Experiences of Adolescents with Health Promotion in the Management of Type 1 Diabetes

A Literature Review

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Description

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Abstract

Background: The above research thesis evaluates the benefit of health promotion and how it has evolved positively the care and management of adolescents living with type 1 diabetes.This has exposed also the different means that has been carried out in camps, peer group supports, school led interventions, and also family and home care settings. Adequate programs that have given positive characteristics such as creating a safe atmosphere that enables the reduction of isolation, which is as a result of stigma, also with efficient skills such as carbohydrate counting, checking of blood sugar levels which help to enhance knowledge. Additionally, having good communication amongst young adults, the healthcare personnels and family members is paramount to enhance trust and support self-management and independent towards autonomy in self-care.

Method: the literature review was drawn from CINAHL, Medline, and PubMed Central databases. Seven from these database articles which are relevant and published within 2015 and 2025 was picked for the analysis. The data that was deduced from these articles was examined qualitatively to get the relevant insights.

Findings: The results from this analysis gave three key areas for getting efficient care and support. The first is that it is paramount to have a good conducive environment that promotes learning and understanding positively. The second is that every other means of support for the adolescent such as family, the community, school and other forms of support is very integral.The third factor is that for there to be a good practical knowledge and proper management, there must be empowerment. The review also mentioned other key challenges like worries and anxiety amongst educators, economic hardship and strain, inaccessible healthcare equipment and programs and lack of training amongst school staff.

Conclusion: The research proves the benefit of health promotion amongst adolescents based on the level of its empowerment to autonomy in self-care. To ensure the longevity of this empowerment, there have to be a lot of reinforcement in educative tools, policies and support network.These activities are paramount to decreasing type 1 diabetes cases, create inclusion and support for adolescents and promoting independence to self-care.

Keywords/tags (subjects)

Experiences, Adolescents, Health promotion, management of type 1 diabetes.

Miscellaneous (Confidential information)

N/A

Contents

1 Introduction

According to the International Diabetes Federation (IDF, 2017), the global prevalence of diabetes in children and adolescents is rising annually, with T1DM increasing by approximately 3% per year in some regions among those under 15 years. Annually, 19.2 per 96 children under 15 are diagnosed with T1DM, rising to 132,600 cases by age 20. It has been estimated that more than 1.2 million children and adolescents younger than 20 years worldwide have T1D (Azar et al, 2024.); Europe accounts for 28.4% and North America 21.5% of T1DM cases in individuals under 20. Type 1 diabetes (T1D) is a condition characterized by the immune-mediated destruction of insulin-producing pancreatic β-cells, leading to absolute insulin deficiency. Type 1 diabetes shows differently in each person, with various metabolic, genetic, and immune system features that also vary significantly with age. Because of this variability, care must be tailored to the individual (Holt et al, 2021.).

Young adults that live with this ailment find it hard to live with daily life. This is as a result of the changes that occurs during puberty, which is a phase of life where there is increment in insulin resistance and the blood sugar levels become volatile and unpredictable. They also have to deal with the other phase of social and emotional work of growth occurring around them and trying to identify themselves around their immediate environment and navigating and gaining control of their everyday life. Other challenges are also not left out such as the burden of carrying out their diabetes care. Their attention and needs not being met, also can frustrate these teens and make them segregate from their peers (Azar et al, 2024.). Patient and family education becomes paramount. Means to care for this ailment have to be programmed in such a way the knowledge level and socioeconomic status of the patient and family can be well communicated and understood. Family collaborations and open communication leads to trust and therefore helps to create an informed independence on T1DM management (Emiliana et al, 2019.). Peer-led education becomes proportional to expert-led approaches which benefits selfcare, medication adherence, and self-efficacy, with adolescents getting a boost to be confident in the daily hurdles of their care. Group learning which helps in carbohydrate counting, becomes easy therefore leading to understanding of their meals and glycemic factors (Emiliana et al, 2019.).

Therefore, this research looks into the experiences of adolescents with health promotions towards T1DM management. The aim is centered on the impact of health promotion in the management of

T1DM amongst adolescents. The result of this study would identify how important various health promotion is to adolescents when managing their condition.

2 Background

2.1 Type 1 diabetes

About other autoimmune diseases, type 1 diabetes in some people is related to genes hence making them susceptible to the ailment. Genetic markers are strongly linked to the cause of type 1 diabetes; also, environmental factors are sometimes believed to trigger an attack by the immune system though no one yet knows exactly what the environmental trigger is. These triggers can be like viruses, food additives, or cow milk have been suggested, none have been proven to directly cause the disease (Titchener, 2020.).

According to the World Health Organization, (2023) type 1 diabetes can be defined as a chronic disease that occurs as a result of insufficient production of insulin by the pancreas as insulin is a hormone responsible for the regulation of blood glucose. This is always a result of some autoimmune activities that target the beta cells in the pancreas responsible for producing insulin leading to a subsequent decrease normal secretive function of insulin in the pancreas (Titchener, 2020). Moreso, uncontrolled diabetes could lead to high blood sugar hence causing deterioration of the body system especially the nerves and blood vessels (WHO, 2023). About 80-90% of people diagnosed with type 1 diabetes have no family trace and history of the condition. In a study carried out by Ursu et al, (2024) in South-East Romania about new pediatric cases of type 1 diabetes on the potential connection between vitamin D deficiency and onset of type 1 diabetes, it was found out that pediatric with type 1 diabetes have been found to have a low level of vitamin D hence raising the need for prompt monitoring and supplementation of vitamin D among individuals susceptible to type 1 diabetes.

Furthermore, though other family members may have one or other autoimmune disease, people with type 1 diabetes are also likely to develop other autoimmune disorders. If a close family member has type 1 diabetes, the risk of another relative developing it is 15–20 times higher and it is worthy to note that while it was once seen as a childhood disease, type 1 diabetes can develop at any age, even in older adults (Titchener, 2020.).

Type 1 diabetes comprehension differs in several ways, it is understood as having its own variants or endotypes which are separate with its own distinct biological process (Wilson & Pozzilli, 2025).

Before its management was dependent on utilizing a standardized insulin therapy which is used to control the symptom without fixing the major disease causing it (Carr et al, 2022).the present study is majorly centered on elements such as onset, immune system behaviors, genetics, the rate of which the beta cell that are being lost enhance to cause this disease therefore showing its true complex (Redondo et al, 2022; Parviainen et al, 2022). Having this understanding opens the path to precision medicine, which the management of the disease is specifically designed for the patient, hence increasing its positive longevity (Weston et al, 2024).

The study shows that type 1 diabetes can be grouped into different factors, with each factor having its own uniqueness. The one known as Endotype 1, is known to have its onset at early childhood before seven years (Wilson & Pozzilli, 2025). This form is characterized by a highly aggressive, T-cell-driven autoimmune attack on pancreatic β-cells resulting in a swift decline in β-cell function, evidenced by low C-peptide levels and a consequent high risk of long-term complications thus patients typically present with high titers of autoantibodies, particularly insulin autoantibodies (IAA), and a strong genetic association with the HLA-DR4-DQ8 haplotype (Weston et al, 2024; Powers, 2021; & Battaglia et al, 2019).

Conversely, Type 1 Diabetes Endotype 2 (T1DE2) typically manifests after the age of 12 and follows a more indolent progression as the loss of pancreatic β-cells occurs more slowly, allowing for the preservation of moderate C-peptide levels, and the T-cell-mediated immune response is less severe. These patients often have few or no detectable autoantibodies and can maintain their own insulin production for a longer period (Wilson & Pozzilli, 2025.). While not strongly linked to classic high-risk HLA alleles, T1DE2 shows genetic overlaps with type 2 diabetes, including variants in the TCF7L2 gene (Weston et al, 2024; Powers, 2021; & Battaglia et al, 2019).

Diagnosing children in the 8 to 12-year-old age range is not always straightforward, since their symptoms can overlap with more than one type of diabetes progression (Wilson & Pozzilli, 2025). One helpful tool for telling these forms apart is the proinsulin to C-peptide ratio, which tends to be raised in T1DE1. This elevation reflects underlying beta-cell strain and poorer cellular health (Redondo & Morgan, 2023; Leete et al, 2020). Type 1 diabetes can develop at any age, but it is most frequently diagnosed in early adolescence, with the highest rates occurring between 10 and 14 years old (Ruiz-

Grao et al, 2024). Puberty brings intense hormonal changes that create considerable metabolic pressure, changing how the disease advances. This is largely due to a disruption in the growth hormone (GH) and insulin-like growth factor-1 (IGF-1) system. While increasing GH levels naturally make the body more resistant to insulin during these years, the existing insulin deficit in T1D also reduces IGF-1 production. Together, this can lead to unstable blood sugar levels and may interfere with normal growth (Codner & Cassorla, 2008; Skog & Korsgren, 2018; Holl et al, 1998; Kelsey & Zeitler, 2016; Olarescu et al, 2000 & Nijenhuis-Noort et al, 2024.). This pubertal stress does not affect everyone the same way. For those with the T1DE1 endotype, the increased insulin resistance accelerates the loss of insulin-producing beta cells, increasing an already rapid disease progression, (Parviainen et al, 2022; Weston et al, 2024; Kelsey & Zeitler, 2016 & Leete et al, 2016). On the other hand, individuals with the T1DE2 endotype often begin with more remaining beta-cell function. This provides them with a better capacity to adjust during puberty, although a higher body mass index can sometimes lessen this benefit (Weston et al, 2024; Skog & Korsgren, 2018 & Leete et al, 2016.). The added insulin resistance can sometimes cause T1DE2 patients to temporarily display T1DE1-like characteristics hence for the intermediate group, outcomes are highly variable, necessitating careful monitoring of C-peptide and autoantibody levels to distinguish between the two progression patterns (Weston et al, 2024; Kelsey & Zeitler, 2016; & Nijenhuis-Noort et al, 2024).

