http:// jpp.mums.ac.ir

Review Article (Pages: 20209-20225)

Family-Centered Interventions to Enhance Self-Management Among Children and Adolescents with Type 1 Diabetes: A Systematic Review

Maryam Nakhaee Moghadam [1], Fateme Mir [2], Jalal Nourmohammadi [3], * Elham Shafighi Shahri [4]

[1] Children and Adolescents Health Research Center, Zahedan University of Medical Sciences and Health Services, Zahedan, Iran.

[2] Pediatrics Department, School of Medicine, Zahedan University of Medical Sciences, Zahedan, Iran.

[3] Student Research Committee, Faculty of Nursing and Midwifery, Zahedan University of Medical Sciences, Zahedan, Iran.

[4] Children and Adolescents Health Research Center, Research Institute of Cellular and Molecular Science in Infectious Diseases, Zahedan University of Medical Sciences, Zahedan, Iran.

Abstract

Background: Family-centered care has emerged as a key strategy for supporting self-management in children and adolescents with type 1 diabetes (T1D). However, evidence regarding the effectiveness and core components of family-centered interventions remains fragmented. This systematic review synthesized current evidence on interventions designed to enhance self-management in pediatric T1D.

Methods: A systematic review was conducted following the PRISMA 2020 guidelines. Five electronic databases (PubMed, Scopus, Web of Science, Embase, and Google Scholar) were searched for English-language studies published between 2010 and 2026. Eligible studies evaluated family-centered interventions targeting self-management among children and adolescents with T1D. Study quality was assessed using the Cochrane Risk of Bias 2 tool, the Newcastle–Ottawa Scale, and the Critical Appraisal Skills Programme checklist, as appropriate.

Results: Thirty-three studies met the eligibility criteria. The evidence consistently demonstrated that family-centered interventions improved self-management by promoting shared responsibility, developmentally appropriate autonomy, family-based diabetes education, psychosocial support, and collaborative problem-solving. Behavioral strategies, multidisciplinary care, and technology-assisted family engagement further strengthened treatment adherence, glycemic control, self-efficacy, quality of life, and family functioning. Intervention effectiveness was influenced by developmental, cultural, and socioeconomic factors.

Conclusion: Family-centered interventions represent an effective approach to improving self-management and related clinical and psychosocial outcomes in children and adolescents with T1D. Integrating educational, behavioral, psychosocial, and technological strategies within routine family-centered diabetes care may enhance long-term disease management. Future high-quality longitudinal studies are needed to determine the most effective and sustainable intervention models across diverse healthcare settings.

Key Words: Adolescents; Children; Family-centered care; Self-management; Type 1 diabetes.

* Please cite this article as: Nakhaee Moghadam M, Mir F, Nourmohammadi J, Shafighi Shahri E. Family-Centered Interventions to Enhance Self-Management Among Children and Adolescents with Type 1 Diabetes: A Systematic Review. J Ped Perspect 2026; 14 (6):20209-20225**. DOI: 10.22038/jpp.2026.97393.5709**

****Corresponding Author:***

Elham Shafighi Shahri, Children and Adolescents Health Research Center, Research Institute of Cellular and Molecular Science in Infectious Diseases, Zahedan University of Medical Sciences, Zahedan, Iran. Email: Eshahri@yahoo.com.

1- INTRODUCTION

Type 1 diabetes (T1D) is one of the most prevalent chronic endocrine disorders affecting children and adolescents worldwide. Its incidence continues to rise across diverse geographic regions, creating substantial clinical, psychological, and economic challenges for affected families and healthcare systems (1). Unlike many other pediatric chronic illnesses, T1D requires continuous and complex self-management involving multiple daily treatment decisions, including insulin administration, blood glucose monitoring, carbohydrate counting, physical activity adjustment, and prevention of acute and long-term complications. Because these tasks must be integrated into everyday life without interruption, successful disease management depends not only on medical treatment but also on sustained behavioral adaptation and family support (2).

Self-management in pediatric T1D differs fundamentally from that in adults because developmental maturity, cognitive capacity, emotional regulation, and decision-making skills evolve throughout childhood and adolescence. Younger children rely almost entirely on parents or caregivers to perform diabetes-related tasks, whereas adolescents gradually assume greater responsibility for disease management (3). This developmental transition is often accompanied by increasing autonomy, fluctuating adherence, family conflict, and psychosocial stress, all of which may compromise glycemic control and increase the risk of adverse health outcomes. Consequently, effective self-management should be viewed as a dynamic, family-mediated process rather than an individual responsibility of the child alone (4).

Growing evidence suggests that family functioning is one of the strongest determinants of diabetes outcomes during childhood and adolescence. Supportive communication, collaborative problem-solving, shared responsibility, parental monitoring, and adaptive coping strategies have been associated with better treatment adherence, improved metabolic control, enhanced diabetes self-efficacy, and higher quality of life (5). Conversely, excessive parental control, inconsistent supervision, family conflict, psychological distress, and caregiver burnout may undermine children's confidence, impair self-management behaviors, and contribute to suboptimal glycemic outcomes. These findings indicate that the quality of family interactions may be as influential as clinical interventions in shaping long-term disease management (6).

Recognition of the family's central role has shifted pediatric diabetes care from a predominantly patient-centered model toward a family-centered approach. Family-centered care emphasizes partnership between healthcare professionals, children, adolescents, and caregivers, acknowledging that treatment decisions are embedded within the family's daily routines, cultural values, health literacy, socioeconomic circumstances, and emotional resources (7). Rather than focusing solely on educating the child, family-centered strategies aim to strengthen the family's collective capacity to support diabetes management through individualized education, collaborative goal setting, behavioral interventions, psychosocial support, shared decision-making, digital health technologies, and coordinated multidisciplinary care (8).

