



# What Are the Various Comprehensive Treatment Models to Improve Self-Efficacy and Self-Management in Adolescents with Diabetes Mellitus? A Scoping Review

\**Arsita Eka Prasetyawati*<sup>1,2</sup>, *Ari Probandari*<sup>2</sup>, *Mora Claramita*<sup>3</sup>, *Madarina Julia*<sup>4</sup>

1. Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada, Yogyakarta, Indonesia

2. Department of Public Health, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

3. Department of Medical Education and Bioethics and Department of Family & Community Medicine, Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada, Yogyakarta, Indonesia

4. Department of Child Health, Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada, Yogyakarta, Indonesia

\*Corresponding Author: Email: [arsita.ep@staff.uns.ac.id](mailto:arsita.ep@staff.uns.ac.id)

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## Abstract

**Background:** This review aimed to synthesize intervention models involving the role of adolescent and family support as part of comprehensive care to improve self-efficacy and self-management among adolescents with Diabetes Mellitus (DM).

**Methods:** A review was conducted to conform to Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) standards. We searched PubMed, *Research Gate*, *Science Direct*, *Cochrane Library* databases, and grey literature. We included articles exploring family intervention models on improving self-efficacy and self-management among adolescents with DM, published from January 1, 2009, to June 30, 2022, and in English. Articles were declared eligible, reviewed critically, and then synthesized narratively.

**Results:** We identified 487 abstracts and title records from the initial search and excluded 409 irrelevant studies. Sixty-six full-text articles were screened, and nine were included in the synthesis. Five articles presented findings from using models focusing on child and adolescent intervention, while in the remaining four articles, the intervention models involved adolescents and their caregivers or parents. Only two models provide comprehensive care that requires collaboration among healthcare providers, patients, and families. Adolescent self-efficacy and self-management schemes as intermediary variables are closely related to everything that can influence health behavior, metabolic control, and quality of life for adolescents, which requires support from a multidisciplinary collaborative team.

**Conclusion:** Excellent comprehensive care team collaboration involving family support is essential to increase the self-efficacy and self-management of adolescents with DM.

**Keywords:** Diabetes mellitus; Adolescent; Family support; Self-efficacy; Self-management

## Introduction

Diabetes mellitus (DM) is a complex metabolic disorder characterized by chronic hyperglycemia

due to defects in insulin secretion, insulin action, or both. DM can be classified into two categories



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based on etiology; type 1 DM (T1DM) and type 2 DM (T2DM) (1). T1DM accounts for more than 90% of all DM cases in adolescents. The prevalence of T1DM is estimated to increase by 2-3% annually. In addition, the incidence of T2DM among adolescents is growing significantly (8-45% of new cases) (2-4). These figures reveal the missed opportunity of DM case finding among adolescents, closely related to parents' common knowledge of the disease and symptoms and local culture influencing perceptions of illness and how to respond to it (5-8).

As a chronic disease, DM significantly interferes with adolescents and their family lifestyles; personalities; and mental, social, knowledge, and economic conditions (9,10). Early adolescence begins with hormonal changes that lead to puberty. Therefore, adolescents tend to have problems adjusting when diagnosed early (11). The transitional growth phase from childhood to adulthood causes unique adolescent changes (11,12). Adolescents with DM require repeated examinations to monitor their blood glucose levels and to control treatments that might cause discomfort (12-14).

During adolescence, there are concerns about being unacceptable to peers and the environment and anxiety about future education. These aspects can cause blood sugar fluctuations and affect their quality of life (11,12,15).

Early treatment management can disrupt family life (8). Families may have feelings of loss of freedom, psychological burdens, and drastically changed parenting roles (16,17). It can interfere with the parent-child relationship. Family cohesion, authoritative parenting, agreement on managing DM, supportive behavior, and collaborative problem-solving must be associated with adherence to treatment regimens and better glycemic control (8,16).

A holistic approach and comprehensive sustainable management with support from the family must be made so that adolescents grow and develop optimally according to their expectations

and needs when the disease continues (18). The involvement of family, doctors, and other medical personnel who treat the patient as a team is essential (7,19). Case management aims not only to cure disease or prevent complications but also to build self-efficacy and improve self-management abilities and the quality of life among adolescents (18,20).