The spectrum of T1D also includes Endotypes 3–5 (T1DE3–5), often classified under Latent Autoimmune Diabetes in Adults (LADA) as they appear in adulthood and involve a slower, macrophage-driven destruction of β-cells (Connor et al, 2023 & Lenzen & Jörns, 2024). Among these, T1DE3 demonstrates the most robust immune response, while T1DE5 is the mildest and can closely resemble Type 2 Diabetes (Weston et al, 2024). The gradual nature of the autoimmune attack in T1DE3–5 creates a window for therapeutic interventions targeting insulin resistance or lifestyle modifications (Weston et al, 2024; Connor et al, 2023 & Lenzen & Jörns, 2024).

A more recently identified form, Type 1 Diabetes Endotype 6 (T1DE6), has been associated with COVID-19 as it is hypothesized to result from direct SARS-CoV-2 damage to pancreatic β-cells or from virus-induced autoimmunity, leading to hyperglycemia (Weston et al, 2024; Wu et al, 2021; Müller et al, 2021; Ben Nasr et al, 2021; Deng et al, 2024 & Maddaloni & Buzzetti, 2020). The clinical outcome is heterogeneous, with some patients recovering β-cell function and others progressing to

permanent insulin dependence (Wu et al, 2021; Müller et al, 2021; Ben Nasr et al, 2021; Deng et al, 2024 & Maddaloni & Buzzetti, 2020).

In summary, the unique pathological and clinical profile of each T1D endotype underscores the critical importance of personalized medicine thus, categorizing patients by endotype allows clinicians to select the most appropriate and effective interventions for specific subgroups as this targeted approach optimizes resource allocation, improves cost-effectiveness, and enhances patient access to beneficial therapies, while simultaneously reducing the burden of unnecessary treatment for individuals already managing a demanding chronic condition (Wilson & Pozzilli, 2025).

2.2 Health promotion

Health promotion is a team effort that centers on developing safe, supportive, social, and physical environments at all levels of life including personal, organizational, and community levels hence focusing on improving factors that affect health thereby empowering individuals to take charge of their well-being (WHO, 2022). Health promotion, health protection, and disease prevention all work together to help the public achieve and maintain a healthier population and improve their lives in general (Jadotte et al, 2019).

Globally, health background entails that the method of supporting a person's wellbeing have to be revaluated to elevate the health of the whole community which are struggling with threats and therefore develop various means for health promotion (Barry, 2021). The indication of this is that diving deep into medical care have to be overstretched that it cuts across other social and economic factors that molds a better healthcare thereby creating reduction in inequalities (World Health Organization, 2019). The COVID-19 pandemic gave a paramount lesson to be learned by researchers. Physical and economic health stability caused a great toll and exposed so many frailties within the health care system in time of crisis. The experience gave insight into the idea that the best way to have an effective health system is through collective collaborations amongst all sectors of society to combat hidden issues in poor healthcare systems. It highlighted the need to have active health care that mandates social and behavioral support, with a good coordination among local and international level (Barry, 2021.).

The pandemic era also pointed out the big gap on funding for both traing and the essential things needed in the system, such as multi sectoral approach which helps identify modern public health and also health promotion (Barry, 2021). All the research done in the past years gave insight on how to have a solid based initiatives and approaches tailored at all the communities. These programs helps to contain severe conditions and also fast reaction in hazardous outbreaks, with high support towards mental health while at the same time working to bring down the deep segregation that harm the public day to day living (World Health Organization, 2017; McQueen & Jones, 2007.).

The gains that have been attributed to health promotion in diabetes management is highly paramount and is seen below showing its advantage to good health. In research done by Young et al, (2014) based on the level of parental interventions on type 1 diabetes management, it shows the need for health promotion amongst the parents and adolescents which is paramount for diabetes management. In cases of young teens with diabetes encounter a good team effort with good conversations, with emotional backing, their health positively elevates. This supportive environment encourages their general wellbeing and creates better self-care and blood sugar (Jaser & Grey, 2010.). Young teens have the tendency of following their tailored selfcare management plan leading to better glycemic control and stability (Palmer et al, 2009; Berg et al, 2008; Jaser & Grey, 2010; & Lloyd et al, 2009). As their confidence in handling their own care grows (Berg et al, 2011), they experience fewer dangerous episodes of diabetic ketoacidosis (Geffken et al, 2008) and exhibit fewer related behavioral challenges (Berg et al, 2011).

Research suggests that the most beneficial parenting approach blends emotional support with clear, consistent boundaries (Young et al, 2014). Adolescents tend to show improved blood glucose management when their parents are both nurturing appropriately (Shorer et al, 2011; Greene et al., 2010), and they are more likely to follow through with daily diabetes routines such as checking glucose levels and taking insulin as prescribed (Greene et al., 2010). The adolescent's own view of their parents' involvement also plays a critical role as guidance is most effective when adolescents perceive that support as helpful and welcome (Berg et al, 2008).

However, Parents and adolescents frequently hold different opinions about how well the teen manages their diabetes (Young et al, 2014). Caregivers often rate their teenager's abilities lower than

the teens rate themselves (Butner et al, 2009), and this mismatch can create tension around autonomy and is linked to poorer blood glucose outcomes (Butner et al, 2009). For this reason, parental involvement is most effective when it functions as supportive framework thereby helping when necessary but not taking control, allowing the adolescent to gradually build confidence and competence (Young et al., 2014).

Open and honest conversation is key when it comes to sharing the responsibilities of diabetes care (Young et al, 2014). When teens are open with their parents about their care, they adhere better to their treatment, while secrecy is linked to poorer adherence (Osborn et al, 2013), honest dialogue makes daily monitoring easier and helps healthcare teams prevent long-term problems. For parents finding it hard to give up control, communication builds the trust needed for a true partnership (Young et al, 2014).

While ongoing parental involvement is recommended, studies show that reducing parental responsibility too quickly can lead to poorer adherence (Hsin et al, 2010; Ingerski et al, 2010 & Vesco et al, 2010) and worse glycemic control (Ingerski et al, 2010). Over time, a drop in parental involvement is linked to a decline in adherence (Ingerski et al, 2010), especially if the teen does not gain confidence in their own skills at the same time (Wiebe et al, 2014). The key is tailored support; for example, parental help during difficult diabetes situations can boost the confidence of teens who doubt their own abilities (Young et al, 2014).

2.3 Nursing Intervention

The best way to manage a disease in an early stage is through a collaborative effort amongst the child, parents or family and healthcare personnels (Shulman et al, 2010). When diagnosed of type 1 diabetes during childhood, it brings a lot of emotional pressure on the young adult and the family members because of the enormous task involved in the care. Adolescents precisely find it difficult to attain independence on their care based on the hectic schedule and routine of the day, and also the physical changes occurring due to puberty and the environment around them. The hurdles can bring pressure which relates to their friends and also personal identification of who they are which further delays diabetes management (Hoey et al, 2009.).

The means of balancing their glucose level requires three key elements: regular glucose monitoring, adequate insulin dosage, with effective communication. Insulin therapy either done through injections or pump based infusion directly to the subcutaneous tissue adjusted based on interstitial glucose readings. Management is paramount in avoiding problems such as hypoglycemia or diabetic ketoacidosis, and also complications like retinopathy and kidney disease (Ziegler et al, 2011.). Glucose levels can be checked frequently through finger-stick testing (SMBG) or through more advanced tools like continuous glucose monitoring (CGM) and flash glucose monitoring (FGM), all these offer reliable readings, therefore making it easier to administer insulin at right doses through continuous subcutaneous insulin infusion (CSII) with an insulin pump (Galderisi et al, 2017). Additionally, adolescents utilize all these in checking their sugar levels and administering insulin doses to their preferred specific personal care (ADA, et al, 2019).

2.4 Adolescents' role in type 1 diabetes management

Adolescent age consists of the time when young teens seek independence. According to the WHO, (2025) the term "Adolescents" is defined as people between 10 and 19 years old, while "youth" is defined as the ones aged 15 to 24. Together, these groups are classified within the same category of "young people," ranging from age 10 to 24. However, for adolescents with type 1 diabetes, this sudden surge to become dependent becomes complicated and becomes unpredictable, this causes a huge rift for both their personal desires to be independent and the hectic routine for medical adherence (Kelly et al, 2021.).

Amongst the adolescents that are learning to manage their T1D, the process is usually deep and connected. The process of taking care of themselves can't be done solely as a specific responsibility rather their quest for independence is molded by their relationship amongst their healthcare teams and family members. This idea known as relational autonomy exposes that their ability to take care of themselves is boosted by support which questions that independence is based solely on (Varga et al, 2022.).