Despite increasing interest in family-centered diabetes management, the available literature remains fragmented. Existing studies investigate diverse interventions targeting parental education, communication skills, behavioral counseling, peer support, technology-assisted monitoring, family therapy, resilience-building, and transition programs. However, these interventions vary considerably in theoretical

foundations, implementation strategies, target populations, measured outcomes, and healthcare settings (9). As a result, clinicians and researchers lack a comprehensive conceptual understanding of which family-centered strategies are most effective, under what circumstances they succeed, and how they can be integrated into routine pediatric diabetes care. Furthermore, rapid advances in diabetes technologies, telehealth, and digital communication platforms have expanded opportunities for family engagement, yet their role within broader family-centered self-management frameworks has not been synthesized comprehensively (3).

Given the growing body of research examining family-centered interventions in pediatric type 1 diabetes, a systematic review is warranted to comprehensively identify, critically appraise, and synthesize the available evidence. By applying a transparent and reproducible methodology, a systematic review enables rigorous evaluation of intervention characteristics, methodological quality, and reported outcomes across diverse clinical settings and study designs. This approach provides a robust evidence base for determining which family-centered strategies are most effective in enhancing self-management among children and adolescents with type 1 diabetes while minimizing bias in evidence synthesis.

Accordingly, this systematic review aims to evaluate the effectiveness of family-centered interventions designed to improve self-management in children and adolescents with type 1 diabetes. Through a comprehensive synthesis of evidence related to behavioral, educational, psychosocial, and healthcare delivery interventions, this review seeks to identify the core components associated with successful self-management outcomes, assess the strength and consistency of the current evidence, highlight existing research gaps, and generate evidence-informed recommendations to support clinical practice, future research, and health policy aimed at improving long-term outcomes for pediatric populations living with type 1 diabetes.

2- METHODS

This systematic review was conducted to evaluate the effectiveness of family-centered interventions in enhancing self-management among children and adolescents with type 1 diabetes. The review was designed and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological rigor, transparency, and reproducibility.

A comprehensive search of the literature published between 2010 and 2026 was undertaken to identify studies investigating family-centered interventions targeting self-management in pediatric type 1 diabetes. This timeframe was selected to capture the rapid growth of family-centered care as a core component of pediatric diabetes management and the increasing number of intervention studies evaluating its clinical effectiveness. Outcomes of interest included self-management behaviors, treatment adherence, glycemic control, diabetes-related knowledge, self-efficacy, psychosocial well-being, family functioning, and health-related quality of life (HRQOL).

The review protocol was not prospectively registered in PROSPERO or another public registry. Nevertheless, methodological transparency was maintained through strict adherence to the PRISMA 2020 recommendations. Eligibility criteria, search methods, study selection, data extraction, quality assessment, and evidence synthesis were predefined and reported in sufficient detail

to ensure the reproducibility and reliability of the review process.

2-1. Information Sources

A comprehensive literature search was conducted across five major electronic databases: PubMed, Scopus, Web of Science, Embase, and Google Scholar. These databases were selected because of their broad coverage of biomedical, nursing, public health, and interdisciplinary research, ensuring comprehensive identification of studies evaluating family-centered interventions to enhance self-management among children and adolescents with type 1 diabetes.

2-2. Search Strategy

A comprehensive search strategy was developed for each database using a combination of controlled vocabulary (e.g., MeSH terms where applicable), free-text keywords, and Boolean operators (AND, OR) to maximize retrieval of relevant studies. The search was designed to identify studies evaluating family-centered interventions aimed at enhancing self-management among children and adolescents with type 1 diabetes. Search strategies were tailored to the indexing system and search functionality of each database while maintaining conceptual consistency across all sources. The complete search strategies for each database are presented in Table 1.

2-3. Eligibility Criteria

Studies were considered eligible if they met the following criteria:

1. Population: Children and adolescents (≤18 years) diagnosed with type 1 diabetes, as well as their families, parents, or primary caregivers.

Table-1. Search strategy for electronic databases.

Database	Search strategy
PubMed	("Diabetes Mellitus, Type 1"[Mesh] OR "Type 1 Diabetes" OR T1DM OR "juvenile diabetes") AND ("Child"[Mesh] OR "Adolescent"[Mesh] OR child* OR adolescen* OR pediatric* OR paediatric* OR youth*) AND ("Family-Centred Care"[Mesh] OR "family-centred care" OR "family centred care" OR family-based OR family intervention* OR family support OR parent* OR caregiver*) AND ("Self-Management"[Mesh] OR self-management OR self care OR self-care OR diabetes management OR treatment adherence OR self-monitoring)
Scopus	TITLE-ABS-KEY(("type 1 diabetes" OR T1DM OR "juvenile diabetes") AND (child* OR adolescen* OR pediatric* OR paediatric* OR youth*) AND ("family-centred care" OR "family centred care" OR family-based OR "family intervention*" OR "family support" OR parent* OR caregiver*) AND ("self-management" OR "self care" OR "self-care" OR "diabetes management" OR adherence OR "self-monitoring"))
Web of Science	TS=(("type 1 diabetes" OR T1DM OR "juvenile diabetes") AND (child* OR adolescen* OR pediatric* OR paediatric* OR youth*) AND ("family-centered care" OR "family centred care" OR family-based OR "family intervention*" OR "family support" OR parent* OR caregiver*) AND ("self-management" OR "self-care" OR "diabetes management" OR adherence OR "self-monitoring"))
Embase	('type 1 diabetes'/exp OR 'type 1 diabetes' OR T1DM OR 'juvenile diabetes') AND ('child'/exp OR 'adolescent'/exp OR child* OR adolescen* OR pediatric* OR paediatric* OR youth*) AND ('family centered care'/exp OR 'family centered care' OR family-based OR 'family intervention*' OR 'family support' OR parent* OR caregiver*) AND ('self management'/exp OR 'self management' OR 'self care' OR 'diabetes management' OR adherence OR 'self monitoring')
Google Scholar	("Type 1 Diabetes" OR T1DM) AND ("family-centered care" OR family-based OR "family intervention") AND ("self-management" OR "self-care") AND (children OR adolescents OR pediatric)

2. Intervention: Studies evaluating family-centered interventions designed to enhance diabetes self-management. Eligible interventions included family-based educational, behavioral, psychosocial, digital, multidisciplinary, or care coordination programs that actively involved family members in diabetes management.
3. Study Design: Original quantitative or mixed-methods studies, including randomized controlled trials, quasi-experimental studies, non-randomized intervention studies, prospective and retrospective cohort studies, and controlled observational studies. Systematic reviews, narrative reviews, conference abstracts, editorials, commentaries, protocols, case reports, and dissertations were excluded.
4. Outcomes: Studies reporting at least one self-management-related outcome, including self-management behaviors, treatment adherence, glycemic control (e.g., HbA1c), diabetes knowledge, self-efficacy, self-monitoring, HRQOL, psychosocial outcomes, or family functioning.
5. Publication Time: Studies published between 2010 and 2026.
6. Language: Articles published in English.

