulin was started. In result dyslipidemia in these participants is related to the glycemic control (Levitt, 2018, p.7). It was found that when HbA1c is controlled with the effect of insulin therapy on total and atherogenic LDL-C subgroups (Levitt, 2018, p.7). In conclusion from this multi-trial study more research strategies to achieve better glycemic control is needed.

In the research by Malik (2019) 2,172 participants ranging from ages 13-21 years old were observed and assessed with prevalence of diabetes and screening done that is recommended by the American Diabetes Association (Malik, 2019, p.353). This study sought to look at the association between previously measured metabolic status in relation to diabetes complications with the recommendation of screening. Further this study examines the relation of satisfaction with diabetic care and recommended clinical screening (Malik, 2019, p.352). A linear and multinomial regression model was used to evaluate the associations. In the results 60% of the participants have reported three or more HbA1c measurements in the past year (Malik, 2019,

p.353). Amongst the participants a higher satisfaction in the care of diabetes was associated with increasing odds of meeting the screening criteria for most ADA recommended measures. In conclusion more research should be conducted to improve diabetes complications screening efforts of young adolescents with Type I diabetes (Malik, 2019, p.354).

In Seckold's (2019) a retrospective cross-sectional review amongst 22 children with ages ranging from 3 to 7 years old. This study evaluated the dietary aspects of children's diet by incorporating less foods that contain saturated fat and increased the amount of vegetables to see the effect of glycemic control (Seckold, 2019, p.5). Foods that contain a lot of saturated food include butter, red meat, and dairy products. The measurements in this study included the children's baseline HbA1c, daily weights, food logs, and mealtime management survey that are collected. The food that was evaluated in this study was macronutrients consisting of carbohydrates, fats, and protein intake. The majority of the children did not meet the vegetable and lean meat intake recommendations. The commonly eaten foods consisted of apples, bananas, cheese, strawberries, white bread, full-cream milk, fruit yogurt, and ice cream (Seckold, 2019, p.3). The findings of this study suggest that a regular eating pattern and an intensive insulin therapy has been associated with lower blood glucose levels (Seckold, 2019, p.5).

In Goethal's (2021) longitudinal study with a sample size consisting of 178 of Type I Diabetics ranging from ages 13 to 17 years old. The variables measured in this study include enhancing self-behavior around blood glucose monitoring and insulin administration in teens with Type 1 diabetes. Along with motivational interviewing with problem solving strategies around the two self-care behaviors and additionally text messages in reminding teenagers when to check their blood glucose levels at specific times (Goethal, 2021, p.2). The findings from this study suggest that over the course of 18 months that as the teenagers got older and more mature

their readiness for independent self-care increased. The greater teen self-management by the teen-report and parent-report it was related to a lower HbA1c level (Goethal, 2021, p.4). As the teenagers in the study grew older and gained maturity, both the teenager and the parent reported an increase in the teenagers' preparedness for independent self-care (Goethal, 2021, p.5).

In Gray's (2019) journal article with a collection of current information available from a variety of scientific based guidelines and resources on nutritional recommendations. The article discusses general recommendations for diabetic management in reference to nutrition. Target guidelines for macronutrients including carbohydrates, fats, and proteins with the individual's metabolic goals (Gray, 2019). The nutritional goal with a personalized meal plan is that it will address the individual's nutritional needs based on personal and cultural preferences, attain blood pressure, glycemic, and lipid goals, and educate the individual with food related information on a day-to-day meal planning (Gray, 2019). The major variables that are considered are different carbohydrate types including: sweeteners, non-sweeteners, sugar alcohols, fiber, resistant starch and fructans, and gluten free. The different types of Fats consist of Monounsaturated fatty acids, polyunsaturated fats, omega-3 fats, saturated fats, trans fats, cholesterol. Also evaluating Protein, Vitamins, and Minerals. This article includes information regarding the assessment of the individual's current eating patterns and benefits of personalized healthy meal plans for patients with diabetes in consideration of the individual's lifestyle, socioeconomics, and cultural background (Gray, 2019).

In the research done by Hackl (2021), Size matters: Influence of center size on quality of diabetes control in children and adolescents with Type 1 diabetes, it investigated center sizes in the correlation to metabolic outcomes. This is a longitudinal study with 46,098 participants younger than the age 21 years with Type I diabetes treated in 2009-2018 were analyzed. Diabetes

centers were classified in categories according to the number of patients from extra-small “XS” to extra-large “XL” (Hackl, 2021, p.67). The differences in the size categories with HbA1c levels and frequency of follow up visits. The variables that are measured in the study are the amount of follow up visits for each size, HbA1c level, and rates of Hypoglycemia and DKA in the patients (Hackl, 2021, p.67). The findings of this study indicate that in 2018 the “M” and in 2009 “L” diabetes centers had the highest centers proportion of patients with HbA1c. The “XS” diabetes centers had the highest proportion of patients with suboptimal diabetes control.