Young teens that care better for themselves at young age, takes proper care of their wellbeing. For example, a situation where a family playfully acts out emergency scenario of use T1DM after diagnosis is to show how they teens can responds in real situation when it arises and they are far from home (Trudeau et al, 2019). After making this kind of preparation, young teens get self confidence

on managing their condition. Experts suggests that when such scenarios are carried out often and early, they attain a mastery based on their age and individual abilities. Early preparation can also reduce the stress faced in the family, but it does not predict a better outcome in the future (Castensoe et al., 2017.). In addition, the process of sharing responsibility amongst parents and adolescents is very important in proper self care management, thus this supports efficiency in clinical outcomes, psychological wellbeing with better quality of (Goethals et al, 2021). Parental advocacy and collaborations is vital to helping these young teens to achieve autonomy in managing their (Kelly et al, 2018).

Adolescents that have little or no parental guidance usually finds it hard with T1DM self-management in contrast to the ones who have a collaborative parental (Fornasini et al, 2020). AMongst family seettings, Hanna et al (2013) emphasized the need for parental support and guidance and their integral role in managing T1DM. The result portrayed that parental involvement helps both in boosting the adolescents perception on independence and shared responsibility in their T1D management (Collet, 2018)

3 Aim, purpose, and research question

The main aim of this literature review is to analyze existing research conducted on the experiences of adolescents with health promotion on the management of type 1 diabetes in adolescents. The goal is to ascertain, with the help of evidence-based articles, the experiences of the proposed population of this study and also find key areas that need future research and general improvement concerning type 1 diabetes management. The results gathered from the literature review will give insight in improving the quality of life for a diabetic patient. The research question addresses the question, What kind of experience does adolescents have with health promotion while managing their type 1 diabetes?

4 Methods

4.1 Literature Review

A literature review is a methodology for conducting research that explains an overview of other types of reviews already carried out hence it is so essential in research because it offers access to

various existing research in a particular field of study (Snyder, 2019). Therefore, a literature review can be defined as a methodical approach to gathering and combining prior information (Baumeister & Leary, 1997; Tranfield, Denyer, & Smart, 2003). A solid basis for knowledge advancement and theory building is established by a well-executed review as a research approach (Webster & Watson, 2002). A literature review can answer research questions more effectively than any study by combining numerous empirical studies, conclusions, and viewpoints thus giving an overview where research is interdisciplinary and diverse ideas that might also be beneficial. Moreover, a literature review is a great method for combining study findings to demonstrate meta-level evidence and identify areas that require further investigation, both of which are essential for developing theoretical bases and conceptual models (Snyder, 2019).

Literature review methodology is a systematic and rigorous way to do research using existing studies, making it a type of secondary research. Primary research means gathering and analyzing new data yourself, while secondary research means gathering and analyzing data that's already been collected by others. Thus, letting us see what all the existing evidence shows when put together (Aveyard, 2014.). So, a literature review uses published work as its data. However, for a literature review to truly count as secondary research, it must follow high-quality standards. It needs a careful, thorough process to reduce the chance that its findings are just due to luck, mistakes, or bias (Cronin et al, 2008, Aveyard 2014.). Doing this well requires following several key steps, and each one is equally important: you need to figure out why a review is needed and what it should focus on. Then, set the review's specific question, goals, and purpose. Next, plan how to search for studies and set clear rules for which ones to include or exclude. Carry out the search, and carefully note the search details, what you found, and why you included or excluded each study. Evaluate each study's quality, combine the findings from all the included studies, draw overall conclusions, make recommendations based on them, and finally, plan how to share the review's results.

This research is tailored based on the six-stage framework for carrying out literature reviews as suggested by Templier and Paré (2015). The process began by defining the research topic, reviewing the relevant background literature, and establishing the study's aim and central research question. The second stage involved conducting a literature search in chosen databases using the PICO (Population, Interest, Context) framework. In the third stage, all identified literature was screened for inclusion based on predefined criteria and relevance to the research topic. The fourth step focused

on assessing the quality of the selected articles using an evaluation tool. In the fifth stage, data relevant to answering the research question was extracted from the chosen studies. Finally, the last stage involves analyzing the data, discussing the findings, and drawing conclusions based on the analysis and discussion.

4.2 Article selection process

4.2.1 Table 1: PICOS framework

Population	Adolescents
Interest	Type 1 diabetes health promotion
Context	Experiences
Study characteristics	Peer reviewed, full text, free access, published between 2015-2025

The method for the selection process was from studies that were conducted before the search was carried out. The studies included in this review were the ones that included only adolescents or adolescentsin majority and very little adults.

4.2.2 Table 2: Inclusion and Exclusion Criteria

INCLUSION CRITERIA	EXCLUSION CRITERIA
Studies that were conducted with English language ranging from 2015 and 2025,peer reviewed, are full text, contains abstract, free access to JAMK University of applied sciences	Studies that were conducted before 2015, published in languages other than English, are not peer reviewed, are not freely accessible to

students, and have an answer to the research question.	JAMK UAS students and don't have an answer to the research question.

The data search was done using Boolean search mode (AND/OR) and suggested the major-search words and phrases are shown in the table below.

4.2.3 Table 3: study search terms

Experiences OR perception OR attitude OR views OR feelings OR perspective	AND
Health promotion OR health education OR patient education OR health awareness	AND
Adolescents OR teenagers OR young adults OR teens OR youths OR students	AND
Type 1 diabetes OR T1d OR diabetes mellitus OR Juvenile diabetes OR insulin dependent diabetes	

4.3 Data selection and Appraisal

The data that was search came from CINAHL Ultimate, PUBMED, and Medline resulted into a total of 248 articles with the application of the criterias that were included with its limits. During the screening 15 duplicates were removed. 233 of the articles remaining were then screened with the relation to title and presence of abstract, and more 215 were removed. 18 articles remaining were full text screened and 11 was removed, as they were not attributed or related to all the inclusion

criteria since they had participants from other persons not termed adolescents or did not give definite answer to the research question. On completion of the final full text screening, 7 articles used in the study were selected. The selection process was represented in a PRISMA flowchart (fig.1) below.

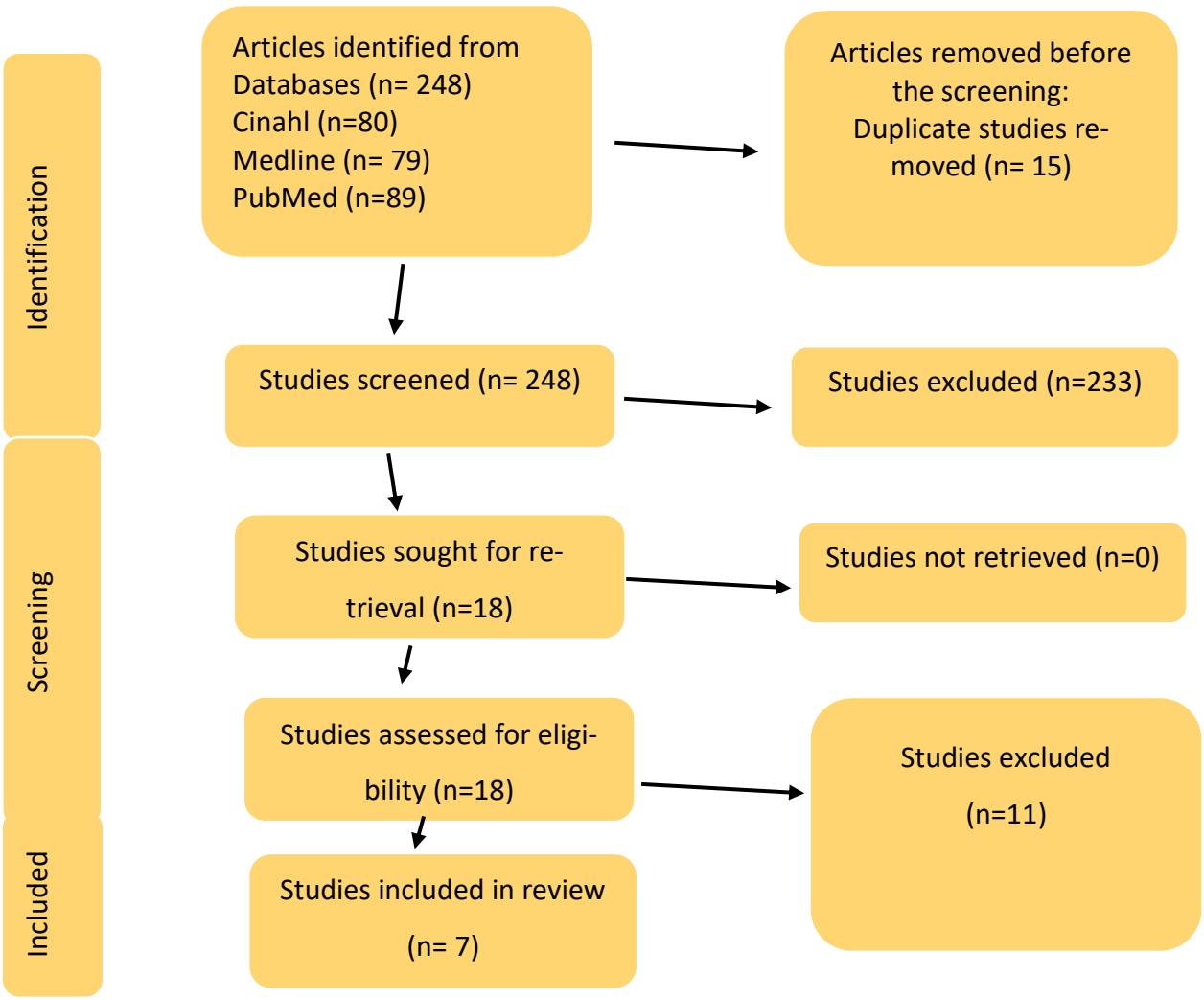


Fig.1: PRISMA flowchart

The caliber of studies in the research was evaluated with the Joanna Briggs Institute (JBI) critique tool. The goal of reviewing these articles, which served as study data, was to gauge data trustworthiness and detect potential bias in the research process (Moola et al, 2020). For numerical studies, the JBI cross-sectional checklist includes 8 elements for rating research, with scores marked as 'Yes,' 'No,' 'Uncertain,' or 'Not relevant.' This studies quantitative analysis was asseessed using

various key factors which met upto 6 out of 8 points. The points gave a rating which is satisfactory for the inclusion criteria. In the descriptive and qualitative aspects of this research, JBL checklist used for qualitative research was utilised. Overall rating for qualitative research met the required score of 9 points out of 10. These ratings were included in detail in Appendix 1.

