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Self-Care Practices among Children and Adolescents with Diabetes: An Integrative Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Systematic Review

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ABSTRACT

Background: Self-care is vital in the management of diabetes since it helps to prevent complications. A systematic review on Self-care Practices among children and adolescents with Diabetes at the nation-wide level has not been investigated.
Aim: This study aims to synthesise studies related to the practices of diabetes self-care among young children and adolescents.
Methods: PubMed/MEDLINE, Google Scholar databases and Science Direct Journal lists were searched and yielded a total of 19 articles that were used in this integrative literature review. The Medical Subject Headings (MeSH), such as Diabetes, Self-care, Young Children, Adolescents, and Parents were used to identify studies conducted among children and adolescents and published in the English language from 2017 through to 2021. The checklist for Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) was followed to present the findings.
Results: Some review study participants struggled with self-care due to emotional disturbances in the diabetic child, these experiences included the child feeling different, the child experiencing distraction in everyday activities and the school staff's lack of education and inattention.

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In the same vein, there was the transformative process of improvement of information in the social surroundings as the child/adolescents and their families tried to figure out how to cope with the complex environment. We identified two major categories of diabetes self-care practice based on self-care reported practices: "hurdles to diabetes self-Care practices" and "enablers to diabetes self-Care practices".

Conclusions: To improve adherence to recommended self-care practice in children and adolescents with type 1 diabetes (T1D), health care practitioners can help enhance the enablers to diabetic self-care habits by arguing to policymakers on the necessity for the development of effective solutions for the challenges that this unique group faces.

Keywords: Diabetes; health care professionals; self-care; young children; adolescents; integrative review.

1. INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease with multiple etiologies characterized by hyperglycemia caused by deficiencies in insulin release, insulin actions, or both [1,2]. Type 1, insulin-dependent diabetes (T1DM), is the second most common chronic disease in children, and its prevalence has risen by 3% per year globally in recent decades [3].

Furthermore, 75% of all DM1 cases diagnosed are in people under the age of 18 [1,2]. Poor metabolic control is known to cause the majority of acute and chronic problems in diabetes patients, and its efficient management is a challenging task [2]. Self-care practices remain the mainstay of the management of diabetes, as the majority of the disease management is carried out by patients themselves or their families. Despite the importance of self-care, research findings show that patients with diabetes do not get good self-care scores in many areas. Self-care is defined as a naturalistic decision-making process involving the choice of behaviours that maintain physiological stability and the response to symptoms when they occur [4-8].

Self-care practices involve adherence to medications, periodic health checkups, daily blood glucose monitoring, intake of a healthy diet (a diet that contains all the needed food nutrients in their right proportions for healthy growth and development) and routine regular exercises such as 30 minutes of brisk walking for at least three times a week. This practice not only seeks to control the illness but also to allow the child to grow and develop healthily [9,10].

Noteworthy, the diabetes regimen is often cumbersome to keep up with, most especially for young children and adolescents [11]. Though adolescents may have the necessary motor skills to complete the tasks of T1D management, research indicates that parents maintaining involvement in their children's care leads to better medical outcomes [11, 12].

While attempting to keep up with these routines, children may face setbacks in the form of an unfavourable school environment, friends and families fear of complications, lack of information, and personal characteristics, among others [13]. Some adolescents found Flexible Lifestyle Empowering Change intervention (FLEX) repetitious, more directive coaching, and unacceptability to parent participants [14].

Although the literature on this subject area is vast, data on the individual challenges that adolescents with T1DM face in managing their disease are not well synthesized. More so, Improving self-care behaviours is the cornerstone in helping patients better control their illness, and this highlights the importance of understanding children and adolescents with diabetes perceptions about self-care behaviours and practices [7, 12, 15]. Thus, this review aimed to identify the children and adolescent's self-care practice of managing T1DM and outline any possible hindrances.

To avoid acute and chronic diabetes complications in a child's life, synthesising their practice about diabetes self-care is critical to suggest interventions for daily diabetes management.

Healthcare professionals must continue to think of methods to provide support, lessen the stress, and minimize interference into the lives of teenagers with T1D.

Previous reviews have synthesised issues that influence the ability to self-care for adults living

with diabetes types 1 or 2 [8] and of current evidence regarding the impact of hypoglycaemia on quality of life (QoL) and related outcomes in adults [16] in specific contexts such as T1D management in school settings [17]. The experiences and perceptions of self-management of type 1 diabetes of children and young people living with type 1 diabetes (CYPDs) have been recently synthesised qualitatively [6]. Of these reviews, none synthesised evidence specifically relating to studies related to the practice of diabetes self-care among children and adolescents using both qualitative and quantitative findings.

This suggests a need for a synthesis of evidence from wider contexts nation-wide, including quantitative and mixed study evidence that focuses on self-care practices in settings beyond schools, among adolescents and also explicitly considering all attributes of the self-care process which include activities and goals [6, 8, 16, 17]. Understanding the practices of self-care in adolescents with diabetes according may inform health care professionals and others involved in the care of these children on how best to assist families of these children which in turn may lead to improvements in clinical and psychosocial outcomes.

The aim of this study was therefore to review current studies concerning the practice of self-care in children and adolescents with diabetes.

2. THE REVIEW METHODS

2.1 Aim

This study aims to synthesise studies related to the practices of diabetes self-care among young children and adolescents, this understanding will give insight on ways to close the gaps in diabetes self-care practice that could be realized.