The role of Technology in Diabetic Management

The role of technology with management of health has increased the ways an individual can communicate quickly with a healthcare provider. Young adolescents transitioning into adulthood no longer seek pediatric care. These individuals lose communication with their pediatrician in this transition and therefore the diabetic management declines.

In Butalia’s (2020) study with 14 participants ranging from the ages 15 to 25 years old looked at the technological use and the influence on diabetic management during the transition from youth to young adolescents. In this transition period it was found that 60% of youth with diabetes do not continue seeking medical care treatment (Butalia, 2020, p.2). Three groups were conducted in this study including pre-transfer youth with diabetes, post-transfer young adults, and parents of recently transferred young adults with diabetes. This study measured the type of technological communication used, education and preparation, and social and peer support. The key findings of this study indicated that there is a lack of communication with the use of technology in this transitional phase, peer influence is important with managing diabetes, and having a shared experience with others who have diabetes can have a positive impact (Butalia, 2020, p.5).

Addala's (2019) research focuses on the transitions that influence management in these two age groups. Major themes from this transition phase that did not change in these participants was the state of hypoglycemia and a sense of futility around exercise. The study that is being performed is a qualitative study in 17 young adults (6 male, 11 female) and 16 completed the focus group (Addala, 2019, p.977). Within these participants, 70% used insulin pumps for insulin delivery. The criteria for these participants include being diagnosed with Type I diabetes for more than a year, HbA1c less than 13%, and age 18-25 years who are seen at the Advent Health Translational Research Institute for Metabolism and diabetes. This study focused on the transition from youth to young adulthood and measured BMI, eating behaviors, HbA1c, personal relationships, and glycemic control. In the conclusion of the study, evolving themes from youth to young adulthood were concluded. Young adults reported that they would like more input from their healthcare providers regarding diabetes specific technology (Addala, 2019, p.979). Other themes included in this transition are unhealthy eating patterns, personal relationship with T1DM, glycemic control and weight loss (Addala, 2019, p.980).

In a systematic review by Döger (2019), a sample study of 82 patients with ages ranging from 5-15 years old. In this systematic review the major variables studied included counting carbohydrates and communication networks that are used by the patients. Over 6 months fourteen (17.1%) of the cases were on insulin pump therapy and 59 (72.0%) were counting carbohydrates (Döger, 2019, p.72). The four measurements that were studied included HbA1c, pump therapy, carbohydrate counting, and the different telehealth systems used by patients. In the findings of the review the method used as a telehealth system was Whatsapp provided a means for instant messaging in most instances and also contact with diabetes education (Döger, 2019, p.72). The nurse consultation with the diabetes team about insulin doses and blood glucose

regulation is also an interactive message. The outcome of this study indicates that an increase in the frequency of counseling by the diabetes team led to improved blood glucose control in T1DM.

In the article by Geremia's (2019), Comparison of the effect of a compact vs a conventional, long-term educational program on metabolic control in children and adolescents with Type I diabetes: a pilot, randomized clinical trial, determining the differences in the two programs. The study that was conducted is a randomized clinical trial with 62 participants and ages ranging from 8-21 years old with Type I diabetes. In this randomized clinical trial, there is an experimental and clinical both participating in one lecture class every three months for one year. The experimental group participated in three sessions of 90 minutes with one session per week that contained five videos. The control group attended an extended program in which it had 45-minute PowerPoint lectures and one class every 3 months (Geremia, 2019, p.780). These participants also had their HbA1c levels tested at the end of 12 months. The analysis was a pre-protocol analysis. The mean HbA1c level was reduced by 2.3 for the experimental group and 1.8 for the control group (Geremia, 2019, p.781). The outcome of this study is that a compact education program in Type 1 diabetes Mellitus was comparable with an extensive program in the overall goal of reducing the HbA1c levels (Geremia, 2019, p.783).

The influence of Peer Pressure and Mental Health with Management

In the school setting young adolescents are influenced negatively and positively by peers in the management of their diabetes. This is due to their peers having a lack of education regarding the management that is needed for diabetic individuals leading to these diabetic individuals to either neglect their diabetes or embrace it.

In Winkley's (2020) systematic review in self-managed Type I and Type II diabetes a total of 96 studies were included in the systematic review with 18,659 participants. In these studies, it looks at psychological interventions for improving dietary behavior and the quality of life. Evaluating the effectiveness of education programs aiming to improve the mindset of individuals who have poorly managed diabetes (Winkley, 2020, p.2). The data analysis of the studies showed that in adults with Type I diabetes demonstrated a mean difference in the systematic review with self-managed Type I and Type II diabetes. This article suggests that self-managed diabetes is key to success and provides information regarding the influence of a negative and positive mindset on the management of Type I and Type II diabetes (Winkley, 2020, p.107).