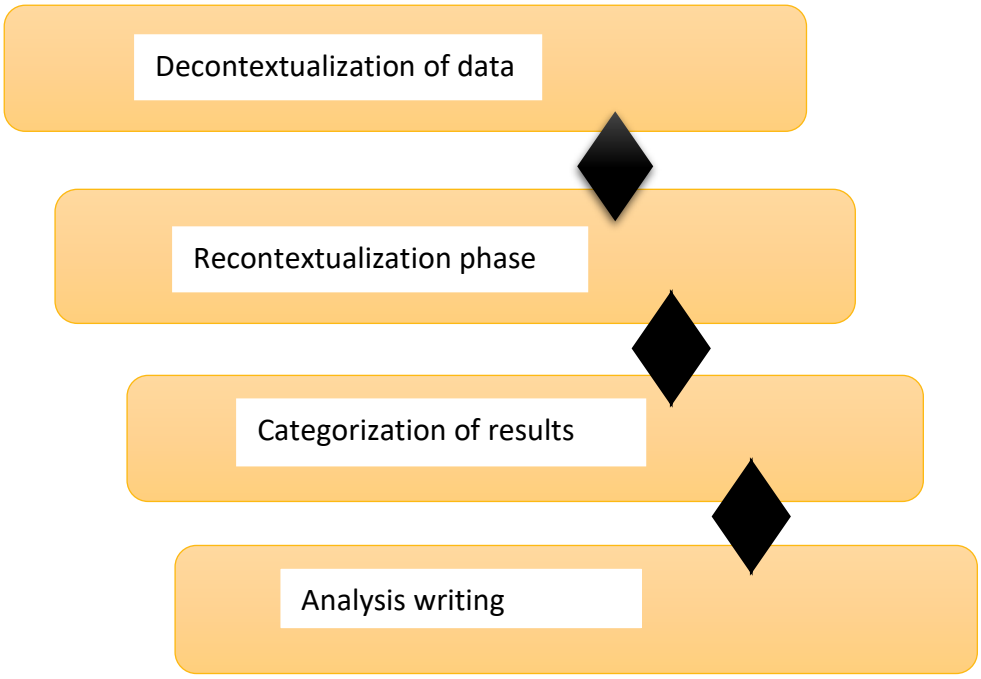
4.4 Method of Analysis

This study was analysed using content analysis to assess the research data. This has been a renowned means for retrieving information and gave clues on how to answer the central questions involved in the study (Polite & Beck, 2006.). The major point of content analysis is to be adaptable; scholars can execute this in so many ways be it in qualitative and quantitative means. Qualitative methods help to deduce the text data by grouping it into emergent themes. This method gives a broader and better understanding of the participants' personal experiences and concepts, because of its ability to compress raw information into reasonable concepts. This differs with quantitative application of content analysis which focuses more on numbers in the data, and evaluating statistics of the frequencies, means, or modes on how to get an objective result (Kleinheksel et al, 2020).

This review was done between both researchers, Okorie and Osuagwu individually. The keywords were deduced from the third chapter of this thesis and then the search was in PubMed, Cinahl, and Medline individually. Afterwards, we independently picked 7 articles answering our research question; color coding, themes and sub-themes was developed from these chosen articles. It is worthy to note that the same total number of research articles was found by both researchers in Cinahl, PubMed and Medline while using the search term. Furthermore, while analyzing these articles together, the content analysis was done following four-stage framework proposed by Bengtsson (2016). The first stage, decontextualization, involved independent multiple readings of the data to grasp its meaning, with individual ideas assigned for definite codes. For this research, the findings from the selected articles done individually were thoroughly reviewed together several times to ensure they align with the study's objectives and ensure relevant ideas addressing the research questions were highlighted. The second stage, recontextualization, required re-examining the chosen articles independently reviewed, to uncover any initially overlooked ideas that could contribute best to answering the research question. All findings from the final selected 7 literature were revisited together, with a focus on uncoded sections to ensure that no relevant insights were missed. In the third stage, categorization, the color-coded ideas from the 7 best fitting articles were concise

and organized into 3 broader themes and 6 sub-themes. Ideas sharing similar themes were summarized into concise statements and then classified into three major themes: supportive networks, Nurturing environments and Empowering growth. Within these themes, additional sub-themes were developed to capture more specific thematic nuances (Following the independent search carried out, we convened, choose the best fitting 7 articles from both works done, then analyzed the themes and sub-themes of both works hence formed the best themes and sub-themes for this thesis research likewise the color coding as seen below). The final stage, compilation, involved drafting the written analysis, presenting the categorized findings in a systematic and meaningful narrative. Figure 2 illustrates the content analysis process and provides a sample of the data analysis for clarity.

Fig 2: Content analysis



5 Results

The data analysis incorporated seven peer reviewed research articles, comprising five qualitative studies, 1 quasi experimental study and one non-randomized longitudinal study design. Geographically, these publications originated from: Denmark, Australia, Ireland, Turkey, Portugal, Iran and India. Analysis of this research was streamlined into three primary themes and main themes were further expanded into a total of six distinct sub-categories. Data description and color coding of the articles used were described and shown in detail in appendix 2 and 3 respectively.

Main Themes	Sub-Themes
Fostering lasting knowledge and confidence in adolescents with T1D.	Building on existing knowledge. Cultivating self efficacy: from skill acquisition to independent action.
Creating safe, stigma-free spaces for adolescents.	Combating stigma through inclusion and peer connection. Transitioning responsibility: Adolescent pathways to self management.
Structured empowerment through support ecosystems and collaborations.	Enabling Independence through camps and schools. Building trust and self direction.

5.1 Fostering lasting knowledge and confidence in adolescents with T1D

5.1.1 Building on existing knowledge

Participants repeatedly noted that the new information connected well with what they already knew thus when new strategies fit with their previous understanding, it was easier for them to learn more and change their behavior. This led to them saying things like: It was nice to hear it again since I'd forgotten some of it and I feel it built on knowledge I already had. Also, through group-based learning, participants were able to exchange ideas with peers and professionals in an open environment that encouraged active engagement, critical thinking, reflection, and the revision of prior beliefs based on new insights, leading to a deeper and more accurate understanding of the topics discussed. Some of the had these to say: We talked a lot about breakfast and realized it's not just about the food but also how the body and hormones work in the morning. That was quite educative. I know nothing on biology, so I will lean something different (Pedersen et al, 2024.).

It was noted by the two patients which are the expert patients and the ones who participated both highlighted that there are a lot of positives from the program, they said that the program broadened their horizon on managing their type 1 diabetes. They also appreciated the fact that there were discussions which taught about topics they viewed only towards the reach of medical practitioners (Flora et al, 2025.). There was also low scores on participants' attitude towards selfcare which highlights the fact that their self-care was reduced drastically after two months of participation. The low score was attributed to less educational activities and content which was not reinforced after learning hence emphasis on sustained training and learning is required to boost this low score. The program also demonstrated statistical analysis, Also, based on statistical analysis it showed that there was a lot of improvement in self-care behavior of adolescents with type 1 diabetes after peer education. However, the negative scores recorded over two months after interventions shows that the positive yields are not static because of lack of reinforced knowledge. This generally means that with continuous training and reinforcement of the knowledge on the populace, long term success can be achieved for such programs (Sabagh et al, 2023.).

5.1.2 Cultivating self efficacy: from skill acquisition to independent action

The need for home based nursing is highlighted based on the rapid growth to compare with standard care the program growth improvement attributes up to 14% in the reduction of HbA1c levels

and also promoting adolescent diabetes management and their independence in selfcare prowess (Gürkan, Bahar, & Böber, 2019.). Another research, gave a different result in the control of diabetes within the participants, the result within 6.7 to 14% with an average of 9.1%.Most participants agreed that the had optimal trust in themselves to adjust doses of insulin and also managing their blood sugar levels, while only little amongst the participants felt they can independently count their carbohydrate (D'Sa et al, 2021.). This means that in all, it positively affected adolescent type 1 diabetes management, responsibility and independence (Gürkan et al, 2019). It was also noted in another study that there was a lot of positives deduced from camping and that it promoted the adolescent to be independent from guardians or teachers in managing their ailment. This camp gave adolescents independence and free will to master the skills learnt from camp and also be confident to try them alone with less dependence (Flora et al, 2025.)