2.2 Review Question

1. What are the Diabetes Self-Care practices in children and adolescents?

2.3 Design

This study is based on the guidelines of Whittemore and Knafl (2005), the Integrative review method. The integrative literature review method is one of the most comprehensive methodological review approaches [18]. According to Whittemore and Knafl (2005), the purpose of an integrative literature review is to define concepts, review theories or evidence, and analyze methodological issues of a phenomenon. It allows for the inclusion of both qualitative and quantitative studies since both methodologies provide more excellent knowledge and understanding of the subject being researched. The findings in this study were reported according to the PRISMA checklist (Liberati et al., 2009).

2.4 Search Strategy

Electronic databases of PubMed/MEDLINE, Google Scholar and Science Direct Journal list were searched between April and July 2021. Key search terms used were a combination of concepts related to self-care and diabetes (Table 1). MeSH descriptors such as: “Barriers, diabetes, Diabetes Mellitus, Type 1, Self-Care, young children, Adherence, Patient Compliance. Hemoglobin A, Glycosylated, adolescents, and parents” were used by combining with the Boolean operators “AND” and “OR” to ensure a comprehensive literature search. Manual searches included hand searching the reference lists of relevant articles to locate studies not identified via a computer search. The search strategy was modified to fit each database. A University librarian provided advice to ensure a systematic search strategy.

The SPIDER framework (Sample, Phenomenon of Interest, Design, Evaluation, Research type), by Cooke Smith and Booth[19], was used to inform the inclusion criteria.

2.5 Inclusion Criteria

The inclusion criteria were limited to:

1. Studies among children and adolescents and published in the English language within the period of 2017 through to 2021. A five-year window was selected to capture the most recent evidence as standards of care for youth with T1D has continuously being revised,
2. Searches were limited to children (1–12years) and adolescents (13–24years),
3. Primary research, including qualitative, mixed-methods, and quantitative studies of all designs
4. The Practice of diabetes self-care was explicit.

2.6 Exclusion Criteria

1. Studies were excluded if they did not focus on the practices of diabetes self-care in children or adolescents.

2. Unpublished manuscripts (that is, abstracts or dissertations) and editorials, opinions or discussions were excluded
3. Non-English papers

2. 7 Study Selection/ Screening Process

Using the inclusion/exclusion criteria, a two-stage screening process was completed.

During Stage 1, titles and abstracts of identified papers were screened; in Stage 2, full-text papers were assessed for eligibility. This process was independently completed by the first author and second author; however, consultation with the third author took place when there was uncertainty whether a paper met the inclusion criteria.

2.8 Data Extraction

An excel form developed by the first author was used to extract data from the included studies. Extracted pieces of information were: a. Authors, counties and date b. Aims, Study Design and type of analysis c. Study Participants details (Ages and sample size) and d. Main findings. Each study was assessed by the first author: R. N. N and the content of data extraction forms was reviewed and discussed by all authors.

2.9 Methodological Quality Assessment of Included Studies

The quality of included studies was assessed by R. N. N and discussed among the research team members, using a validated critical appraisal tool from Hawker et al [20] that is widely used, especially in integrative review studies [21]**.** This tool has well-defined criteria and comprises nine items (e.g., sampling and data analysis) that enable an assessment of the methodological rigour of each study. Quality appraisal aided critical consideration of the methodologies and findings of included articles.

2.10 Data Synthesis

In line with the aims of this review, through utilizing the synthesis approach outlined by Whittemore and Knafl [18], This study used a content analysis approach. This approach is based on the constant comparison method. This method converts extracted data into systematic categories, facilitating the distinction of patterns, themes, variations, and relationships. Once compared, similar data were grouped, and essential differences were contrasted. Results that answered the review question were those of interest; therefore, were those that we included.

For example, R. N. N started data reduction by extracting relevant data from each included study to address the review questions. Critical statements from the findings that represent current debates were noted down as our evidence and further categorized.

3. RESULTS

The search strategy produced a total of 1,527 references; 1324 studies were not relevant to the review's questions. After the assessment and deletion of duplicates, 19 papers were identified and were included in the review (Fig.1).

Table 2 provides a summary of each of the included papers, which comprised: qualitative (n = 10), quantitative (n = 9), designs. In Table 3, the main findings of the included studies are provided.

3.1 Study Characteristics, Strengths, and Limitations

Nineteen studies were included in the studies. Among the included studies, five (5) were conducted in the USA, three (3) in the UK, two (2) studies were from Portugal, One (1) each from Finland, Cameron, Germany, Netherlands, Slovak Republic, Norway, Spain, Iran and Taiwan respectively.

All the included studies assessed the Diabetes Self-Care practices in children and adolescents that were published between 2017–2021. The children in most of the studies reviewed were between the ages of 1-24 years with a total population of at least 2000+ participants.

Fifteen (15) studies were assessed as good and four (4) as fair, using Hawker et al. [20], approach. No studies were excluded from the review based on their quality assessment since they were all published in peer review Journals and had no major methodological challenges. Since all had some strengths that warranted their inclusion in the synthesis list, all the papers were considered.

Common strengths of the 15 studies assessed as good included appropriate data collection methods to address the research aims and results that relate directly to the study aims. Among the 4 studies assessed as “fair,” common limitations included unclear sampling strategies, poor consideration of ethical issues and bias, and limited transferability due to minimal description of the study context and setting.