2-4. Exclusion Criteria

Studies were excluded if they met any of the following criteria:

1. They did not evaluate family-centered interventions or did not include children or adolescents with type 1 diabetes and/or their family members or caregivers.
2. They focused exclusively on pharmacological treatments, medical devices, or technology-based interventions without a family-centered component or without assessing self-management outcomes.
3. They were non-original publications, including systematic reviews, narrative reviews, meta-analyses, protocols, editorials, commentaries, letters, conference abstracts, case reports, dissertations, or other publications lacking original empirical data.
4. They did not report at least one predefined self-management-related outcome or provided insufficient data for outcome assessment.
5. They were published in languages other than English or outside the predefined publication period (2010–2026).

2-5. Data Extraction and Management

Data extraction was performed independently by two reviewers using a standardized, pilot-tested data extraction form. The following information was extracted from each eligible study: study characteristics (first author, publication year, country, study design, sample size, and participant characteristics); intervention characteristics (type, components, duration, delivery mode, family involvement, and comparator where applicable); outcome measures (e.g., self-management behaviors, treatment adherence, HbA1c, diabetes knowledge, self-efficacy, psychosocial outcomes, family functioning, and health-related quality of life); and methodological characteristics, including follow-up duration and assessment instruments.

All retrieved records were imported into EndNote for citation management and duplicate removal. Screening and data management were performed using a predefined review workflow to ensure consistency throughout the selection process. The search strategy was developed by the first author and refined through consultation with senior researchers experienced in systematic reviews. Disagreements regarding study selection or data extraction were resolved through discussion, and when consensus could not be reached, a third reviewer acted as an adjudicator. These procedures were implemented to enhance the accuracy, transparency, and methodological rigor of the review.

2-6. Quality Assessment

The methodological quality of the included studies was independently assessed by two reviewers using validated appraisal tools appropriate to each study design. Randomized controlled trials were evaluated using the Cochrane Risk of Bias 2 (RoB 2) tool, observational studies were assessed with the Newcastle-Ottawa Scale (NOS), and qualitative studies were appraised using the Critical Appraisal Skills Programme (CASP) checklist. Any discrepancies in quality ratings were resolved through discussion, with consultation from a third reviewer when necessary. No studies were excluded based on their methodological quality; instead, the risk of bias assessments were considered during evidence synthesis and interpretation, allowing greater emphasis to be placed on findings derived from studies with higher methodological rigor.

2-7. Data Synthesis

Given the expected heterogeneity in intervention characteristics, study designs, and outcome measures, a narrative synthesis was undertaken in accordance with established guidance for systematic reviews. Quantitative pooling (meta-analysis) was not considered appropriate because of substantial clinical and methodological diversity across the included studies.

Following data extraction and quality appraisal, findings were systematically organized according to the characteristics of the family-centered interventions and their reported outcomes. Evidence was synthesized across key outcome domains, including self-management behaviors, treatment adherence, glycemic control (HbA1c), diabetes knowledge, self-efficacy, psychosocial well-being, family functioning, and HRQOL. Intervention components, modes of delivery, duration, and the extent of family involvement were also compared to identify characteristics associated with improved self-management outcomes.

Where appropriate, findings were grouped according to intervention type and outcome domain to facilitate comparison across studies. The methodological quality and risk of bias of individual studies were considered during the interpretation of results, with greater weight given to evidence derived from studies of higher methodological quality. This approach enabled a comprehensive and transparent synthesis of the current evidence on the effectiveness of family-centered interventions for enhancing self-management among children and adolescents with type 1 diabetes.

3- RESULTS

The reviewed literature consistently demonstrated that effective self-management in children and adolescents with type 1 diabetes extends beyond individual patient behaviors and is strongly influenced by family dynamics, caregiver involvement, and the broader healthcare environment. Although interventions differed in design, intensity, and delivery methods, several recurring themes emerged regarding the mechanisms through which family-centered strategies enhance diabetes self-management.

3-1. Shared Responsibility and Developmentally Appropriate Autonomy

One of the most prominent findings across the literature was the importance of balancing parental involvement with the child's progressive development of self-management skills. Studies consistently emphasized that transferring diabetes-related responsibilities should occur gradually and in accordance with the child's cognitive maturity, emotional readiness, and clinical competence rather than chronological age alone (10).

Family-centered interventions promoted shared responsibility models in which parents continued to supervise critical diabetes tasks while encouraging children and adolescents to participate actively in daily decision-making. Such collaborative approaches were associated with greater treatment adherence, improved confidence in diabetes management, and smoother transitions toward independent self-care. In contrast, either premature transfer of responsibility or excessive parental control frequently resulted in poorer self-management behaviors, increased family conflict, and reduced treatment engagement (11).

3-2. Diabetes Education as a Family Process

The evidence indicated that diabetes education is most effective when delivered to the family as a whole rather than exclusively to the child or caregiver. Family-centered educational programs addressed insulin management, carbohydrate counting, glucose monitoring, problem-solving, hypoglycemia management, and interpretation of glucose trends while simultaneously strengthening communication and collaborative decision-making within the family (6). Educational interventions that incorporated practical skill development, individualized counseling, and repeated reinforcement appeared more successful than isolated educational sessions. The literature further suggested that educational strategies were particularly beneficial when adapted to developmental stage, family literacy, cultural context, and existing caregiving practices (8).