In addition, further research showed that interventions tailored for educational purposes influence positive selfcare attitude amongst adolescents with type 1 diabetes study found that the educational intervention significantly enhanced self-care behaviors in adolescents with diabetes according to, ANOVA and pairwise time comparisons (Sabagh et al, 2023). The adolescents mastered the skill of measuring blood glucose, taking medications and living a healthy life. However, there was a reduction in the scores after a couple of times which means that there is need for reinforcing support amongst institutions and corporative that favor the support on adolescent type 1 diabetes management, ensuring skill acquisition amongst adolescents are carried out constantly and consistently daily in their lives. This method goes a long way to promote durable and lasting outcomes for adolescents' diabetes management within the population (Sabagh et al, 2023.); Some families agreed that the ACC program helped in a positive way by giving them the knowledge and confidence to tackle problems associated with providing efficient interventions and care to their adolescents effectively (Pedersen et al, 2024).

5.2 Creating safe, stigma-free spaces for adolescents

Creating a conducive environment for adolescents with type 1 diabetes stretches both the health promotion attributes and analyzing their ability to function under specific conditions.

5.2.1 Combating stigma through inclusion and peer connection

This refers to the various means environments must ensure that support is not being judgmental and that the adolescents have a less shameful environment to manage their (T1D9 diabetes. Adolescents feel stigmatized when they are using injection syringes and insulin pumps when they are managing their ailment at school (Mourão et al, 2022; Crespo et al, 2018 & Arns-Neumann et al, 2020). Interacting with peers who share the same medical condition was identified as highly important by those in the study. These peer connections were found to expand social networks and provide a platform for discussing everyday life challenges and strategies (Flora et al, 2025.). Camps and home/school programs build practical skills in playful, stigma-free settings, delivering short- to medium-term glycemic gains; tailored ACC courses with repetition enhance dietary retention, HbA1c (7/8 participants), and responsibility (Pedersen et al, 2024). Peer education rival's expert-led methods in boosting self-care and HbA1c, while therapeutic education drives behavior change through awareness, training, and psychosocial support, promoting understanding, participation, autonomy, and family roles (Flora et al, 2025; Hasan et al, 2021). Camping was noted to be one of the things that adolescents were happy to participate, because they mix up their skills with other things and factors they can relate with in camp. Continuous training of nurses is required in the management of hypoglycemia, good communication, screening patient for proper mental health, culturally sensitive issues and less clinical issues which also enhance proper care in this field. (Gürkan et al, 2019; Sezer et al, 2015). The need to use theatre plays and other initiatives approved by school to fight stigma by making sure that there is attitudinal change and also diabetes education with family support leads to independence (Mourão et al, 2022; Szmedra et al, 2018). Peer education should also be paramount as it helps in creating good self-esteem and self believe (Sabagh et al, 2024; Abdollah et al, 2016). Soaris et al, (2018) highlights that when adolescents strive to be normal, this means favoring social integration above the management of the ailment because this reduces stigma, and fosters family communication with a secure environment.

5.2.2 Transitioning responsibility: Adolescent pathways to self-management

When an adolescent is diagnosed of T1D, it has a monumental effect on the entire family based on the child's reliance on the environment and family to manage their diabetes and administer insulin doses prior to meals. As the child progresses the responsibility becomes theirs, therefore, tailoring dietary guidance to adolescents becomes paramount. Predominantly, mothers participate more in adolescent carbohydrate counting, thereby reducing the father's participation and experience in

the care thus leading to an incomplete reflection of the care construct (Pedersen et al, 2024.). At the end of the transition clinic, patients completed a questionnaire. While just over half (56%) felt more confident about moving to adult care, all participants (100%) found the clinic helpful for the process. Adolescents provided positive feedback, describing the healthcare team as friendly, accessible, and easy to talk to. They appreciated the opportunity to ask questions and get them answered. It was noted from a patient that it is good to know the names of teams and their roles for proper knowledge (D'Sa et al, 2021.). The rift identified shows the need to reform policies to create better independence amongst educational institutions. There is huge need for psychological support amongst adolescents and their family members because the ailment creates emotional instability, and peace in the family. There should be promotion of open communication to help curb down the blow back of psychosocial issues. Good and continuous record keeping helps to promote compliance by constant routine checks. The tutoring system drew criticism for unclear roles and logistical barriers (e.g., separate dormitories hindering communication), perceived negatively by participants (Flora et al, 2025.). Upgrades could include streamlined tutor training, co-located support, and clear role definitions to better align with adolescents' developmental needs for independence and effective guidance in T1DM self-management.

5.3 Structured empowerment through support ecosystems and collaborations

Peer groups play an important role in the support of adolescents with type 1 diabetes. The findings attached to peer support shows that there is need for adolescent led peer education, though adolescents may have specific strategies to balance and normalize their self-management. Supportive family and community environments are also other social support are other critical evidence on the benefits of collaborative involvement. (Sabagh et al, 2024 & Edraki et al, 2020).

5.3.1 Enabling independence through camps and schools

Diabetes camps empower adolescents and expert patients by promoting independence from parental oversight, as highlighted by participants. A scoping review of 12 studies on T1DM adolescents' experiences reveals that autonomy in diabetes control is influenced by socioeconomic factors, parents' readiness to step back, and youths' proficiency in self-management (Flora et al, 2025.). Attending camps without parents, backed by multiprofessional teams, creates key opportunities for building confidence and skills in independent T1DM handling. School-based empowerment strategies

include training staff to ensure students always carry a "diabetes kit bag" equipped with 15–30 g fast-acting carbohydrates, an extra snack for hypoglycemia prevention/correction, glucometer, insulin, reagent strips, and syringes/pens (Mourão et al, 2022.). These measures foster proactive self-control, reducing barriers and enhancing empowerment in daily T1DM care. Also, the Diabetes in Schools report recommends that each Australian state and territory diabetes organization should provide or enable standardized diabetes training for nominated schoolteachers and other staff before the child commences, or as soon as possible, with follow up training if required as this is essential to ensure teachers feel adequately prepared, children are safe, and parents have confidence in the school (Marks et al, 2019 & Diabetes Australia, 2017.). Administering insulin therapy in the school office created a safer and more consistent environment for management. This centralized approach minimized the risk of dosage errors that could occur in a loud, disruptive classroom where a teacher's attention is divided. As one staff member noted, the quieter office setting allowed for proper supervision, which was crucial for catching and correcting common mistakes, such as entering incorrect glucose readings, thereby reducing the burden and potential liability for the classroom teacher (Marks et al, 2019.).

5.3.2 Building trust and self direction

Effective communication through peer education enhances self-care, medication adherence, and reduces insulin requirements in peer groups versus controls, though differences exist in community, sample size, gender, and intervention duration/type (Sabagh et al, 2024). Adolescents value camp sessions that integrate knowledge systematization with relational, helping, and sharing skills, complementing recreational and sports activities for psychological, clinical benefits, and self-management gains (Flora et al, 2025). Home-based nursing interventions, via targeted communication, boost adolescents' self-efficacy perceptions in T1DM management (Gürken et al, 2019). Open, stigma- and peer pressure-addressing dialogues foster trust and autonomy (Zandra et al, 2024).

Also, a study by D'Sa et al, (2021.), shows how all seventeen respondents reported that the clinic was beneficial for their transition to adult care. Adolescents expressed appreciation for the opportunity to interact with the healthcare team, describing them as approachable, friendly, and responsive to questions. Various participants indicated the need for getting closer to healthcare personnels, this is because having this close relationship enhances better communication and understanding for smooth and efficient care. Schools train staff (including nonmedical personnel)

to manage hypo/hyperglycemia in nurses' absence, ensuring clear communication protocols for safety. Peer-sharing discussions build identity, reduce suffering, and develop problem-solving skills. Simplifying carbohydrate calculations through accessible communication emerged as a key insight, with children, adolescents, and parents reporting improved understanding of blood glucose influencers, empowering independent decision-making (Pedersen et al, 2024.).

6 Discussion

This research established that adequate health promotion, supportive environment, caregiver and parental literacy creates better practice implication for both the nurses and the adolescents with type 1 diabetes. Health promotional need for adolescents with type 1 diabetes highlights emphasizes normalcy, stigma reduction, family involvement, developmental needs, encouraging autonomy, communicating and building trust, creates an effective way for tackling diabetes amongst adolescents. The results of this literature review show the experiences of health promotion knowledge gained by the adolescents and children in the management of type 1 diabetes and as a result, three themes were developed: the important role of peer and other forms of support, supportive and educative environment as well as empowerment through and skill development.