Table 1. Literature search strategy

Search Teams	Search Strategy
Child and young person	child OR child* OR adolescent OR adolesc* OR juvenile* OR pediatric OR pediatric* OR paediatric* OR teen* OR youth* OR young* OR girl* OR boy OR boys AND
Type 1 diabetes	type 1 diabetes OR iddm OR t1dm OR t1d OR 'type 1 diabetic' OR 'juvenile onset diabetes' OR 'juvenile diabetes' OR 'early onset diabetes' OR 'autoimmune diabetes' OR 'auto immune diabetes' OR insulin depend* OR insulindepend* OR absolute insulin deficien* OR 'paediatric diabetes' OR 'pediatric diabetes' OR 'childhood diabetes' OR type 1 diabetes OR 'type one diabetes' AND
Self Care	"self-management", "self-care", "diet modification", "diet restriction", "fluid restriction", "patient compliance", "medication adherence", "patient participation", "symptom assessment", and "symptom management" AND
Example of the search strategy used in PubMed	"Self-Care"[Mesh] OR "Self-Management"[Mesh] OR "self-care" OR "self-management" OR self-care OR "Patient Compliance"[Mesh] OR "patient complains*" OR "medication adherence" OR "Patient Participation"[Mesh]) OR "Symptom Assessment"[Mesh] OR "symptom management" OR "Patient Participation" OR "symptom assess* OR self*" AND (("Chronic Disease"[Mesh] OR "chronic illness" OR chronic*)) AND ((type 1 diabetic' OR 'juvenile onset diabetes' OR 'juvenile diabetes' OR 'early onset diabetes' OR 'autoimmune diabetes' OR 'auto immune diabetes' OR insulin depend)) Filters: English language, 2017-2021.

Table 2. Characteristics of Included Studies

Authors, counties and date	Aims	Study Design and type of analysis	Study Participants details (Ages and sample size)
Davis [23], USA.	To Examine what parents of youth with type 1 or 2 diabetes, including minorities, thought were barriers to and facilitators of good diabetes management in their child	Qualitative studies Focus groups and the key informant interview. The authors analyzed the data using an inductive or data-driven Grounded Theory Approach. (Data analysis occurred in four steps.)	Seventeen (17) Parents of children with diabetes ages 11–21 years.
Bergner [24], USA	To identify barriers, facilitators, and consequences of obtaining sufficient sleep in adolescents with type 1 diabetes from adolescents and parents' perspectives.	Qualitative studies Semi-structured interviews. Thematic analytic methods	Adolescents (n = 25) and their caregivers (n = 25).
Rankin [4]. Scotland	To explore the challenges pre-adolescent children, encounter when self-managing diabetes and the factors which enable them to take on new diabetes-related tasks.	Qualitative studies In-depth interviews using age-appropriate questioning. Data were analysed using an inductive, thematic	24 children (aged 9–12 years).

Authors, counties and date	Aims	Study Design and type of analysis	Study Participants details (Ages and sample size)
		approach.	
Survonen [25], Finland.	To analyse and the psychosocial self-efficacy in adolescents with type 1 diabetes, evaluate associations between self-efficacy and metabolic contro0l.	Quantitative studies A descriptive correlational survey. Using a questionnaire. frequencies, percentages, means and standard deviation Spearman rank-order correlation coefficient (rho).	189 adolescents (13–16-year-old)
Agarwal et al. [26]. Brooklyn, NY.	To recognize social factors and compliance barriers affecting glycated haemoglobin (A1c) levels in T1D patients among the minority population.	Quantitative studies T-tests, one-way ANOVA and Spearman correlation were used for analysis.	Questionnaires 84 T1DM patients, ages 3 to 21 years
Grossoehme et al. [27] the UK.	To identify themes related to adolescent and parental feasibility and acceptability for participation in large behavioural trials designed to improve adolescents' Type 1 diabetes self-management.	In qualitative studies. Thematic analysis methodology	Interviews (N = 72) adolescent–parent dyads
Vloemans et al. [28] Netherlands.	To examine the longitudinal association between executive functioning (EF) and glycemic control in youth with type 1 diabetes and possible moderation by responsibility for diabetes management and youth's age	Quantitative studies cohort study The analysis of the youth, shared, and parent responsibility) were standardized into Z scores by using the mean and SD of the baseline scores of the whole study sample.	174 youth aged 8–15 years and their parents were included at baseline. Data were collected every year over 4. years Questionnaires
Djonou [29], Cameroon.	To describe the prevalence of glycemic control and related factors.	Quantitative studies A cross-sectional study. Data are reported as mean ± standard deviation for continuous variables and proportions/frequencies for categorical variables. Chi-square test was used to test the association between HbA1c and the characteristics of the participants and Binary logistic regression.	95 children and adolescents (aged from 6 to 19 years). structured questionnaire
do Nascimento Andrade and Alves [30]. Portugal.	To evaluate the influence of socioeconomic and psychological factors on glycemic control in young children with type 1 diabetes mellitus.	Quantitative studies Cross-sectional study. Statistical analysis by bivariate and multivariate robust Poisson regression model, Fisher's exact and Pearson's chi-squared tests	87 children with T1DM, aged 2–9 years. structured questionnaires
Bächle [4]. Germany.	To analyse the association of area-level deprivation with health- and disease-related (QoL) and glycaemic control (HbA1c) jointly with individual-level socioeconomic status (SES) in young	Quantitative studies Survey. Means and standard deviations (SDs) or percentages, basic multiple linear mixed regression	629 children/adolescents with type 1 diabetes aged 11–21 years.