A systematic review written by Velasco (2020) incorporating 13 studies that were selected covering 10 interventions. These reviews interpreted the outcomes of psychosocial interventions amongst preteens, (9 to 12 years of age) who have Type I diabetes (Velasco, 2020, p.2). The major variables in these studies include psychosocial interventions including teaching diabetes-related knowledge or skill, psychological training, or support as well as psychotherapeutic interventions targeting individuals and families. These interventions in the articles that selected the measurement of data ranged from a time span of 3 to 12 months. The psychosocial interventions included teaching diabetes-related knowledge or skill, psychosocial training or support, psychotherapeutic interventions that are aimed towards the individual and that individual's family (Velasco, 2020, p.2). The participants had the option between three intervention sites either from their home, clinical setting, or at a public location. The parents of the individuals also had the option of attending the sessions. The sessions ranged from 20-90 minutes and occurred for 18 weeks. In these intervention sessions information on glycemic control, self-management and adherence, self-efficacy, diabetes knowledge, coping skills, and

quality of life, and psychological distress were all discussed and measured throughout the 18 weeks (Velasco, 2020, p.8). The findings in this systematic review suggest that there is a need for educational programs that are specific to the age of the target population.

The article written by Zhao (2019) discusses the parental intervention in their adolescent with diabetes. The method used in this study was a random control trial with 962 participants, and this trial compared a control group to the intervention group. The interventions in the study focused on supportive parent training, including physiological support, family responsibilities, conflict management, and social support (Zhao, 2019, p.3). These interventions ranged from 5 to 12 sessions and were conducted between 2 weeks and 12 months. In the findings of this study, it was concluded that the parents feared a state of hypoglycemia for the child resulting in a physiological response increasing emotions such as fear and anxiety. More parental involvement in the child's diabetic management is beneficial for both the child and parent. Increased parent interventions will reduce physiological distress and assist in seeking for social support (Zhao, 2019, p.5).

Deeb's (2018) observational study had a sample setting of 58 adolescents with Type I diabetes and their parents with structured interviews on patients over the time span of 6 years. The goal of the study aimed to highlight some psychological issues with children and adolescents with Type I diabetes (Deeb, 2018, p.1). The variables observed included the differences in the reactions and adjustments with diabetes, impact on mental health, differences in the family dynamic, and assessing eating disorders in adolescents. The management of diabetes were measured in four categories: maladaptive disorders, eating disorders, family psychopathy, and family dysfunction. After the 6 years of the observational study the findings suggest that diabetes has an impact on overall mental health, $\frac{1}{3}$ of the patients at the end of the six years had

experienced depressive symptoms (Deeb, 2018, p.2). The lack of psychological support and resistant attitudes can lead to poor metabolic control. In preventing physiological difficulties, a supportive family backed up by experienced multidisciplinary team members can be beneficial in prevention (Deeb, 2018, p.7).

Yang's (2018) qualitative study with ten 12- to 17-year-old adolescents with diabetes from a pediatric endocrinology clinic in Taiwan, In this study the purpose is to describe how adolescents with Type I diabetes are perceived to their peers in the school setting with self-managing their diabetes. Adolescents are most concerned with how their peers perceive them and how the individual perceives themselves. A negative peer influence can influence responses and avoidance that negatively impact the health outcomes of adolescents with Type I diabetes. In analyzing the peer influences amongst the participants, the results indicated six themes that included: knowledge seeking, curiosity, enthusiasm, empathy, fearfulness, isolation and bullying (Yang, 2018, p.104). In conclusion to this study, an understanding of peer influence with adolescents who have Type I diabetes can provide information regarding diabetes as well as assisting school nurses with the goal to facilitate successful management of Type I diabetes in adolescents.

Discussion

During the literature review a gap was found that more research was needed for diabetic management that is specific for the adolescent age group. Limitations that exist in this literature review include the need for more education and screening for adolescents with Type I and Type II diabetes with the goal to improve management of diabetes. A greater effort is needed to improve the diabetes complication screening in the youth and those with higher risks for diabetes complications. The results of these articles highlight a common theme of a need for educational

programs that are specific to the age of the target population. Incorporating specific diets for these patients can increase their management in maintenance of the diabetes. An understanding of peer influence with adolescents who have Type I and II diabetes can provide information regarding diabetes, as well as assisting school nurses with the goal to facilitate successful management of Type I and II diabetes in adolescents (Yang, 2018, p.110).