Empowerment through role models (professionals) and tutoring support, facilitating practical knowledge and shared learning was experienced where adolscents and their families learned new, practical skills by connecting with each other in a peer-supported program led by professionals. But, unplanned conversations with other parents and a dietitian were especially helpful, as it allowed them to share tips for everyday situations, like managing diabetes during swimming hence this interaction with the design of the youth-specific carbohydrate counting program, which emphasized active involvement in educational tasks, was a key factor in enhancing participants' knowledge and experiences hence providing important emotional support and reducing feelings of isolation (Pedersen et al, 2024.). Based on a field research conducted in cameroon involving 32 partcipants, the result showed that there was long term goals recorded and as a result there was low glycated hemoglobin recorded after one year participation (Dehayem et al, 2016)other camp consisting of 60 people within the duration of 5 days where medical nutrition therapy was praticed with how to control blood sugar, it recorded the same low glycated (Santiprabhob et al, 2008). Education that involves nutrition usualy have a questionnaire follow ups that are given usually after few months showed that there were brief yield in the glycemic control, even thiugh these positive yields reduced

after few months. Furthermore, the participants that their sugar levels was often checked had less blood sugar (Athanasiadou et al, 2024.). This differs from Marks et al, (2019) which portrayed that for their to be better efficiency and support for adolescents with type 1 diabetes, there has to be efficient diabetes education. Although tteacgers get their knowledg through reading from sources ike internet, parents and as well as diabetes education tutors highlighted that there is need for multiple training rather than having one time teachings which is usually not effective in the long run and as such addresses issues like anxiety and vulnerability (Marks et al, 2014; Diabetes Australia, 2017 &. Marks et al, 2018). This challenge can also be doubled if the diabetes tutors and other forms of support is not accessible and hence add lots of problems amongst the parents or guardian because of communication barriers and other life commitments (Marks et al, 2018, & Marks et al, 2014b). Therefore, this leaves a big rift for tutors who indicates their preference for formal training to make up for less theoretical skills on type 1 diabetes management with its everyday application. Such standardized training would not only build competence and confidence but also validate their role as qualified caregivers, thereby reducing the burden of responsibility they feel (Boden et al, 2012.).

Furthermore, conversations and educational elements produced a deeper understanding of different aspects that affect the glycemic response. When the actual glycemic response deviated from the anticipated glycemic response, the informants tended to attribute this solely to inadequate carbohydrate calculations, even though other biological factors could be involved. The children and adolescents highlighted the importance of simplifying the equations, thus implicating the importance of fostering confidence and making (adolescent carbohydrate counting) ACC more accessible, which is of particular importance because over time, young people gradually assume greater responsibility for ACC (Pedersen et al, 2024.). This was contradicted that this diabetic education does not always yield the positive result because the results from research by Julia and Elin (2016), showed that there was no significant relationship regarding diabetes management education with the level of compliance in the treatment of diabetes ($p = 0.238 > 0.05$). These results were considered to less impact on the diabetes teaching because the number of patients who received the education was 78.7%, but only around 44.7% of the patients understood the diabetes management, thus showing that even after given education with proper communication on skill, there is no measure that provides high level of compliance on treatment (Emiliana et al, 2019). Bogonza et al, (2015.), in their research, found that in Uganda, the management of diabetes, especially in terms of treatment, had a low level of compliance (32%) because the community had a low socioeconomic level,

thus, many patients were unable to redeem treatment and lack of knowledge about diabetes. The respondents with high family income were able to access an affordable health care facility and good treatment while the families with low income also had less affordable healthcare (Emiliana et al, 2019). A scoping review of 12 studies concluded that most adolescents feel different from their peers, which leads to social withdrawal, and this is because diabetes is perceived as being different from your healthy peers amongst adolescents and managing T1D requires complex care for which adolescents are not always prepared (Flora et al, 2025 & Eines et al, 2022).

According to Sabagh et al, 2024, giving adolescents peer education led to increased self-care, correct use of medications, and reduced insulin needs in the peer group compared to the control group and thus enables autonomy and self-care promotion. In the research study by Pedersen et al, 2024, simplifying carbohydrate calculations was highlighted as one of the positive insights gained by children and adolescents during the course. Both children, adolescents, and parents reported having achieved a greater understanding of the parameters that impact the blood glucose response. Many of the adult informants in another study described feeling relieved after talking with peers facing similar concerns and obstacles and doing so without experiencing stigma. This underscores the significance of providing a dedicated space for adult caregivers, where they can openly share concerns and challenges with one another and this helps to lessen their burden during care (Pedersen et al, 2024).

Also, it is important to note that the majority of children with T1DM are using diabetes technologies, such as insulin pumps (continuous subcutaneous insulin infusion, CSII), CGMs, or hybrid closed-loop systems (artificial pancreas) which highlights the effect of empowerment through knowledge and skill development which attributes to positive intervention towards the ailment (Athanasiadou et al, & Somali et al, 2020). Another study suggested that almost 50% of children attending T1DM diabetes camps are using an insulin pump, and this can only be possible through skill development and empowerment. Additionally, it has been proved that the use of diabetes technologies significantly improves glucose variability and reduces hypoglycemic events during camp attendance (Somali et al, 2020.).

However, there was one staff school participant who still negatively answered about this subject after the training. This negative answers also continued stemming from reports from people with

diabetes (personal communication) that it has been mistaken for an illicit drug user while inject insulin with a syringe, thus this have a negative effect on the nurses/caregivers while given the care to the adolescent and also possibly increase the stigma of being called a drug user. (Mourä o et al, 2023). The Diabetes in Schools report recommends that each Australian state and territory diabetes organization should provide or enable standardized diabetes training for nominated schoolteachers and other staff before the child commences, or as soon as possible, with follow up training if required (Marks et al, 2019 & Diabetes Australia, 2017). This is essential to ensure teachers feel adequately prepared, children are safe, and parents have confidence in the school. Yet, the increased incidence of T1DM has increased the workload of Australian Des who are therefore unable to provide this level of school support in all areas and particularly for level three skills training. (Marks et al, 2019.). Teachers who had no health background in the study were unsure if they were legally covered when supporting adolescents with type 1 diabetes. Although teachers volunteered, they expressed feelings of pressure, the responsibility of having a child's life in their hands, being overwhelmed and uncomfortable at times, and they feared making a mistake. Other studies echoed these concerns about potential liability, when performing tasks that are generally understood that it is meant for registered nurse to undertake (Marks et al, 2019.).

7 Ethical Consideration

Research ethics encompass the moral and legal principles that guide researchers to conduct studies with integrity, responsibility, and respect, particularly when human participants are involved. These guidelines are critical in ensuring that research does not cause harm and prioritizes the well-being, safety, and rights of participants. It can be noted that ethical consideration is always firm based on the weaknesses of participants for example adolescents with T1D having challenges that involve physical, psychological, emotional issues (Priyadarshini, 2020.). For every scientist who partake in research, they are mandated to maintain their participants autonomy, hence the participants independently making decisions on whatever they partake in and also making sure their participation is on their own accord (Laryeafio et al, 2023). The participants self-esteem must not be jeopardized or reduced, therefore both individually and collectively, they must be treated with respect and their privacy and personal data protected for example health information and experiences (Vanclay et al, 2013).

Some studies that involve teens with T1D which are usually within the bracket of people known to be vulnerable based on their age, ailments, and emotional instability ethical considerations are mandated. Informed consent must be obtained from both adolescents and their parents/guardians, ensuring comprehension of study aims, procedures, and voluntary participation. Adolescents' consent, alongside parental consent, respects their emerging autonomy while acknowledging developmental limitations in decision-making capacity (Laryeafio et al, 2023.). All reviewed studies reported institutional ethics committee approval and documented informed consent (verbal or written), with participants afforded the right to withdraw at any stage without consequence (Laryeafio et al, 2023).

Predominantly ethical principles were followed at all stages of the research, until the end of the study as obligated by ethic code that researchers owe to the society (Vanclay et al, 2013). Studies involving camps or peer education likely ensured voluntary participation, avoiding pressure on adolescents or families to join. Ethical research would make clear that participation is optional and that withdrawing would not affect their care (Laryeafio et al, 2023.). Finally, the thesis entirely is following the University's guidelines for conducting research, the research was conducted strictly according to the university guidelines with proper referencing of ideas made by the authors.

8 Validity and Reliability

A researcher's objective is to ensure the study yields findings that are both valid and reliable, a fundamental responsibility throughout the entire research process (Bengtsson, 2016). To establish credibility in this study, articles were sourced exclusively from reputable, evidence-based databases endorsed by JAMK University of Applied Sciences, and the analysis was restricted to peer-reviewed literature published between 2015 and 2025.

The transparency of the research process further bolsters its reliability. A clearly documented, step-by-step account of the search strategy, inclusion criteria, and analysis procedure was provided, which allows for reproducibility and strengthens credibility (Saif-Ur-Rahman, 2022). Furthermore, the use of multiple sources to explain the phenomena demonstrates that the conclusions are built upon a comprehensive evidence base (Nowell et al, 2017). Acknowledging potential limitations is also crucial; the restriction to freely available, full-text articles in English may have introduced selection bias by excluding other relevant studies (Borges de Almeida & Garcia de Goulart, 2017).

However, by explicitly stating the selection criteria and adhering to ethical university guidelines, the study maintains its integrity and generates valid and reliable results.

9 Conclusion

From the analysis based on the results and discussion outlined above clearly portrays that for adolescents with type 1 diabetes to care for and take care of their condition, it entails having a supportive, less stigmatized environment that helps these adolescents feel normal and emboldened. Activities like going for diabetes camps, peer age groups, and school education creates a big impact in their lives. These places helps to mold adolescents into independence on knowing how to practicalise things and also how to use insulin and count carbohydrates thereby taking charge of their life. For example, adolescents can be able to count their carbohydrate level and control their sugar intake which creates a better blood sugar level for them. Trust is also established by having good communication between the healthcare personnel and the family of the adolescents, helping them to create more effective dialogue and understanding of the ailment.