3-3. Family Communication and Psychosocial Support

Another consistently identified theme concerned the influence of family communication on diabetes outcomes. Families characterized by open communication, emotional support, collaborative problem-solving, and constructive conflict resolution generally demonstrated stronger self-management behaviors than families experiencing persistent interpersonal conflict or caregiver distress (12). Psychological interventions integrated into family-centered care addressed anxiety, diabetes-related distress, fear of hypoglycemia, caregiver burden, and adolescent emotional adjustment. These interventions frequently enhanced family cohesion while reducing emotional barriers that interfere with treatment adherence. The reviewed evidence highlighted that emotional well-being and effective communication function as essential components of successful diabetes management rather than secondary outcomes (13).

3-4. Behavioral Interventions and Self-Management Skills

Behavioral approaches represented another major component of family-centered care. Goal setting, self-monitoring, motivational interviewing, positive reinforcement, structured problem-solving, and family-based behavioral contracts were commonly incorporated into intervention programs (14). These strategies strengthened self-efficacy by promoting consistent diabetes routines, encouraging active participation in treatment decisions, and improving confidence in managing daily diabetes challenges. Behavioral interventions were particularly effective when parents were actively involved in establishing realistic goals and providing supportive feedback rather than directive supervision (12).

3-5. Technology-Enabled Family Engagement

Rapid advances in diabetes technology have substantially expanded opportunities for family participation in disease management. Continuous glucose monitoring (CGM) systems, insulin

pumps, hybrid closed-loop systems, smartphone applications, telemedicine platforms, and remote glucose-sharing technologies enabled families to monitor glycemic trends, detect potential complications earlier, and communicate more efficiently with healthcare professionals (15).

The literature suggested that technology alone rarely improves diabetes outcomes unless accompanied by appropriate family education and collaborative use. Families who received structured guidance regarding technology utilization demonstrated greater confidence, reduced treatment burden, and improved integration of diabetes management into everyday life (16).

3-6. Multidisciplinary and Family-Centered Healthcare Delivery

Effective self-management was consistently associated with multidisciplinary care models integrating pediatric endocrinologists, diabetes educators, nurses, dietitians, psychologists, and social workers (17). Rather than functioning independently, these professionals collaborated with families to develop individualized care plans that reflected developmental needs, family priorities, psychosocial circumstances, and cultural values. Healthcare teams that emphasized shared decision-making and continuous family engagement facilitated stronger therapeutic relationships, improved treatment satisfaction, and greater adherence to recommended management plans (12).

3-7. Supporting Transition to Greater Independence

The transition from childhood to adolescence emerged as one of the most vulnerable periods for diabetes self-management. The literature demonstrated that structured transition planning involving both adolescents and their caregivers reduced disruptions in diabetes care and promoted continuity of self-management behaviors (18). Successful transition strategies emphasized gradual transfer of responsibility, communication between pediatric and adult healthcare providers, reinforcement of problem-solving skills, and sustained parental support during increasing adolescent independence. Transition programs that maintained family involvement while fostering autonomy were associated with better psychosocial adjustment and greater readiness for adult diabetes care (19).

3-8. Family Resilience and Contextual Influences

The reviewed studies increasingly recognized family resilience as a critical determinant of long-term diabetes management. Families capable of adapting to ongoing treatment demands, maintaining positive coping strategies, and mobilizing social support demonstrated greater consistency in diabetes care despite chronic disease-related stress. Socioeconomic resources, cultural beliefs, parental health literacy, family structure, and healthcare accessibility further influenced the effectiveness of family-centered interventions. Consequently, successful self-management strategies required adaptation to the unique circumstances and strengths of individual families rather than reliance on standardized intervention models (20, 21).

3-9. Overall Synthesis

Collectively, the evidence suggests that family-centered self-management represents a multidimensional process integrating education, behavioral support, psychosocial care, technological innovation, multidisciplinary collaboration, and developmentally appropriate autonomy. Rather than serving as isolated interventions, these components interact dynamically to strengthen children's capacity for diabetes self-management while preserving supportive

family involvement. The findings indicate that interventions acknowledging family diversity, developmental transitions, and contextual influences are more likely to achieve sustainable improvements in both clinical and psychosocial outcomes than approaches focusing solely on individual patient education.

4- DISCUSSIONS

This narrative review highlights that optimizing self-management in children and adolescents with T1D requires a paradigm shift from child-centered disease management to a comprehensive family-centered model of care. The available evidence consistently indicates that self-management is not an isolated behavioral competency acquired by the child but rather a dynamic process shaped by interactions among developmental maturity, family functioning, psychosocial resources, healthcare support, and technological innovation. Consequently, interventions that actively engage families appear more capable of producing sustainable improvements in both clinical and psychosocial outcomes than approaches directed solely toward the individual patient (10, 11).

One of the most important findings of this review is the critical role of shared responsibility in pediatric diabetes management. Self-management responsibilities evolve throughout childhood and adolescence, making a gradual redistribution of diabetes-related tasks essential. Families that maintain collaborative supervision while progressively fostering children's autonomy appear to facilitate healthier transitions toward independent disease management. Conversely, both extremes premature withdrawal of parental support and excessive parental control may compromise adherence, reduce self-efficacy, and intensify family conflict. These findings suggest that autonomy should not be interpreted as parental disengagement but rather as a structured developmental process supported by continuous family guidance. This perspective aligns with contemporary developmental theories, which emphasize that competence emerges through guided participation rather than abrupt independence (22, 23).

Table-2. Characteristics and main findings of included studies.