The results of this study indicate a need for a better system to be put in place for the management of diabetes in adolescents. Nurses can aid in this by ensuring that the patient has resources that are beneficial in the maintenance of the individual's diabetes. Nurses can also promote patient education incorporating patient centered education to ensure the patient understands how to manage their diabetes. More research is needing to be done regarding ways to improve healthcare guidance in the management of diabetes with the transition from young adolescents to adolescents.

Conclusion

The main findings of this literature review are centered around factors that influence the poorly managed diabetes in young adolescents. The four main factors contributing to the influence of diabetic management are mental health and peer influence, technology, nutritional status and blood glucose levels, and physical activity. Peer pressure and influence in the school setting with young adolescents can either negatively or positively impact diabetic management. In this age group individuals are more concerned with how their peers perceive them and how the individual perceives themselves. A negative peer influence can influence responses and avoidance that negatively impacts the health outcomes of adolescents with Type I diabetes (Yang, 2018, p.105). The amount of exercise that the individual performs in relation to a diet that is lower in carbohydrates, lower in saturated fats, and healthier in beverage options showed an

improvement in glycemic control. Over the course of six months the individuals whose diet and fitness enhanced showed an improvement in glycemic control (Kriska, 2018, p.39). The role that nutrition has influences glycemic control, HbA1c, and lipid levels. Garonzi (2021) conducted a systematic review, and the main findings indicate that a high-fat intake affects glucose control in children and adolescents. There was a higher HbA1c level frequency reported for individuals consuming high amounts of fats (Garonzi, 2021, p.1). The use of technology with telehealth and management of diabetes in adolescents is lacking. This transition period between young adolescents into adulthood concluded that 60% of youth with diabetes do not continue seeking medical care treatment (Butalia, 2020, p.2). Technology is very prevalent in this age group and improving apps with telehealth communication to healthcare providers can improve the management in this age group. In conclusion, more education is needed for young adolescents who have diabetes for their management and maintenance.

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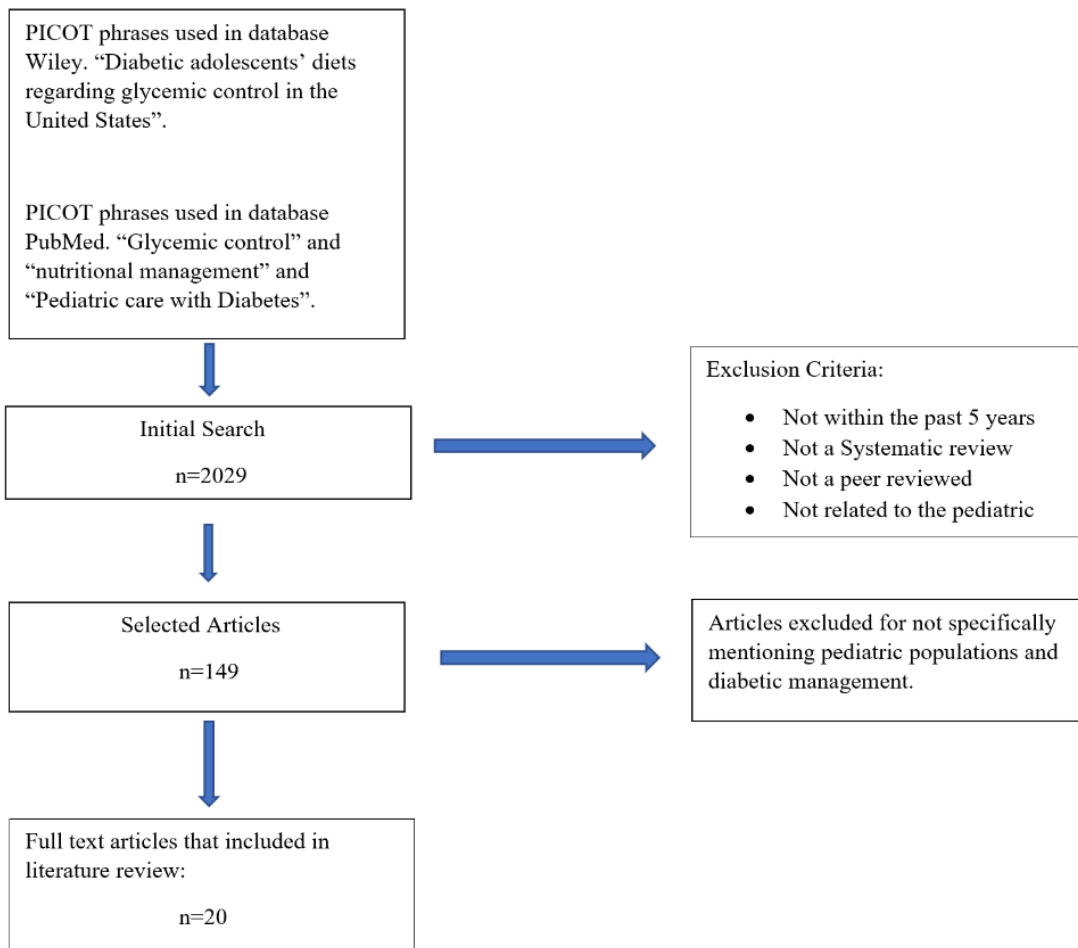
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Appendix A: Flow Chart of Search Results