Authors, counties and date	Aims	Study Design and type of analysis	Study Participants details (Ages and sample size)
	patients with preschool-onset type 1 diabetes.	models.	
Butler, et al., [31].USA	To assess the Barriers and facilitators to involvement in children's diabetes management among minority parents.	Qualitative studies, semi-structured interviews that were transcribed and analyzed using thematic analysis	28 parents of children with diabetes. The children were aged 5–9 with T1D.
King, K. M., [32]. UK	To explore the Perceptions of Adolescent Patients of the "Lived Experience" of Type 1 Diabetes.	Qualitative methodology adopting a grounded theory approach was used, using indebt interviews.	adolescence who had a diagnosis of type 1 diabetes, aged 16–21 years.
Husárová D, [33]. Slovak Republic	To investigate if Adolescents with T1DM Differ from Their Peers in Health, Eating Habits and Social Support?	A quantitative study, Self-reported questionnaires	27 adolescents of the same age
Marshall K, [34]. US	To explore Perceptions about Insulin-Dependent Diabetes Mellitus in Adolescent Patients and Peers	An exploratory qualitative method was interviewed.	A sample of 6 subjects, 2 with diabetes and 4 peers, in age between 15-18
Strand M., [35]. Norway	To investigate Adolescents' perceptions of the transition process from parental management to self-management of type 1 diabetes	Qualitative, Semistructured interviews.	18 strategically sampled adolescents (7 boys and 11 girls, aged 16–18 years) with type 1 diabetes
Núñez-Baila, [36]. Spain	To explore Social Support and Peer Group Integration of Adolescents with Diabetes	Qualitative studies are analyzed through the interpretation of general discourses.	15 people aged 18–35 with type 1 diabetes mellitus
Mohammadzadeh [37]. Iran	To explore Knowledge, Perspectives, and Priorities Regarding Self-Care Activities: A Population-Based Qualitative Study among Iranian Adolescents	This qualitative study a using descriptive phenomenological qualitative study with cross-sectional data collected in an online questionnaire with open and closed-ended questions. Snowball sampling	adolescents, both male and female, aged 14–20. 294 participants
Almeida, A. C., [38]. Portugal	To assess Individual and Family Management in Portuguese Adolescents with Type 1 Diabetes: a Path Analysis.	Quantitative, in a cross-sectional study.	100 adolescents (aged 12–19) and their parents participated
Chen, C. Y., [39]. Taiwan.	To identify the Roles of Emotional Autonomy, Problem-Solving Ability and Parent-Adolescent Relationships on Self-Management of Adolescents with Type 1 Diabetes in Taiwan.	Quantitative, Cross-sectional design. Self-reported questionnaires	A total of 242 adolescents with T1D were recruited by convenience sampling in Taiwan.

Table 3. Main Findings

Study/country	Hurdles to diabetes self-Care practices	Enablers to diabetes self-Care practices
Davis [23], USA.	• Child feeling different • Distraction in "everyday" activities • School staff's lack of education and inattention • Expenses of healthy foods • Parents' job insecurity • Lack of safe places for recreation.	• Child's acceptance of the diagnosis • Parental oversight and supervision • Support from parents, friends, medical professionals, and siblings.
Bergner [24], USA	• Inadequate sleep as a result of the use of electronics such as cell phones, laptop computers, and/or television before bed.	• Enforcing early bedtime • Using soothing sounds including playing music, nature sounds, or ambient noise to help their teen relax and fall asleep • Limiting distractions around bedtime • Using sleep aids such as melatonin or allergy medicine.
Rankin [5]. Scotland.	• Calculating insulin doses if they did not use a bolus advisor • Administering injections or insert a cannula in hard-to-reach locations. • Seeking respite from managing Diabetes • Relying on parents to perform the complex maths involved in working out carbohydrate content in food	• Being motivated to minimise the pain experienced when others administered injections • Participating independently in activities with their peers. • Being responsible for their health, using labels on food packaging to determine carbohydrate contents, or choosing foods with carbohydrate values they could remember. • Calculating insulin doses • Using mobile phones to seek advice about carbohydrate contents in food. • Alleviating the burden on their parents • Using bolus advisors with pre-programmed ratios • Entering carbohydrates on food labels or values provided by their parents
Survonen [40], Finland.	• Challenges in identifying positive ways of coping with diabetes-related stress (mean: 3.69 SD 0.79) • Challenges in identifying what helped in self-motivated diabetes care (mean: 3.78 SD 0.78)	• The ability to ask for support for having and caring for diabetes when in need • Knowing where to get support for having and caring for diabetes.
Agarwal et al. [41].	• The problems with the improvement of glycated haemoglobin (A1c) level: Physiological pubertal changes, Psychosocial stressors, A1C level among children of pubertal age (10-15yrs) was the highest (10.8% ±2.6, p ¼ 0.46), as compared to other age groups. • Barriers to the improvement of glycated haemoglobin (A1c) level:	• Facilitators to the improvement of glycated haemoglobin (A1c) level included: frequent Blood Glucose Meters (BGM) measurements (3-4x/day) positively impacts the A1C level • Age and race played an important role in determining glycemic control.