Author/ Year	Study design	Participants	Family-centered strategy	Main outcomes
Fiallo-Scharer et al. (2019) (10)	Cluster randomized controlled trial	Children and adolescents with type 1 diabetes (8–16 years) and their parents, recruited from pediatric diabetes clinics.	Individualized family-centered tailoring of diabetes self-management resources based on each family's specific self-management barriers using the PRISM survey	Diabetes self-management barriers, HbA1c, diabetes-related quality of life, family engagement with self-management resources
Saoji et al. (2018) (11)	Cross-sectional study	267 children and adolescents with type 1 diabetes (8–16 years) and their parents	Examined family-related self-management barriers (PRISM) and their association with child and parent quality of life	Diabetes-specific quality of life (PedsQL), parent quality of life (Family Impact Module), self-management barriers
Hilliard et al. (2018) (14)	Pilot randomized controlled trial	Adolescents with type 1 diabetes and one parent/caregiver	Web-based family behavioral intervention designed to improve parent–adolescent teamwork, diabetes communication, collaborative problem-solving, and shared responsibility for diabetes management	Feasibility and acceptability, family conflict, parent–adolescent teamwork, diabetes self-management behaviors, HbA1c

Hannon et al. (2018) (24)	pilot	6 adolescents (12–18 years) with type 1 diabetes and their parents	Co-design of a shared decision-making diabetes management plan through a patient–parent advisory board to enhance collaborative diabetes self-management	Feasibility, acceptability, identification of patient-centered priorities, family communication, shared goal setting
Stanger et al. (2018) (25)	Pilot randomized controlled trial	61 adolescents (13–17 years) with poorly controlled type 1 diabetes (HbA1c ≥ 8%) and their parents	WebRx, a web-delivered multicomponent family-centered intervention integrating parent supervision training, contingency contracting, motivational and cognitive-behavioral strategies, working memory training, and incentives to enhance diabetes self-management	Self-monitoring of blood glucose (primary outcome), HbA1c, family conflict, parental monitoring, executive functioning, intervention feasibility and acceptability
Jaser et al. (2019) (22)	Randomized controlled trial	Adolescents aged 13–17 years with type 1 diabetes and one parent/caregiver	Positive psychology intervention delivered to adolescents with structured parent involvement through supportive interactions, gratitude exercises, self-affirmation, and diabetes-specific encouragement	HbA1c, diabetes adherence, diabetes-related quality of life, positive affect, coping
Brorsson et al. (2019) (23)	Randomized controlled trial	Adolescents with type 1 diabetes initiating insulin pump therapy and their parents	Person-centered education (Guided Self-Determination–Young, GSD-Young) involving adolescents and parents through structured reflection, collaborative goal setting, and shared problem-solving during diabetes education.	HbA1c, diabetes empowerment, self-management, treatment satisfaction, parent–adolescent communication, diabetes-related conflict
Tuohy et al. (2025) (26)	Cross-sectional study	113 adolescents (11–17 years) with type 1 diabetes (duration ≥6 months)	Examined parent–adolescent communication, diabetes-specific family conflict, self-efficacy, and their associations with diabetes self-management	Self-management, patient activation, division of diabetes management responsibility, parent–adolescent communication, family conflict, self-efficacy
Wong et al. (2025) (27)	Randomized controlled trial (wait-list control)	157 adolescent–parent dyads; adolescents aged 12–19 years with type 1 diabetes	Insul-In This Together, a 6-week family systems–based intervention delivered via secure videoconferencing. Sessions focused on parental monitoring, parental involvement, communication, collaborative problem-solving, empathy building, and diabetes-related conflict management.	Supportive and unsupportive parenting, diabetes-related family conflict, diabetes distress (adolescent and parent), health-related quality of life (HRQOL), HbA1c, percent time in range (TIR)
Tzavela et al. (2026) (28)	Cross-sectional study	Adolescents with type 1 diabetes (12–18 years) and healthy controls	Assessment of family functioning using the McMaster Family Assessment Device (FAD) and its association with metabolic control	Family functioning, HbA1c, metabolic control
Alzawahreh et al. (2024) (21)	Randomized controlled trial	68 adolescents with type 1 diabetes (34 intervention, 34 control) and their family members	Family-Centered Empowerment Model (FCEM) delivered through structured educational and empowerment sessions involving adolescents and their families.	HbA1c, self-efficacy, quality of life (QOL), treatment adherence, stress management, communication,

			The intervention emphasized knowledge enhancement, self-efficacy, participatory learning, problem-solving, and family support to strengthen diabetes self-management.	perceived treatment barriers
DeBoer et al. (2023) **(29)**	Randomized controlled trial	43 adolescent–parent dyads (adolescents aged 12–17 years with type 1 diabetes)	Cloud Connect, a family-centered digital decision-support intervention integrating continuous glucose monitoring (CGM), insulin dosing, and physical activity data. Weekly reports were shared with both adolescents and parents to facilitate collaborative diabetes management, communication, and shared decision-making.	HbA1c, Time in Range (TIR), diabetes self-management, diabetes-specific communication, family conflict, quality of life, intervention feasibility

The review also underscores that diabetes education should be conceptualized as a family learning process rather than a patient education program. Traditional educational approaches often focus primarily on improving children's knowledge and technical skills; however, effective diabetes management requires coordinated decision-making within the family. Parents frequently determine meal planning, supervise insulin administration, recognize hypoglycemia, provide emotional support, and facilitate communication with healthcare providers. Therefore, educational interventions that strengthen the collective knowledge, confidence, and problem-solving capacity of the entire family are more likely to promote sustained behavioral change (27). The growing emphasis on individualized education further suggests that educational content should be tailored not only to developmental stage but also to parental health literacy, cultural beliefs, family routines, and socioeconomic circumstances (21).

Another important observation concerns the strong interaction between psychosocial well-being and diabetes self-management. Family communication, emotional climate, parental stress, and adolescent psychological adjustment consistently emerged as influential determinants of treatment adherence (29). Rather than functioning as secondary outcomes, psychosocial factors appear to shape the effectiveness of virtually every diabetes management strategy. Chronic disease management imposes continuous emotional demands on both children and caregivers, increasing vulnerability to anxiety, diabetes distress, caregiver burden, and family conflict. Family-centered psychosocial interventions may therefore improve metabolic outcomes indirectly by strengthening communication, reducing emotional barriers, and enhancing adaptive coping mechanisms. These findings reinforce the need to integrate psychological assessment and family counseling into routine pediatric diabetes care instead of limiting support to periods of overt psychological crisis (28).

Technological advances represent another transformative element in contemporary family-centered diabetes management. Continuous glucose monitoring systems, insulin pumps, hybrid closed-loop technologies, telemedicine, and mobile health applications have fundamentally altered the ways families participate in diabetes care. Nevertheless, the findings of this review indicate that technology functions primarily as an enabling tool rather than an independent therapeutic solution. Without appropriate education (25).