APPENDIX B: Characteristics of Article Findings

TABLES OF EVIDENCE

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Addala 2019	Qualitative study	n=72 participants With T1DM diagnosed for 1 year, HbA1c less than 13% and age 18-25 years old.	Evolving themes from youth to young adulthood population. Unhealthy eating patterns, personal relationship with T1DM, glycemic control and weight loss. New themes that emerged from young adulthood. This includes family planning, impact on relationships, financial management, work, and role of physicians.	BMI, HbA1c, diabetes duration Demographic Information Barratt Impulsivity Scale Eating Behaviors Disordered Eating	Descriptive analysis was done by using the SAS version. All transcripts were also read by five investigators who also participated in the analysis.	Themes from adolescents to young adulthood arose in this study. Themes like: Hypoglycemia as a barrier to weight control. Stigma around T1DM, greater technology integration, additional responsibilities in young adults from a financial and emotional point of view.	The outcome of this study indicates the complexity of diabetic management. The significance of developmental milestones and life experience is also shown in the study.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Butalia 2020	Qualitative study Calgary, Alberta	n=14 Seven youth with T1DM who pre-transfer are participated in group 1 (median age 17.5)	Transition period from youth to young adulthood regarding management of diabetes. The focus group	Communication Technology Education and preparation	Analytic process using conventional qualitative analysis.	Key findings include: Social/peer influence on the individual is important. Sharing the experience with diabetes has	The outcome of this study provides information that is relevant regarding the diabetic

		<p>Four young adults in the post-transfer in group 2</p> <p>Three parents of youth group with T1DM</p>	<p>included positive and negative experiences within the last 6 months related to the transition and diabetes.</p>	<p>Social and peer support</p>		<p>a positive impact. Education regarding diabetes can be improved. Lack of communication in technology in the transition period.</p>	<p>management from youth to young adulthood and what can be improved during this transition.</p>
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
<p>Campoverde-R eyes 2020</p>	<p>Objective Study.</p> <p>Anonymous email including a survey sent from February 2020 through March 2020 at a large academic system.</p>	<p>n=73</p>	<p>Exploring obesity training amongst physicians.</p> <p>Collection of age/weight/racial background/height/country of origin/type of medical degree/primary medical specialty.</p> <p>Pediatricians were asked to disclose if they had a history of being overweight and personal eating habits.</p>	<p>Total number of obesity-related training hours by qualities, demographics, physicians clinical practice patterns, and physicians' knowledge of pediatric management.</p>	<p>All statistical analysis was conducted using stata software. Student t test and X² analyses.</p> <p>Multiple variable analyses were performed using an ordered logistic regression model.</p>	<p>Physicians who had more obesity training felt more successful and confident when they are treating a patient who is obese. They also felt more confident in discussing treatment options that included nutrition, physical activity, and MBS.</p>	<p>The outcomes of this study indicate that pediatricians who have an increased knowledge regarding obesity and training that they have more confidence in providing patient centered management.</p> <p>Incorporating obesity training during residency to</p>

							increase knowledge.
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Deeb 2018	Journal Article Observational Study	n=58 Adolescents diagnosed with T1DM and their parents with structured interviews.	Study aimed to highlight some of the psychological issues children and adolescents with diabetes. Differences in the reactions and adjustments with diabetes. Impact on mental health. Differences in the family dynamic. Assessing Eating disorders in adolescents.	The management of the adolescent's diabetes is measured in these four categories : Maladaptive disorders Eating disorders Family psychopathy Family dysfunction	Based on the patients over a time span of 6 years.	In the findings it suggests that diabetes has an impact on overall mental health, 1/3 of the patients at the end of the six years had experienced depressive symptoms. In preventing physiological difficulties, a supportive family backed up by experienced multidisciplinary team members can be beneficial in prevention.	The outcome of this article suggests that the four categories explored impact the overall management of adolescent's diabetes.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Döger 2019	Systematic-Review	82 patients, with ages ranging from 5-15 years old.	Fourteen (17.1%) of the cases were on pump therapy and 59 (72.0%) were	Different telehealth systems used by patients. Pump therapy	The telehealth system was developed by the diabetes team. The demographic	Whatsapp provided a means for instant messaging in most instances and contact	The outcome of this study indicates that an increase in the frequency of counseling by the