Study/country	Hurdles to diabetes self-Care practices	Enablers to diabetes self-Care practices
	• Family dynamics and developmental behaviours showed a higher mean A1C among the children of African Americans (10.6 ± 2.28%)	
Grossoehme et al. [14] UK.	• Some adolescents found Flexible Lifestyle Empowering Change (FLEX) repetitious, more directive coaching and non-acceptability to parent participants.	• Flexible Lifestyle Empowering Change (FLEX) provided a structured, positive framework for goal-setting, problem-solving and developing alternative concrete strategies for diabetes care • FLEX provided positive, supportive opportunities for adolescents and parents to talk about diabetes with a non-judgmental listener outside of a clinic setting • Adolescents and parents believed in the ongoing benefit of skills developed in FLEX • Phone/video delivery was acceptable for convenience when there were no perceived significant issues • Acceptability was not related to teen's initial motivation to improve their glycaemic control and Parents perceived that coaches' characteristics affected their adolescents' ability to connect with the coach
Vloemans et al. [28] Netherlands.	• Poorer Executive functioning {EF) was associated with worse glycemic control over time, and this association is moderated by responsibility for diabetes-management tasks.	• Executive functioning (EF) problems were significantly associated with better glycemic control over time in the following instances: • More EF problems in combination with less youth responsibility (b = 0.501; P = 0.048) • More parental responsibility (b = 20.767; P = 0.006) • Executive functioning (EF) problems were significantly associated with better glycemic control over time in the following instances: • higher HbA1c over time (b = 0.190; P = 0.002). • More parental responsibility (b = 20.767; P = 0.006)
Djonou [31], Cameroon do Nascimento Andrade and Alves[30].	• The low educational level of the patient • Unhealthy eating habits Short duration of diabetes. • Compromised psychological status • Unfavourable socioeconomic status	• Being diagnosed for more than 2 years, because they presented a better glycemic control than those with a recent diagnosis
Bächle [4]. Germany.		• Increased individual-level of socioeconomic status (SES). • SES is indicated to be positively associated with QoL scores and negatively associated with HbA1c across all urbanisation levels.
Butler, et al [31]. USA	• child and parent distress. • access to diabetes technologies Opportunity-based barriers consisted of food insecurity/low financial resources.	• including positive stress management, • religious/spiritual coping, • organizational/planning skills, and

Study/country	Hurdles to diabetes self-Care practices	Enablers to diabetes self-Care practices
		• diabetes knowledge blood glucose levels high.
King, K. M., [32]. UK.	• experienced a constant daily struggle of conforming to a prescriptive way of life. • the quality of care provided for adolescent patients with type 1 diabetes is failing to meet their expectations and falls short of the essential standards commensurate with current health care policy. • Many admitted to purposely keeping their blood glucose levels high.	
Husárová D, [32].Slovak Republic	• adolescents with T1DM perceive higher support from classmates and teachers	
Marshall K, [34]. US	• limited support from peers. • Lack of knowledge in colleges to manage stress	• positive family support
Strand M., [35]. Norway	• Adolescents want more independence. • Taking responsibility for own diabetes was dependent on coping comprised • Adolescents felt that transition is like a roller coaster', and taking responsibility means that it is their fault if they make mistakes. • Adolescent felt that It is demanding to take responsibility for own diabetes • Taking responsibility for own diabetes requires knowledge and skills, • It is time-consuming to take responsibility for own diabetes', • Having responsibility for own diabetes is like being examined every day.	• The adolescents felt that It is natural to take over responsibility for their diabetes
Núñez-Baila, [36]. Spain	• Adolescents perceived that Peers provide merely provide an indifferent role by not meddling in any aspect related to diabetes. • Peers could lead to social conflicts through discrimination and the stigma of adolescents with diabetes. • Peers may bring a specific conflict regarding diabetes to their adolescent peers.	• Adolescents perceived that Peers provide a protective role by basically offering emotional support and sends reminders of different aspects of the treatment, • They perceived that peers foster the social integration of adolescents with diabetes into the peer group. • Peers may offer support
Mohammadzadeh [37]. Iran		• Participants like spending time on the Internet had the highest repetition rate among boys' responses, • Followed by "going to the gym", "video games", and "listening to music"

Study/country	Hurdles to diabetes self-Care practices	Enablers to diabetes self-Care practices
		• Participants enjoyed travelling and being with friends. • The girls showed more interest in • attending nightclubs or spending time outside the home late at night.
Almeida, A. C., [38]. Portugal	• What threatens adolescents' perceptions of diabetes consequences and emotional representation were associated with perceptions of lower quality of life. • Also, the perceptions of less treatment control and more illness concerns were associated with worse participants functioning. • More threatening emotional representations, in adolescents, and higher perceptions of consequences, in parents, were associated with worse metabolic control (high glycemic levels)	• Adolescents' illness representations (identity and coherence), the family's illness representations (timeline, control through treatment, identity, coherence, and emotional response), and school support did not influence self-care in the adolescents.
Chen, C. Y. [39].Taiwan.	• body mass index, problem-solving ability, father-adolescent relationship, and emotional autonomy were significant factors associated with self-management.	• The interactions of emotional autonomy with the problem-solving ability and with the parent-adolescents relationship were not significantly associated with self-management.