There have been many challenges adolescents face in organisations like schools. The adolescents find it hard to check their blood sugar independently and this affects them in getting timely and efficient care. In some situations, adolescents, face being stigmatized when they use injection insulin, they are often seen as using drugs instead of medication and hence this face off as challenges that should be taken into consideration. Good healthcare and proper medication becomes also a problem for families who have are not wealthy enough to afford it. Medical equipment that helps enhance adolescents care on T1D are not usually available but when they are, lack of technical know-how by teachers or family members becomes a problem based on the less training and usage of these equipment. These issues can be addressed by empowering and teaching family member and teachers how to use this equipment, for example insulin pumps, and also making sure that this equipment are made also accessible to them for proper handling. Also, rules should be tailored in such a way that it accommodates proper diabetes care for teens and also proper collaborations amongst family members, teachers and adolescents to raise confidence and reduce stigma. A lot of challenges still plague given better care to adolescents with (T1D) but through proper resources, peer support, healthy lifestyle and education adolescents with this ailment can still live a healthy life.

However, it is good to note that there is still a lot of work to do to create better long-term efficiency for diabetes management, and more strategies for coping and utilizing knowledge that is gotten from camps through diabetes education. Barriers should also be looked into by making efficient laws that address, and influence positively access to healthcare accessories and other technologies. Also, its paramount to address cultural and regional factors that inhibits care amongst adolescents with type 1 diabetes, hence elevating adolescents with T1D confidence in managing their health in different settings.

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Appendices

Appendix 1. Critical appraisal

CRITICAL APPRAISAL FOR QUANTITATIVE STUDIES

	Yes	No	Un-clear	N/A	Total
1. Were the criteria for inclusion in the sample clearly defined					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				
Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				
Mourão et al., (2021)	+				
2. Were the study subjects and the setting described in detail?					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				
Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				
Mourão et al., (2021)	+				
3. Was the exposure measured in a valid and reliable way?					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				
Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				

Mourão et al., (2021)	+				
4. Were objectives, standards and criteria used for measurement of the condition?					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				
Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				
Mourão et al., (2021)	+				
5. Were confounding factors identified?					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				
Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				
Mourão et al., (2021)	+				
6. Were strategies to deal with confounding factors stated?					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				
Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				
Mourão et al., (2021)	+				
7. Were the outcomes measured in a valid and reliable way?					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				

Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				
Mourão et al., (2021)	+				
8. Was appropriate statistical analysis used?					
Gürkan, K. P., Bahar, Z., & Böber, E., (2019)	+				
Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023)	+				
Mourão et al., (2021)	+				
TOTAL SCORES					
Pedersen et al., (2024)					8/8
D'Sa et al., (2021)					8/8
Marks et al., (2019)					8/8

CRITICAL APPRAISAL FOR QUALITATIVE STUDIES

	YES	NO	UNCLEAR	N/A	TOTAL
1. Is there congruity between the stated philosophical perspective and the research methodology?					

Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
2. Is the congruity between the research methodology and the research question or objectives?					
Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
3. Is there congruity between the research methodology and the methods used to collect data?					
Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
4. Is there congruity between the research methodology and the representation and analysis data					

Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
5. Is there congruity between the research methodology and the interpretation of results?					
Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
6. Is there a statement locating the researcher culturally or theoretically?					
Pedersen et al., (2024)		+			
D'Sa et al., (2021)		+			
Marks et al., (2019)		+			
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)		+			
7. Is the influence of the researcher on the research, and vice versa, addressed?					

Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
8. Are participants, and their voices, adequately represented?					
Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?					
Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?					

Pedersen et al., (2024)	+				
D'Sa et al., (2021)	+				
Marks et al., (2019)	+				
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)	+				
TOTAL SCORE					
Pedersen et al., (2024)					9/10
D'Sa et al., (2021)					9/10
Marks et al., (2019)					9/10
Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C., (2025)					9/10

Appendix 2. Data description.

No.	Author, year and country.	Title	Aim of study	Participant	Methodology	Findings.
1	Pedersen, Z.O.; Jacobsen, S.S.; Ewers, B.; Grabowski, D. (2024). Denmark	Exploring Family Perspectives on a Group-Based Hands-on Advanced Carbohydrate Counting Education Program for Children and Adolescents with Type 1 Diabetes: A Qualitative Study	This research investigates family experiences with an advanced carbohydrate counting program designed for children and adolescents	The qualitative interviews included seven (n-7) participants, mostly recently diagnosed, who ranged in age from 7 to 14 years and were predominantly female	Qualitative method (Semi-structured interview)	The analysis identified five key factors for success: Peer connections are vital for shared learning; how a person views their illness directly affects their food choices; integrating diabetes management into daily life reduces its perceived burden; repeating educational content is necessary for long-term knowledge; and a fun, secure environment is key to

						keeping young people engaged in their own care.
2	Gürkan, K. P., Bahar, Z., & Böber, E. (2019). Turkey	Effects of a home-based nursing intervention programme among adolescents with type 1 diabetes	This study aimed to assess how a home-based nursing program, developed using the Health Promotion Model, influences the health of teenagers with type 1 diabetes.	A convenience sample of n-71 adolescents diagnosed with T1D was selected from hospital-based pediatric endocrinology outpatient clinics during June-December 2017. These participants were allocated to either an intervention group (35 participants) or a control group (36 participants).	Quasi-experimental research method (Quantitative method). (The researchers adhered to the TREND Checklist guidelines for reporting their methodology.)	The home-based nursing program yielded significant positive outcomes, including improved glycemic control (lower HbA1c), enhanced self-efficacy, more consistent self-management, and greater treatment responsibility among participants. These improvements were associated with reduced hospital admissions

						and healthcare costs, demonstrating the program's effectiveness in improving both clinical and practical aspects of diabetes care.
3	Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C. (2025). Portugal.	Experience with a Self-Management Education Program for Adolescents with Type 1 Diabetes: A Qualitative Study	This research explored the views and experiences of participants in a self-management education program for type 1 diabetes.	N-38. Three separate focus groups were organized for data collection: one comprising 16 male adolescents, another with 16 female adolescents, and a third group consisting of six expert patients (equally divided between male	Qualitative study (focus grouped interview)	The findings highlighted two main themes. First, the expert patient role was seen as beneficial, defined by taking responsibility, sharing lived experiences, and serving as a role model. Second, program evaluation stressed the value of peer-led edu-

				and female young adults).		cation and formal sessions, which improved participants' disease-related knowledge and management skills. The expert patients themselves also developed a stronger sense of responsibility, provided mentorship to adolescents, and saw progress in their own self-management.
4	Marks, A. L., Wilson, N. J., Blythe, S., & Johnston, C. (2019). Australia.	The health promotion role of Australian early primary school teachers supporting students	The purpose of this research was to examine the experiences of Australian early primary school teachers in supporting	n- 11 participants	Qualitative research (Narrative inquiry)	The analysis identified six central themes that together formed a cohesive narrative of early primary school

		with type 1 diabetes.	students on intensive insulin therapy, aiming to identify both the helping factors and the outcomes of this support.			teachers' experiences in supporting students on intensive insulin therapy. Key enabling factors included appropriate class placement, structured transition procedures, and effective diabetes education and care models
5	Sabagh, K., Ghaljaei, F., & Ghorbani, M. (2023). Iran	Effect of Peer Group Support Educational Intervention on the HgA1c Level and Self-care Behaviors of Adolescents with Type 1 Diabetes Referred to	The research assesses the impact of a peer-supported education intervention on glycemic control (HbA1C) and self-care activities among teenage	The study utilized a convenience sampling method to enroll 189 participants, who were then randomly distributed into three equal groups of 63:	Quasi-experimental study (Quantitative study). (pretest-posttest design)	The peer support training demonstrated statistically significant benefits, substantially enhancing self-care behaviors and reducing HbA1c levels in the intervention group

		Zahedan Diabetes Clinics.	individuals living with type 1 diabetes.	two intervention groups and one control group.		compared to the control group. While these outcomes showed significant improvement from baseline through post-intervention measurements, the follow-up data indicated that the educational effects were not sustained over time for either self-care practices or glycemic control.
6	Mourão, M.D., Sedlmaier, B.M.G., Pires, V.L.R., Borges., G. F;	Effectiveness of a diabetes educational intervention at primary school.	This study measured the outcomes of diabetes-focused instructional sessions delivered to students and	The research was completed by 89 participants, consisting of 73 students ranging from 7 to 12 years old	Interventional non-randomized longitudinal study design (pre- and post-intervention)	The educational intervention led to a significant improvement in students' understanding of diabetes. Following the

	(2022). Brazil		school personnel.	and 16 members of the school staff.		program, the most notable shifts in knowledge involved recognizing that people with diabetes can consume sugary foods, while school staff showed the greatest improvement in understanding how to manage hypoglycemic episodes.
7	D'Sa, S., Foley, D. J., Hennigan, K., Kelly-Conroy, M., Quinn, A., Norris, M., Dunne, T., Moloney, Y., Fitzpatrick, S., Noctor,	Exploring the attitudes and experiences of adolescents with type 1 diabetes towards transition of care.	The research sought to gather patient views regarding the transfer process from child-centered to adult-oriented diabetes services in the	N-17 Seventeen individuals participated in a qualitative research project, completing surveys both before and after attending a	Qualitative research (Questionnaire prior to and after clinic transition).	Patients demonstrated strong comprehension of hypoglycemia management and insulin adjustment, though carbohydrate counting remained their most

	E., Neylon, O. M., & O'Gorman, C. S. (2021). Ireland.		Mid-West Region of Ireland.	transition clinic.		challenging area. Regarding lifestyle topics, participants rated their knowledge of driving and sexual health with diabetes lower than their understanding of alcohol and smoking effects. Following the transition clinic, most respondents reported feeling better prepared to move to adult diabetes care.