			<p>counting carbohydrates.</p> <p>Counting carbohydrates</p> <p>Communication networks that are used by the patients.</p>	<p>Carbohydrate counting</p> <p>HbA1c levels measured after 6 months.</p>	<p>characteristics, frequency of use and hemoglobin A1c (HbA1c) changes of type 1 diabetic (T1DM) patients using this communication network were analyzed.</p>	<p>with diabetes education. The nurse consultation with the diabetes team about insulin doses and blood glucose regulation is also an interactive message.</p>	<p>diabetes team led to improved blood glucose control in T1DM.</p>
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Eisenberg 2018	<p>Cross-Sectional Study</p> <p>Randomized clinical trial of family based behavioral nutritional intervention among youth with Type I diabetes</p>	<p>n=136</p> <p>Participants above 13 years old</p>	<p>Improvement over a 18 month period in behavioral intervention and diet quality inadvertently increases disordered eating.</p> <p>Nine in-person sessions led by trained research personnel and included behavioral techniques and educational content regarding inclusion of fruits, vegetables, whole grains, and</p>	<p>Baseline for HbA1c measured at 6,12, and 18 months.</p> <p>Blood Glucose levels</p> <p>Assessment of the individual's diet and pattern of eating.</p> <p>Weight monitoring</p> <p>Diabetes eating problem survey revised (DEBS-R) assessment.</p>	<p>Statistical analysis between the intervention and the control at each study visit 6,12, and 18 months.</p> <p>Tested using independent samples of t-test.</p>	<p>The findings of this study indicate that the higher DEBS-R scores were associated with poor glycemic control over time with a higher HbA1c. Also, a higher sensor glucose was associated with higher DEBS-R scores.</p>	<p>The outcomes of this study provide information regarding disordered eating and the effects it has on blood glucose levels.</p> <p>Family-based interventions have a stronger support system for the individual in managing diabetes.</p>

			legumes in the diet.	Association of the DEBS-R with glycemic control.			
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Garozi 2021	Systematic Review	Multiple studies are being reviewed and include the findings of each study. One study included n=180.	Relationship between fat intake and glycemic control, cardiovascular risks, inflammation, and microbiota. Relationship between macronutrient intake, and lipid intake, and glycemic control, CVD inflammation.	Blood glucose levels HbA1c Fat intake Physical activity Low carbohydrate Diets	Meta-analysis regarding macronutrients and glycemic control.	The findings suggest that high-fat intake affects glucose control in children and adolescents. There was a higher HbA1c level frequency reported for individuals consuming high amounts of fats.	The outcome of this article provides information regarding daily food requirements and the types of foods that are included in each macronutrient.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Geremia 2019	Randomized Clinical Trial	n=62 Age group ranging from 8-21 years old with T1DM.	The experimental group participated in three sessions of 90 minutes with one session per week that contained five videos.	The 62 patients were randomized into two groups. The control group which was the	The analysis was a pre-protocol analysis. The mean HbA1c level was reduced by 2.3 for the experimental group and 1.8 for the control group.	The outcome of this study is that a compact education program in Type I diabetes Mellitus was comparable with an extensive	This article provides information that is beneficial in the impact of education for children/adolesce

			<p>The control group attended an extended program in which it had 45-minute PowerPoint lectures and one class every 3 months.</p>	<p>extensive education program and the short-term experimental group.</p> <p>Difference in the two groups HbA1c levels at the end of 12 months.</p>		<p>program in the overall goal of reducing the HbA1c levels.</p>	<p>nts greatly impacts the overall management of their diabetes.</p>
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Goethals 2021	Longitudinal study	<p>n=178</p> <p>The sample size ranged from ages 13-17 years old with Type I diabetes over 18 months.</p>	<p>Enhancing self-behavior around blood glucose monitoring and insulin administration in teens with Type I diabetes.</p> <p>Motivational interviewing with problem solving strategies around the two self-care behaviors and additionally text messages in reminding teenagers when to check their</p>	<p>Readiness for self-management questionnaire</p> <p>Diabetic Management questionnaire</p> <p>Glycemic control</p> <p>HbA1c</p>	<p>Statistical analysis, statistics are presented as a mean standard deviation for continuous data and as percentages for categorical data.</p> <p>Data collected through teenager and parent interviews, reported measurements by teenagers, parent recorded measurements, self-report questions.</p>	<p>The findings from this study suggest that over the course of 18 months that as the teenagers got older and more mature their readiness for independent self-care increased.</p> <p>In conclusion also it was suggested that the teens may not be able to express to parents their readiness for independent management of the</p>	<p>The outcomes from this study indicate that when adolescents start to be more independent with their diabetic management there is more success later in life for overall better diabetic management.</p>