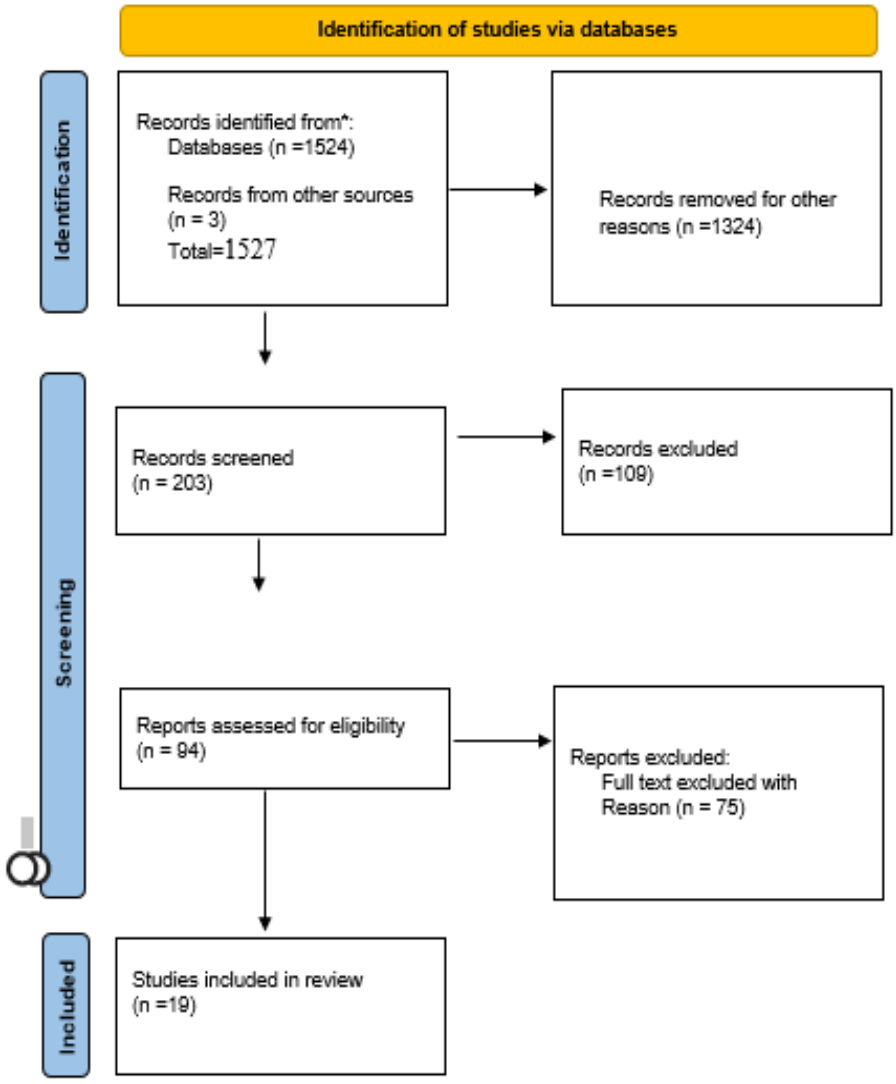

Fig. 1. Prisma flow chart

3.2 Self-Care Practices

In line with the aims of this review, through utilizing the synthesis approach outlined by Whittemore and Knafl [18], this study used content analysis in categorizing interventions into two levels [22]. (a) hurdles to diabetes self-Care practices, (b) enablers to diabetes self-Care practices. To aid in the discussion of each paper that was included, a descriptive narrative was employed as an approach. Due to the heterogeneity of study designs, no meta-analysis of findings was undertaken.

i. Hurdles to diabetes self-Care practices

This analytic theme represents the demands of living with and controlling T1D, such as the child feeling different, experience of distraction in everyday activities, School staff's lack of education and inattention, expenses of healthy foods, parents' job insecurity and lack of safe places for recreation.

ii. Enablers to diabetes self-Care practices

Enablers to diabetes self-care is a transformative process of improvement of information in the social surroundings by figuring out how to cope with the complex environment. It consists of; Child's acceptance of the diagnosis, Support,

oversight and supervision in diabetes self-care from parents, friends, medical professionals, and siblings.

3.3 The Hurdles to Diabetes self-Care Practices

The physiological changes and psychosocial stressors affecting a child with diabetes were cited as barriers to self-management [41]. Other factors, such as the child's emotional feeling [23], the use of electronics such as cell phones, laptop computers, and television before bed [24], have been listed. Also, calculating insulin doses without using a bolus advisor, administering injections, or inserting a cannula in hard-to-reach locations [5]+. Challenges in identifying positive ways of coping with diabetes-related stress, Challenges in identifying what helped in self-motivated diabetes care [40]. The low educational level of the patient, unhealthy eating habits, short duration of diabetes [29]. Compromised psychological status [30].

Other challenges include distraction in "everyday" activities, School staff's lack of education and inattention, Expenses of healthy foods, Parents' job insecurity and lack of safe places for recreation [23]. Seeking respite from managing diabetes, Relying on parents to perform the tricky maths involved in working out carbohydrate content in food [5]. Barriers to the improvement of glycated haemoglobin (A1c) level: Family dynamics and developmental behaviours showed a higher mean A1C among the children of African Americans (10.6 ± 2.28%) [41]. Some adolescents found Flexible Lifestyle Empowering Change intervention (FLEX) repetitious, more directive coaching, and unacceptability to parent participants [14]. Poorer EF was associated with worse glycemic control over time, and this association is moderated by responsibility for diabetes-management tasks[28]. Unfavourable socioeconomic status[30]. Diabetes causes serious coping problems during adolescence because of the need for continuous observation and because of diabetes-related complications. The challenges identified can be grouped into negative feelings about having diabetes, personal barriers, and environmental barriers. Among these barriers identified included problems with school, friends, family, fear of complications, lack of information, and personal characteristics, among others [31,39,33,32,34,37,36,35].