Appendix 3. Colour Coding.

	A	B	C	D
1	author	results	categories	grouping
2				
3	ARTICLE 1 Pedersen, Z.O.; Jacobsen, S.S.; Ewers, B.; Grabowski, D. Year: 2024 Country: Denmark	The data encompass semi-	(1) peer-to-peer interaction is an essential determinant of sharing and learning	Fostering lasting knowledge and
4			The data encompass semi-structured interviews with families who participated in a group-based child-centered advanced carbohydrate counting program. reating a safe and playful learning environment is crucial to engaging children and adolescents in their own treatment.	Creating safe, stigma-free spaces for adolescents.
5			repetition of dietary knowledge is important for retention. normalization of diabetes in everyday life eases the disease burden	Structured empowerment through support ecosystems and collaborations.
6				
7	ARTICLE 2. D'Sa, S., Foley, D. J., Hennigan, K., Kelly-Conroy, M., Quinn, A., Norris, M., Dunne, T.,	In terms of medical	In terms of medical management, patients had a good understanding of hyp	Fostering lasting knowledge and
8			after attending the transition clinic.	Creating safe, stigma-free spaces for
9			Patients self-ranked their knowledge on driving and sexual health with a diagnosis of diabetes as poor, in comparison to understanding effects of alcohol and	Structured empowerment through
10				
11	ARTICLE 3 Marks, A. L., Wilson, N. J., Blythe, S., & Johnston, C. Year: 2019 country: Australia.	Six narrative threads told a	Six narrative threads told a collective story of early primary school teachers' experience of supporting a student using intensive insulin therapy. The factors	Fostering lasting knowledge and
12			Six narrative threads told a collective story of early primary school teachers' experie	Creating safe, stigma-free spaces for
13			a transition process, and diabetes education and diabetes models of care.	Structured empowerment through support ecosystems and collaborations.
14	Article 4 Gürkan, K. P., Bahar, Z., & Böber, E. Year: 2019 Country: Turkey	At the end of the home-based	while self-efficacy perception, frequency of managing diabetes and taking responsibility in managing diabetes increased in the intervention group compared	Fostering lasting knowledge and
15			At the end of the home-based nursing intervention programme, the HbA1c mean scores significantly decreased,	Creating safe, stigma-free spaces for
16			The home-based nursing intervention programme using structural equation modelling increased the frequency of managing diabetes and taking responsibility	Structured empowerment through
17				

Article 5. Flora, M.C.; Barros, L.; Malheiro, M.I.D.D.C. Year 2025 Country: Portugal.	Two dimensions emerged: expert patient roles and	Program evaluation emphasized peer-to-peer sharing and educational sessions. Expert patient roles were viewed positively, with an emphasis on respon- sibility, sharing experiences, and being a role model.	Fostering lasting knowledge and confidence in
		Expert patient roles were viewed positively, with an emphasis on respon- sibility, sharing experiences, and being a role model. Expert patients also benefited from	Creating safe, stigma-free spaces for
		educational sessions, with increased knowledge of the disease and management strategies. patients also benefited from the program by developing a sense of responsibility, serving as role models for adolescents, and improving their disease	Structured empowerment through support ecosystems

Article 6. Sabagh, K., Ghaljaei, F., & Ghorbani, M. Year: 2023. Country: Iran	Peer support training significantly improved self-care behavior (P < 0.001) and decreased HbA1c level (P < 0.001) in the intervention group compared to the control group. Moreover, in the intervention group, the self-care score and HbA1c level were significantly different between the pre-test,post-test,and follow-upstages(P< 0.001).The permanence of the effect of peer education in the follow-up phase	Peer support training significantly improved self-care behavior (P < 0.001) and decreased HbA1c level	Fostering lasting knowledge and confidence in adolescents with T1D..
		Peer support training significantly improved self-care behavior (P < 0.001) and decreased HbA1c level (P < 0.001) in the intervention group compared to the control group. Moreover, in the intervention group, the self-care score and HbA1c level weresignificantlydifferentbetweenthepre-test,post-test,andfollow-upstages(P< 0.001).	Nurturing Environment.
		Peer support training significantly improved self-care behavior (P < 0.001) and dec	Structured empowerment through support ecosystems and collaborations.

Aricle 7. Mourão, D. M., Sedlmaier, B. M. G., Pires, V. L. R., & Borges, G. F. Year: 2021. country: india	A total of 89 participants completed the study, being 73 students aged 7 to 12 years old, and 16 school staff. As a result, there was a positive change in knowledge and perception of diabetes by the students. The greatest changes in the answers among the participants, at the post-intervention period, were related to the possibility of consuming something with sugar by those with diabetes, and particularly how	, and particularly how to cope in hypoglycemia situations by the school staff.	Fostering lasting knowledge and confidence in adolescents with T1D.
		The greatest changes in the answers among the participants, at the post-interventi	Creating safe, stigma-free spaces for adolescents.
		A total of 89 participants completed the study, being 73 students aged 7 to 12 years old, and 16 school staff. As a result, there was a positive change in knowledge and perception of diabetes by the students.	Structured empowerment through support ecosystems and collaborations.

comparism		
(1) peer-to-peer interaction is an essential determinant of sharing and learning	Pedersen, Z.O.; Jacobsen, S.S.; Ewers,	Fostering lasting knowledge and confidence in adolescents with T1D.
In terms of medical management, patients had a good understanding of hypoglycaemia and insulin dose adjustment principles, but were least comfortable with carbohydrate counting.	D'Sa, S., Foley, D. J., Hennigan, K., Kelly-Conroy, M., Quinn, A., Norris, M., Dunne, T., Moloney, Y., Fitzpat-rick, S., Noctor, E., Neylon, O. M., & O'Gorman, C. S.	
Six narrative threads told a collective story of early primary school teachers' experience of supporting a student using intensive insulin therapy. The factors that facilitated support were: suitable class allocation. The implications of providing intensive insulin therapy support were legal considerations and burden of responsibility. The outcome was that all teachers supported intensive insulin therapy.	Marks, A. L., Wilson, N. J., Blythe, S., & Johnston, C.	
while self-efficacy perception, frequency of managing diabetes and taking responsibility in managing diabetes increased in the	Gürkan, K. P., Bahar, Z., & Böber, E.	
Program evaluation emphasized peer-to-peer sharing and educational sessions. Expert patient roles were viewed positively, with an	Flora, M.C.; Barros, L.; Malheiro, M.I.D.d.C.	
Peer support training significantly improved self-care behavior (P < 0.001) and decreased HbA1c level	Sabagh, K., Ghaljaei, F., & Ghorbani, M.	Fostering lasting knowledge and
, and particularly how to cope in hypoglycemia situations by the school staff.	Mourão, D. M., Sedlmaier, B. M. G.,	Fostering lasting knowledge and confidence in adolescents with T1D.
The data encompass semi-structured interviews with families who participated in a group-based child-centered advanced carbohydrate	Pedersen, Z.O.; Jacobsen, S.S.; Ewers, B.; Grabowski, D..	Creating safe, stigma-free spaces for adolescents.
Overall, a majority of the respondents felt more confident in moving to adult-care after attending the transition clinic.	D'Sa, S., Foley, D. J., Hennigan, K., Kelly-	
Six narrative threads told a collective story of early primary school teachers' experience of supporting a student using intensive insulin	Marks, A. L., Wilson, N. J., Blythe, S., &	
At the end of the home-based nursing intervention programme, the HbA1c mean scores significantly decreased,	Gürkan, K. P., Bahar, Z., & Böber, E.	
Expert patient roles were viewed positively, with an emphasis on responsibility, sharing experiences, and being a role model. Expert	Flora, M.C.; Barros, L.; Malheiro, M.I.D.d.C.	
Peer support training significantly improved self-care behavior (P < 0.001) and decreased HbA1c level (P < 0.001) in the intervention	Sabagh, K., Ghaljaei, F., & Ghorbani, M.	
The greatest changes in the answers among the participants, at the post-intervention period, were related to the possibility of consuming	Mourão, D. M., Sedlmaier, B. M. G.,	

repetition of dietary knowledge is important for retention. normalization of diabetes in everyday life eases the disease burden	Pedersen, Z.O.; Jacobsen, S.S.; Ewers,	Structured empowerment through
Patients self-ranked their knowledge on driving and sexual health with a diagnosis of diabetes as poor, in comparison to understanding	D'Sa, S., Foley, D. J., Hennigan, K., Kelly-	Structured empowerment through
a transition process, and diabetes education and diabetes models of care.	Marks, A. L., Wilson, N. J., Blythe, S., &	Structured empowerment through
The home-based nursing intervention programme using structural equation modelling increased the frequency of managing diabetes and	Gürkan, K. P., Bahar, Z., & Böber, E.	Structured empowerment through
educational sessions, with increased knowledge of the disease and management strategies. patients also benefited from the program by	Flora, M.C.; Barros, L.; Malheiro, M.I.D.d.C.	Structured empowerment through
Peer support training significantly improved self-care behavior ($P < 0.001$) and decreased HbA1c level ($P < 0.001$)	Sabagh, K., Ghaljaei, F., & Ghorbani, M.	Structured empowerment through
A total of 89 participants completed the study, being 73 students aged 7 to 12 years old, and 16 school staff. As a result, there was a	Mourão, D. M., Sedlmaier, B. M. G.,	Structured empowerment through