			blood glucose levels at specific times.			diabetes.	
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Gow 2021	Systematic Review	n=674 Children and adolescents ranging from 5-18 years old.	Very low energy diet (VLED) in the effect on glycemic control and weight reduction. Weight loss regarding the VLED. Overall management of diabetes.	Blood Glucose levels HbA1c prior to the VLED and after. Weight prior to the program and after the program. Fasting blood glucose levels.	Meta-analysis of 20/24 includes studies indicated for the VLED program of 3 to 20 weeks.	In the two published studies that implemented VLED in young people having T2DM, both studies demonstrated significant weight loss and improvements in multiple aspects of diabetes, improved glycemic control, and reduction in medication use.	The findings of the article indicates that behavior change in childhood and young adulthood regarding a dietary mindset on eating foods that are not high in calories or fats show improvement in the management.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Gray 2019	Collection of current information	General recommendations for	Carbohydrate types including:	Assessment of the individual's	Current guideline recommendations	The benefits for each food category are	This article includes relevant

	available from a variety of scientific based guidelines and resources on nutritional recommendations.	diabetic management in reference to nutrition. Target guidelines for macronutrients including carbohydrates, fats, and proteins with the individual's metabolic goals.	sweeteners, non-sweeteners, sugar alcohols, fiber, resistant starch and fructans, gluten free. Fat: Monounsaturated fatty acids, polyunsaturated fats, omega-3 fats, saturated fats, trans fats, cholesterol. Protein Vitamins and Minerals	current eating patterns. Personalized healthy meal plans.	tions in protein, carbohydrates, and fats with daily amounts.	related to the individual's overall health.	information regarding essential foods for the management of diabetes.
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Hackl 2021	Longitudinal Study	n=46,098 Patients younger than 21 years old with Type I diabetes treated in 2009-2018 were analyzed.	Diabetes centers were classified in categories according to the number of patients from "XS" to "XL". The differences in the size categories with HbA1c levels and frequency of follow up visits.	The amount of follow up visits for each size. HbA1c level Rates of Hypoglycemia and DKA in the patients.	A longitudinal analysis over a 10-year period. Longitudinal analyses Differences between groups were assessed by Kruskal-Wallis test for continuous variables and X ² tests for dichotomous variables.	The findings of this study indicate that in 2018 the "M" and in 2009 "L" diabetes centers had the highest proportion of patients with HbA1c. The "XS" diabetes centers have the highest proportion of patients with suboptimal diabetes control.	The outcomes of this article indicate that medium centers had the best metabolic control, and the smaller ones did not have the best metabolic control. DKA was the highest and

							frequency of visits was also lower.
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Kriska 2018	Treatment Options for type II diabetes in Adolescents and Youth (TODAY) clinical trial cohort from across 15 US centers.	699 youth aged 10 to 17 years with type II diabetes <2 years and body mass index ≥85th percentile at baseline.	Cardiovascular fitness Glycemic control Weight TY2DM	6 months of cardiovascular fitness assessed using a submaximal cycle ergometer test. Fiber Intake HbA1c Saturated Fat Intake Beverages	The changes from the baseline in these variables were analyzed using general linear mixed models for both continuous and categorical measurement.	At 6 months, ~25% of females and ~33% of males improved CRF. The males showed that this was related to a decreased HbA1c and a lower percent experiencing glycemic failure.	The outcome of this study indicates that the ones whose diet and fitness improved in the 6 months showed an improvement on glycemic outcomes.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Levitt 2018	Multicenter trial Randomized Treatment	n=648	Impact of insulin therapy on lipid and inflammatory markers in youth with T2DM. Changes in lipids and inflammatory markers examined.	Glycemic control and glycated HbA1c. Statins used for low-density lipoproteins cholesterol.	Insulin therapy impacted HbA1c modestly and increased total cholesterol, LDL, and apolipoprotein B.	The findings suggest that dyslipidemia and inflammation over time increases a concern with premature development of atherosclerosis in youth with T2DM.	The outcomes of this article suggest that diets high in lipids in the youth can later in life develop atherosclerosis.