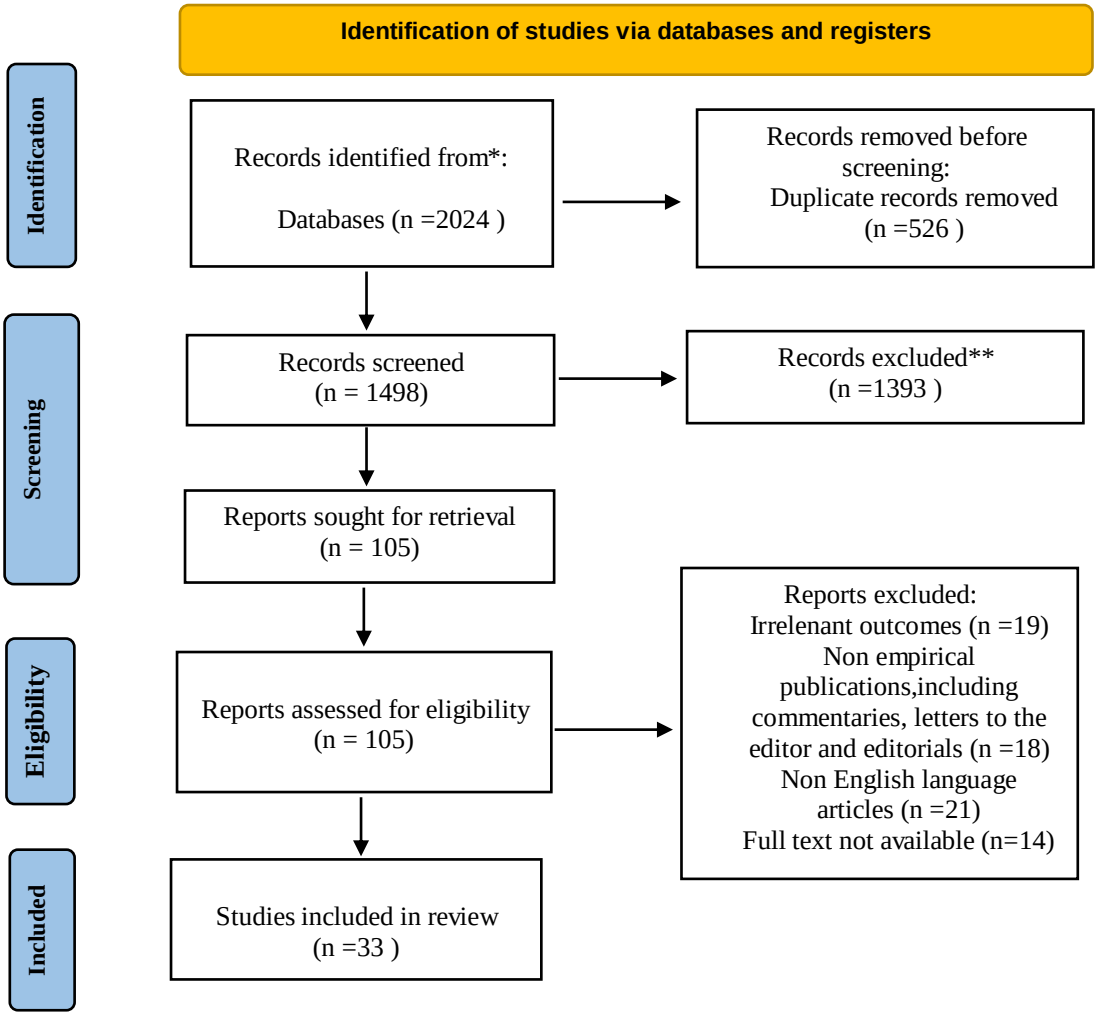

Figure-1: PRISMA flow diagram.

family engagement and ongoing professional support, technological innovations may increase information overload, caregiver anxiety, or treatment complexity. Their greatest benefit appears when digital technologies facilitate collaborative decision-making, improve communication between families and healthcare professionals, and reduce the daily cognitive burden associated with diabetes management. This interpretation emphasizes that successful implementation of diabetes technologies depends as much on family adaptation as on technological sophistication (23).

The review further demonstrates the importance of multidisciplinary healthcare models in supporting family-centered self-management. Diabetes management increasingly extends beyond glycemic control to encompass nutrition, mental health, behavioral adaptation, transition planning, and social support. No single healthcare professional possesses all the expertise required to address these interconnected needs. Multidisciplinary teams create opportunities for coordinated interventions that simultaneously target medical, educational, behavioral, and psychosocial domains. Importantly, effective multidisciplinary care requires families to function as active partners in clinical decision-making rather than passive recipients of healthcare services. Such collaborative relationships promote greater trust, individualized care planning, and sustained engagement with long-term treatment (30).

Transition from childhood to adolescence and subsequently to adult healthcare services represents another critical period identified throughout the reviewed literature. Adolescence is characterized by increasing independence, identity formation, social influence, and emotional variability, all of which may challenge diabetes self-management. The evidence suggests that transition programs are most successful when they prepare both adolescents and caregivers for evolving responsibilities while maintaining supportive family involvement. This finding challenges models that equate successful transition with complete parental withdrawal. Instead, transition readiness appears to reflect the family's ability to redefine supportive roles while preserving collaborative disease management (31).

An additional contribution of this review is the recognition that family-centered interventions cannot be universally standardized because their effectiveness is influenced by contextual factors. Family structure, socioeconomic status, cultural beliefs, healthcare accessibility, parental education, health literacy, and community resources all shape the implementation and outcomes of diabetes self-management strategies. Consequently, interventions developed within one healthcare system or cultural context may not produce equivalent results elsewhere without careful adaptation. Future intervention design should therefore prioritize flexibility and cultural responsiveness rather than assuming universal applicability (32, 33).

Despite the encouraging findings, several important knowledge gaps remain. Considerable heterogeneity exists regarding intervention components, duration, outcome measures, and theoretical frameworks, limiting direct comparison across studies. Many investigations evaluate relatively short-term outcomes, whereas evidence regarding long-term sustainability of family-centered interventions remains limited. Furthermore, fathers, siblings, grandparents, and other family caregivers remain underrepresented in much of the existing literature despite their increasingly recognized contributions to pediatric diabetes management. Research involving culturally diverse populations, low-resource healthcare settings, and digital family-centered interventions also remains comparatively scarce (21, 26).