3.4 The Enablers to Diabetes Self-Care Practices

The following facilitators were found to be relevant in the self-management of T1D: Child's acceptance of the diagnosis [23]. Enforcing early bedtimes [24]. Being motivated to minimize the pain experienced when others administered injections, Participating independently in activities with their peers, Being responsible for their health, using labels on food packaging to determine carbohydrate contents, or choosing foods with carbohydrate values they could remember, Calculating insulin doses, Using mobile phones to seek advice about carbohydrate contents in food [5]. The ability to ask for support for having and caring for diabetes when in need[40]. Other facilitators to the improvement of glycated haemoglobin (A1c) level included: frequent Blood Glucose Meters (BGM) measurements (3-4x/day) positively impact the A1C level, age, and race played an important role in determining glycemic control [41]. Executive functioning (EF) problems were significantly associated with better glycemic control over time in the following instances: More EF problems in combination with less youth responsibility ($b = 0.501$; $P = 0.048$), More parental responsibility ($b = 20.767$; $P = 0.006$)[28]. Being diagnosed for more than two years, because they presented a better glycemic control than those with recent diagnosis[29]. Parental oversight and supervision, Support from parents, friends, medical professionals, and siblings [23]. The use of soothing sounds including music, nature sounds, or ambient noise to help their teen relax and fall asleep, Limiting distractions around bedtime, Using sleep aids such as melatonin or allergy medicine [24]. Alleviating the burden on their parents, Using bolus advisors with pre-programmed ratios, Entering carbohydrates on food labels or values provided by their parents [5]. Knowing where to get support for having and caring for diabetes [40]. Flexible Lifestyle Empowering Change (FLEX) intervention provided a structured, positive framework for goal-setting, problem-solving and developing alternative concrete strategies for diabetes care, provided positive, supportive opportunities for adolescents and parents to talk about diabetes with a non-judgmental listener outside of a clinic setting, Adolescents and parents believed in the ongoing benefit of skills developed in FLEX, Phone/video delivery was acceptable for convenience when there were no perceived significant issues,

Acceptability was not related to teen's initial motivation to improve their glycaemic control and parents perceived that coaches' characteristics affected their adolescents' ability to connect with the coach [14]. Executive functioning (EF) problems were significantly associated with better glycemic control over time in the following instances: higher HbA1c over time (b = 0.190; P = 0.002), More parental responsibility (b = 20.767; P = 0.006)[28]. Findings from this review reveal that healthy food adaptation, adequate physical activity, proper medication practices, and regular glucose monitoring are the most common self-care practices. Parental involvement contributed toward the practice of self-care and self-management among adolescents with T1DM. Other facilitators include; Increased individual-level of socioeconomic status (SES), SES is indicated to be positively associated with QoL scores and negatively associated with HbA1c across all urbanization levels [4].

Self-care support can be described as family and friends, providing an individual with practical or emotional support. To encourage patients to adapt to this devastating situation. Young people with diabetes encounter the same formative directions as healthy adolescents in physical, enthusiastic, social, and behavioural development, and thus family and peer group acceptance and supported them in their disease management [33,37,36,35].

4. DISCUSSION

This integrative review has systematically identified, critically appraised, and synthesized the available evidence on diabetes self-Care practices in children and adolescents. The findings of this study highlight the existing diabetes self-Care practices in children and adolescents. Two categories were identified that offers a new understanding of self-Care practice in children and adolescents. (a) Hurdles to diabetes self-Care practices, which refers to the demands of living with and controlling T1D. (b) Enablers to diabetes self-Care practices; which involved the act of figuring out how to cope with the complex environment surrounding diabetes self-care.

In this current review, Davis et al [23] found that parents perceive the psychosocial factors that affect the management of diabetes to include a supportive society, supportive and available medical professionals, and the child's acceptance of the diagnosis. The perceived barriers include noncaring relatives, friends, and school staff. Parents' job insecurity and inconvenient medical appointments [23]. A Brazilian study by do Nascimento Andrade and Alves (2019) suggested that socioeconomic conditions and psychological characteristics of the study participants were negatively associated with HbA1c results. There was a negative association between glycemic control (HbA1c levels), socioeconomic status (CCEB), and psychological condition (B-PAID). Among the study participants, 73.5% (n = 50) of the children had unfavorable socioeconomic status; 78.0% (n = 39) had elevated levels of HbA1c and 55.6% (n = 11) were classified with appropriate glycemic control. These participants were 1.4 times more likely to present altered HbA1c values [42]. These data reinforce the importance of the studied variables as predictors of glycemic control. Whiles the study in Germany also stated that as compared with individual-level socioeconomic status (SES), area-level deprivation seems to be of minor importance for the quality of life (QoL) and glycaemic control in young people with early-onset and long-term type 1 diabetes, in the entire study group and also in both sexes, different age-groups and urbanization levels of the residence. Hence, the individual level of SES seems to be the considerably better predictor of glycaemic control and QoL in young patients with early-onset T1DM as compared to area-level deprivation [43].

Young children described being able to take on new responsibilities by using strategies that limited the need to perform tricky maths. These included using labels on food packaging to determine carbohydrate contents or choosing foods with carbohydrate values they could remember. They also described using mobile phones to get advice about the number of calories in carbohydrates in their food before intake [5]. Among the included studies, it was interesting to note that patients diagnosed for more than two years presented better glycemic control than those who were newly diagnosed with diabetes [22]. This finding is in line with another included by Vloemans et al. (2019), which indicated that Poorer executive functioning (EF) is associated with worse glycemic control over time, and this association is moderated by responsibility for diabetes-management tasks [44]. Interestingly, among the review studies was

a study showing a new trend in that, most patients reported 'forgetfulness' (19%) followed by 'too time-consuming' (17.9%) as barriers to daily BS monitoring [26].