							Incorporation of a healthy diet with insulin therapy is beneficial for the patients.
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Malik 2019	Cohort Study	n=2,172 Age ranging from 13-21 years.	The amount of times the patients had measurements of HbA1c. Examine the association of previously measured metabolic status related to diabetes complications.	Over the time span of a year the amount of clinical visits and including these measurements: Blood Pressure HbA1c Eye examination Lipid levels checked Foot exam Albuminuria screening	Linear and Multinomial regression models used to evaluate associations.	The findings indicated that 60% of the participants had 3 or more HbA1c measurements in the past year. In the diabetes examination screening 93% reported to have blood pressure in the past year, 81% eye exam, 71% lipids level checked, 64%-foot exam, 63% albuminuria screening.	The outcomes of this study indicate that there should be a greater effort to improve the diabetes complication screening in the youth and those with higher risk for diabetes complications.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
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Seckold 2019	Retrospective, cross-sectional review	22 children, 55% male and 45% female. Ranging from 3 to 7 years old.	HbA1c BMI Duration of diagnosis with diabetes Macronutrient distribution; Carbohydrates, protein, and fat intake.	Baseline characteristics with HbA1c and daily weights, food diary log, and a mealtime management survey were collected.	Most children did not meet the vegetable and lean meat/protein intake recommendations. HbA1c was not correlated with daily carbohydrates, protein, or fat intake. HbA1c was higher in children offered food in a grazing pattern with those offered regular meals.	Dietary quality is concerning in young children with T1DM with excessive saturated fat and inadequate vegetable intake. Young children meeting glycemic targets should receive insulin before meals and follow a routine eating pattern.	This article concludes that following a routine eating pattern results in a more controlled glycemic amount. The dietary aspect of children's diet with incorporating less foods that contain saturated fat and increase the amount of vegetables all help in glycemic control
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Winkley 2020	Systematic review in self-managed type I and type II diabetes.	A total of 96 studies were included in the systematic review (n=18,659 participants).	Blood Pressure Body Mass Index Haemoglobin levels Depression and counseling	Psychological interventions in improving dietary behavior and the quality of life. Improvements in blood pressure and BMI.	Education programs aiming to improve the mindset of individuals who have diabetes and poorly controlled management. The data analysis reports with a little correlation	In adults with type 1 diabetes mellitus (n = 851 participants) that demonstrated a mean difference in the systematic review with self-managed type I and type II diabetes.	This article suggests that self-managed diabetes is a key to success. It offers information regarding one's negative thoughts on management with type 1 and 2 diabetes.

					n to an improvement of counseling and improved glycemic control.		
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First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Velasco 2020	A systematic literature review Finland and Sweden	Twelve studies were selected, covering ten interventions. According to the topics identified, four of these interventions were categorized as self-care programmers, three as psychosocial programmers and three as mixed.	Psychosocial interventions included teaching diabetes-related knowledge or skill, psychological training, or support as well as psychotherapeutic interventions targeting individuals and families.	These interventions in the articles that were found in the literature review ranged from a time span of 3-12months. Blood Glucose levels HbA1c Physiological Distress Coping Skills Quality of Life Knowledge regarding diabetes Self-Efficacy Glycemic control	Glycemic Control was monitored in measuring blood glucose levels with the interventions and HbA1c. Self-monitoring checklist with the 5 aspects of monitoring to children with parents helping less than age 11 and independent children above 11. There was a slight improvement in positive effect and self-management.	A preteen's needs, feelings and points of view should be considered when designing these interventions, while including family and peers. This combination would allow preteens to achieve meaningful behavioral change, along with emerging diabetes management autonomy, that will form a foundation on their way to a good metabolic control and psychosocial well-being during adolescence and, consequently, adult life.	This article shows that there are many factors during this stage in the child's life that influence the overall diabetic management.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Yang 2018	A qualitative Study	Ten 12- to 17-year-old adolescents with diabetes. Mean age was 15.4 years old.	Perceptions of peers' responses. Negative and Positive perceptions affecting health outcomes.	Audio recorded interviewed data with semi-structured interviewing. The interviews ranged from 37-54 minutes.	The interviews were reviewed to explore implicit meaning. Identifying themes of perception and the management within this age group. Interviewed transcripts analyzed using a thematic analysis approach.	Six themes were found in the perceptions of adolescents with Type I diabetes toward the peer responses. Knowledge seeking, curiosity, enthusiasm, empathy, fearfulness, and bullying.	This study includes relevant information regarding the factors into the management of diabetes for adolescents with peer influence. The peer influence can have either a positive or negative outcome on the individual's management.

First Author	Design/Methods	Sample Setting	Major Variables Studied (and their Definitions)	Measurement	Data Analysis	Findings	Appraisal worth to practice
Zhao 2019	Meta-Analysis Randomized-controlled trials	1,514 abstracts originally screened, 44 met the initial inclusion criteria for further assessment. A total of 17 relevant papers from 13 studies met the full inclusion	Parents of children or adolescents no older than 18 with Type I diabetes. Excluded parents included: parents who needed reading assistance, previous development	Physiological outcomes: Effects of parenting interventions on depression, stress, anxiety, and confidence.	A significant effect of parenting intervention on social support for parents was found in this study.	The meta-analysis indicates that parenting interventions can help parents of children and adolescents with T1DM make some psychological adjustments, including	The information that is provided concludes the parents' role with the management of the adolescent and children's diabetes. It provides physiological outcomes

		criteria.	al disorders, or other health disorders.			reducing parents' depression and distress while seeking positive social support.	with parental involvement in the overall management .
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