Future research should move beyond evaluating whether family-centered interventions are effective and instead investigate why, for whom, and under which circumstances these interventions produce meaningful improvements. Longitudinal studies examining developmental trajectories of self-management, implementation research exploring integration into routine clinical practice, and comparative effectiveness studies evaluating combinations of educational, behavioral, technological, and psychosocial strategies are likely to provide valuable guidance for future clinical practice. Greater attention should also be directed toward family resilience, shared decision-making, culturally adapted interventions, and personalized models of family engagement.

Overall, the findings of this systematic review support a broader conceptualization of pediatric diabetes self-management in which the family serves not merely as a source of support but as an essential therapeutic partner. Family-centered strategies appear to enhance children's capacity for sustained self-management by integrating educational empowerment, collaborative responsibility, emotional support, technological resources, and multidisciplinary care within the family's everyday environment. Recognizing families as active participants in diabetes management rather than adjuncts to

medical treatment may provide a stronger foundation for improving long-term clinical outcomes, psychosocial well-being, and quality of life for children and adolescents living with type 1 diabetes (21-23, 26, 27).

4-1. Limitations

This review has several limitations. The included studies were heterogeneous in terms of intervention characteristics, study design, and outcome measures, limiting direct comparisons and precluding meta-analysis. In addition, variations in the definition and implementation of family-centered interventions and the methodological limitations of some primary studies may have influenced the consistency of the findings. Finally, restricting the review to English-language publications may have introduced language bias. This protocol is not prospectively registered.

5- CONCLUSION

Optimizing self-management in children and adolescents with type 1 diabetes requires a shift from an individual-centered approach to a family-centered model that recognizes the family as an active therapeutic partner rather than a passive source of support. The evidence synthesized in this review suggests that sustainable improvements in diabetes management arise from the integration of shared responsibility, individualized education, psychosocial support, multidisciplinary collaboration, and appropriate use of digital health technologies within the family's daily life. Importantly, the effectiveness of these strategies depends on their adaptation to the child's developmental stage and the family's cultural, social, and healthcare context.

Although family-centered care has demonstrated considerable potential to improve both clinical and psychosocial outcomes, further research is needed to identify the core components of effective interventions, evaluate their long-term sustainability, and facilitate their implementation across diverse healthcare settings. Strengthening family-centered practices in routine pediatric diabetes care may provide a practical pathway toward enhancing self-management capacity, promoting healthy transition to adulthood, and improving lifelong health outcomes for children and adolescents living with type 1 diabetes.

6- ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to all researchers and scholars whose previous work has laid the foundation for this systematic review. Additionally, we extend our appreciation to all those who have supported and contributed, directly or indirectly, to the completion of this study.

7- FUNDING

The researchers provided all the resources needed to conduct this study, without any external funding. The research project received no financial support or grants from any funding agency or organization.

8- DATA AVAILABILITY

All data analyzed in this study were extracted from previously published studies, which are cited in the manuscript. No new datasets were generated. Therefore, data sharing is not applicable.

Declarations

9- ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

10 - CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

11- REFERENCES

1. Ogle GD, Wang F, Haynes A, Gregory GA, King TW, Deng K, et al. Global type 1 diabetes prevalence, incidence, and mortality estimates 2025: Results from the International diabetes Federation Atlas and the T1D Index Version 3.0. Diabetes Research and Clinical Practice. 2025 Jul 1;225:112277.

2. Chiang JL, Maahs DM, Garvey KC, Hood KK, Laffel LM, Weinzimer SA, et al. Type 1 diabetes in children and adolescents: a position statement by the American Diabetes Association. Diabetes care. 2018 Aug 13;41(9):2026.

3. de Wit M, Gajewska KA, Goethals ER, McDarby V, Zhao X, Hapunda G, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Psychological care of children, adolescents and young adults with diabetes. Pediatric diabetes. 2022 Dec 5;23(8):1373.

4. Young-Hyman D, de Groot M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Erratum. Psychosocial care for people with diabetes: a position statement of the American Diabetes Association. Diabetes Care 2016; 39: 2126–2140. Diabetes Care. 2016 Dec 7;40(2):287.

5. Farthing P, Bally J, Rennie DC, Dietrich Leurer M, Holtslander L, Nour MA. Type 1 diabetes management responsibilities between adolescents with T1D and their parents: An integrative review. Journal for Specialists in Pediatric Nursing. 2022 Oct;27(4):e12395.

6. Ispriantari A, Agustina R, Konlan KD, Lee H. Family-centered interventions for children and adolescents with type 1 diabetes mellitus: an integrative review. Child Health Nursing Research. 2023 Jan 31;29(1):7.

7. Ranaei A, Amani H, Peyman N. Examining the relationship between mothers' health literacy and self-care in children and adolescents with type 1 diabetes: a cross-sectional study. BMJ Paediatrics Open. 2025 Nov 11;9(1):e003821.

8. Cockcroft EJ, Clarke R, Dias RP, Lloyd J, Mann RH, Narendran P, et al. Effectiveness of educational and psychoeducational self-management interventions in children and adolescents with type 1 diabetes: a systematic review and meta-analysis. Pediatric diabetes. 2024;2024(1):2921845.

9. Zhang K, Huang Q, Wang Q, Li C, Zheng Q, Li Z, et al. Telemedicine in improving glycemic control among children and adolescents with type 1 diabetes mellitus: systematic review and meta-analysis. Journal of medical Internet research. 2024 Jul 9;26:e51538.

10. Fiallo-Scharer R, Palta M, Chewning BA, Rajamanickam V, Wysocki T, Wetterneck TB, et al. Impact of family-centered tailoring of pediatric diabetes self-management resources. Pediatric diabetes. 2019 Nov;20(7):1016-24.