In a study by Survonen (2019), in Finland, the results suggest that there were no associations between psychosocial self-efficacy and metabolic control. Still, a positive association was found between psychosocial self-efficacy and understanding of diabetes and its treatment, adjustment of diabetes to life, and the relationship with the doctor and the nurse (DES-background questions) [25].

While another study stated that empowering adolescent self-management, parental support is also an under-appreciated aspect to consider in other to improve self-management among children and adolescents [27]. Other facilitators to diabetes self-care included parents verbalizing that they used soothing sounds, including playing music, nature sounds, or ambient noise, to help their teen relax and fall asleep. Other substance used includes the use of melatonin or allergy medicine to induce sleepiness in their teens before bed [24]. These findings indicate that positive attitudes held by children and adolescents towards diabetes may contribute to more positive engagement with self-management of diabetes that promotes the transitioning of responsibilities for self-management. Significant concerns raised in many is to find out how the medical team solves their psychosocial problems of how to integrate into a healthier lifestyle, and ultimately to achieve better metabolic control [23, 42, 22, 27]. At the same time, families should be educated and assessed for the development of coping skills as soon as possible after diagnosis. These skills should be reassessed about two years after diagnosis [45]. Simple skills, such as identifying and treating hypoglycemia, must be taught as early as possible. All of such interventions must take into account age-appropriate developmental and intellectual abilities [3]. While the bulk of children and adolescents cope reasonably well with the demands of diabetes, a small proportion experiences severe psychological problems, such as depression, eating disorders, and recurrent ketoacidosis [22]. Healthcare professionals must always be aware that there is a high likelihood of psychosocial problems in the absence of a healthy coping strategy for family members and young diabetics, especially in the event of conflicts between culture and healthcare strategies[46, 47]. Families with dysfunctionality are less likely to develop healthy coping strategies. It was suggested that patients required additional approaches to address individual, family, and social practice to improve self-management [31,39,33,32,34,37,36,35, 43].

It is hoped that this current review has closed in the gaps in the literature that indicate the practice of self-care of type 1 diabetes in children and adolescents are not well understood.

Further research is needed in this area to ensure that factors affecting the psychosocial management of type 1 diabetes in children and adolescents are understood and how best to support them in other to bridge this gap. Professionals who learn to observe patient coping strategies and educate people at risk, find that the result is an increase in healthy coping options[22, 48]. Caring for children and adolescents with diabetes is particularly important because they are part of our future leadership [49]. Children and adolescents are a vulnerable group that requires family and professional support to become healthy and productive adults. Furthermore, research is needed to develop robust, well□developed studies on existing diabetes self-Care practices in children and adolescents that take into account the unique social context of each child and their family and through the use of quasi-experiment research and also randomized control trial studies as their were non available during the time of this current review.

5. CONCLUSIONS

In this review, diabetes self-Care practices in children and adolescents were outlined. Some participants in the review studies struggled through the practice of self-care, such as the child having some emotional disturbances such as child feeling different, the experience of distraction in everyday activities, School staff's lack of education and inattention, expenses of healthy foods, adolescents and parents' job insecurity and lack of safe places for recreation. In the same vein, there was the transformative process of improvement of information in the social surroundings as the child/adolescents and their families tried to figure out how to cope with the complex environment. These practices included the Child's acceptance of the diagnosis, Supports from peers, oversight and supervision in diabetes self-care from parents, friends,

medical professionals, and siblings. These practices lead to the formation of two categories of practice which are the: “Hurdles to diabetes self-Care practices” and “Enablers to diabetes self-Care practices”. Noteworthy, Self-care is essential for diabetics to maintain control of their blood glucose levels. Hence, Stakeholders in the health sector must promote children/adolescents and their families' practice of their diabetes self-care needs so that they can improve their self-care habits and avoid diabetes-related problems.

6. RECOMMENDATION

Based on the concerns which the children, adolescents and their parents raised in this review study, such as, the child feeling different and the experience of distraction in everyday activities, health care professionals should support them by spending more time to listen to their concerns and intensifying diabetic self-care educations to the children, adolescents and their parents to help them find their strengths so that they could cope with the disease condition.

To improve the child's School staff’s lack of education and inattention, parents should inform the child's friends, teachers, and other stakeholders about their child's diabetes state and needs such as glucose monitoring, Exercise, Dietary needs, Insulin administration and share phone number of emergency contact details with them. So that they can support through the creation of a healthy environment for the child in the school. It is also recommended that families be connected to diabetic support groups to assist in getting low cost but healthy diets for families with diabetic children. There should be enforcement of policies that safeguard people with chronic diseases such as diabetes from being segregated at their workplaces. It is also recommended that more studies be conducted on paediatric diabetic self-care practices, especially the use of randomized control trials to inform stronger evidence of their self-care needs.

7. STRENGTHS AND LIMITATIONS

Our review has helped to evaluate a nationwide self-care practice in young age groups with diabetes using both published qualitative and quantitative findings. We conducted a comprehensive search across different databases and followed Prisma standards. Individual-centred outcomes were included in the review, and we evaluated the involvement of young people and their parents’ practices and behaviours they put up toward their diabetic self-care needs. There were several limitations in our review. Our search was limited to articles published from 2017 to 2021. So studies published before 2017 were omitted. However, based on the aim and inclusion criteria of the review, it was appropriate to filter according to recent years articles findings. This was because a five-year window was selected to capture the most recent evidence as standards of care for youth with T1D has continuously being revised. Furthermore, because of divergent research methodological approaches in most of the studies identifies and the lack of randomized control trial studies, in the studies identified it was not possible to conduct a Meta-synthesis of the identified findings.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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