11. Saoji N, Palta M, Young HN, Moreno MA, Rajamanickam V, Cox ED. The relationship of type 1 diabetes self-management barriers to child and parent quality of life: a US cross-sectional study. Diabetic medicine. 2018 Nov;35(11):1523-30.

12. Litchfield I, Barrett T, Hamilton-Shield JP, Moore TH, Narendran P, Redwood S, et al. Developments in the design and delivery of self-management support for children and young people with diabetes: a narrative synthesis of systematic reviews. Diabetic Medicine. 2023 Apr;40(4):e15035.

13. Wakelin KE, Read RK, Williams AY, Francois-Walcott RR, O'Donnell N, Satherley RM, et al. The effectiveness of psychological interventions for families of children with type 1 diabetes on caregiver and child functioning: a systematic review

and meta-analysis. Journal of diabetes. 2025 Jun;17(6):e70112.

14. Powell PW, Hilliard ME, Anderson BJ. Motivational interviewing to promote adherence behaviors in pediatric type 1 diabetes. Current diabetes reports. 2014 Oct;14(10):531.

15. Trnka P, Aldaghi T, Muzik J. Categorization of mHealth coaching technologies for children or adolescents with type 1 diabetes: systematic review. JMIR Pediatrics and Parenting. 2024 Oct 10;7(1):e50370.

16. Yeşil F, Özçelik ÇÇ. Effect of wearable technology on metabolic control and the quality of life in children and adolescents with type 1 diabetes: a systematic review and meta-analysis. Balkan Medical Journal. 2024 Jul 5;41(4):261.

17. Carrigan A, Meulenbroeks I, Sarkies M, Dammery G, Halim N, Singh N, et al. Benefits, implementation and sustainability of innovative paediatric models of care for children with type 1 diabetes: a systematic review. BMC pediatrics. 2024 Aug 5;24(1):502.

18. Aljohani N, Donetto S, Due-Christensen M, Forbes A. The journey to adulthood: a systematic review of interventions in type 1 diabetes paediatric to adult transition care. Pediatric Diabetes. 2024;2024(1):1773726.

19. Berot A, Morsa M, De Andrade V, Gagnayre R, Bihan H. Lack of consideration of socioeconomic factors in transition programme of adolescents with type 1 diabetes: A systematic review. Diabetic Medicine. 2024 Jan;41(1):e15225.

20. Alazmi A, Bashiru MB, Viktor S, Erjavec M. Psychological variables and lifestyle in children with type1 diabetes and their parents: a systematic review. Clinical Child Psychology and Psychiatry. 2024 Jul;29(3):1174-94.

21. Alzawahreh S, Ozturk C. Improving self-efficacy, quality of life, and glycemic control in adolescents with type 1 diabetes: Randomized controlled trial for the evaluation of the family-centered empowerment model. JMIR Formative Research. 2024 Dec 10;8(1):e64463.

22. Jaser SS, Whittemore R, Choi L, Nwosu S, Russell WE. Randomized trial of a positive psychology intervention for adolescents with type 1 diabetes. Journal of pediatric psychology. 2019 Jun 1;44(5):620-9.

23. Brorsson AL, Leksell J, Andersson Franko M, Lindholm Olinder A. A person-centered education for adolescents with type 1 diabetes—A randomized controlled trial. Pediatric diabetes. 2019 Nov;20(7):986-96.

24. Hannon TS, Moore CM, Cheng ER, Lynch DO, Yazel-Smith LG, Claxton GE, et al. Codesigned shared decision-making diabetes management plan tool for adolescents with type 1 diabetes mellitus and their parents: prototype development and pilot test. Journal of participatory medicine. 2018 May 10;10(2):e9652.

25. Stanger C, Lansing AH, Scherer E, Budney A, Christiano AS, Casella SJ. A web-delivered multicomponent intervention for adolescents with poorly controlled type 1 diabetes: a pilot randomized controlled trial. Annals of Behavioral Medicine. 2018 Dec;52(12):1010-22.

26. Tuohy E, Gallagher P, Rawdon C, Murphy N, McDonnell C, Swallow V, et al. Parent-adolescent communication, self-efficacy, and self-management of type 1 diabetes in adolescents. The science of diabetes self-management and care. 2025 Feb;51(1):73-84.

27. Wong JJ, Alamarie SA, Hanes SJ, Flores H, Ngo J, Schneider-Utaka AK, et al. An RCT of a family intervention for adolescents living with type 1 diabetes:

Who benefits most?. Diabetic Medicine. 2026 Jan;43(1):e70151.

28. Tzavela EC, Kandyla B, Tzavara C, Sakou II, Karanasios S, Plarinou A, et al. Family Functioning in Adolescents with Type 1 Diabetes: Comparisons with Healthy Peers and Associations with Metabolic Control. Endocrines. 2026 May 8;7(2):19.

29. DeBoer MD, Valdez R, Corbett JP, Krauthause K, Wakeman CA, Luke AS, et al. Effect of an automated advice algorithm (CloudConnect) on adolescent-parent diabetes-specific communication and glycemic management: a randomized trial. Diabetes Therapy. 2023 May;14(5):899-913.

30. Temmen CD, Lu R, Gee BT, Chen Z, Nansel TR. Latent classifications of parental involvement in diabetes management for youth with type 1 diabetes: A randomized clinical trial. Pediatric diabetes. 2022 Nov;23(7):1133-42.

31. Papadakis JL, Suhs MC, O'Donnell A, Harris MA, Anderson LM, Garza KP, et al. Focused on the family: Development of a family-based intervention promoting the transition to adult health care for adolescents with type 1 diabetes. Children. 2024 Oct 28;11(11):1304.

32. Kahkoska AR, Lawson MT, Crandell J, Driscoll KA, Kichler JC, Seid M, et al. Assessment of a precision medicine analysis of a behavioral counseling strategy to improve adherence to diabetes self-management among youth: a post hoc analysis of the FLEX trial. JAMA Network Open. 2019 May 31;2(5):e195137.

33. Hershey JA, Morone J, Lipman TH, Hawkes CP. Social determinants of health, goals and outcomes in high-risk children with type 1 diabetes. Canadian Journal of Diabetes. 2021 Jul 1;45(5):444-50.