There have been only a few in-depth and integrated interventions to explore family function, the role of family support, and the process of family empowerment. This review aimed to identify and synthesize various intervention models involving adolescent and family support to improve self-efficacy and self-management among adolescents with DM.

## **Methods**

This scoping review was conducted using Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines (21). Articles were structurally selected based on the research question: "What are the various models of efforts or comprehensive care interventions to improve self-efficacy and self-management in adolescents with DM?" Articles to be included in the review needed to measure or focus on specific dimensions of models of efforts or comprehensive intervention care that support adolescents with DM and developed in the conceptual framework. The Inclusion and Exclusion Criteria are shown in Table 1.

Peer-reviewed journal papers were included if they were published between January 1, 2009, to June 30, 2022, involved human participants, described one or more types of intervention, and measured the burden or effect of an intervention. Studies that reported the involvement of parents and caregivers in the intervention were also included.

**Table 1:** Inclusion and Exclusion Criteria for Scoping Review

	<i>Inclusion Criteria</i>	<i>Exclusion Criteria</i>
Population	<ul style="list-style-type: none"> <li>Care providers for an adolescent with DM</li> </ul>	<ul style="list-style-type: none"> <li>Adults with DM</li> </ul>
Dimensions and concept	<ul style="list-style-type: none"> <li>Models of efforts or comprehensive intervention care focused on an adolescent with DM, self-efficacy, and self-management</li> <li>Developed in the conceptual framework:                             <ul style="list-style-type: none"> <li>the curriculum content of the intervention program/ model</li> <li>program duration</li> <li>involvement of parents/ caregivers in the care program,</li> <li>The outcome of interventions:                                     <ul style="list-style-type: none"> <li>biomedical indicators for metabolic control</li> <li>behavioral indicators (lifestyle, intake per day, physical activity, self-efficacy, self-care, self-management),</li> <li>psychosocial indicators (quality of life.)</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Preventive, promotive efforts for adolescents at risk of developing DM</li> <li>Models or interventions did not fit into the conceptual framework of the study.</li> <li>Models or intervention for adults or adolescents at risk of developing DM (has not been diagnosed DM)</li> </ul>
Context	<ul style="list-style-type: none"> <li>Descriptions of the studies (country of origin, funder, levels of health care centers, and age range of adolescents)</li> <li>Diabetes care settings for adolescents (primary, secondary, and tertiary health care)</li> <li>All observational and experimental studies were included to consider the different aspects of measuring the burden or effect of an intervention.                             <ul style="list-style-type: none"> <li>Full text available</li> <li>English language</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Diabetes care for adults and preventive-promotive efforts for adolescents have not been diagnosed with DM.</li> <li>Need for more detail for the study to be assessed.</li> <li>Articles with unrelated purposes.                             <ul style="list-style-type: none"> <li>Non-English articles</li> </ul> </li> </ul>

Articles were collected systematically, with online searching that used PubMed, Science Direct, Research Gate, Cochrane Library, and grey literature

(Google Scholar) databases with the following keywords which the Boolean combination that has

been set on the targeted online base page: "(adolescents OR youth OR youths OR teens OR teenagers) AND diabetes AND ("self-efficacy" OR "self-management") AND ("family support" OR "family empowerment" OR "family empowering" OR "family care" OR "caregiver support" OR "caregiver care" OR "caregiver empowering"). We also conducted a manual search of the bibliographies of the selected articles.

All authors screened the same publications, discussed the results, and amended the screening and data extraction manual before beginning the screening for this review to increase consistency among the authors. The stages of identification of relevant articles were based on PRISMA-ScR flowchart guidelines: (1) identifying and matching

articles to exclude multiple articles from all databases; (2) screening by reviewing titles and abstracts to select articles according to the purpose; (3) separately reviewing the full-text articles to assess eligibility, validity, and intervention process and excluding articles that did not meet the requirements for the reasons; and (4) resolving disagreements on study selection and data extraction by consensus and discussion with other reviewers if needed. Two authors (AEP and AP) extracted the data using a data-charting form. The findings of each article that met the requirements were summarized narratively based on established characteristics. The final analysis results were discussed and agreed upon by all the authors. The details of the article search and screening process are shown in Fig. 1.

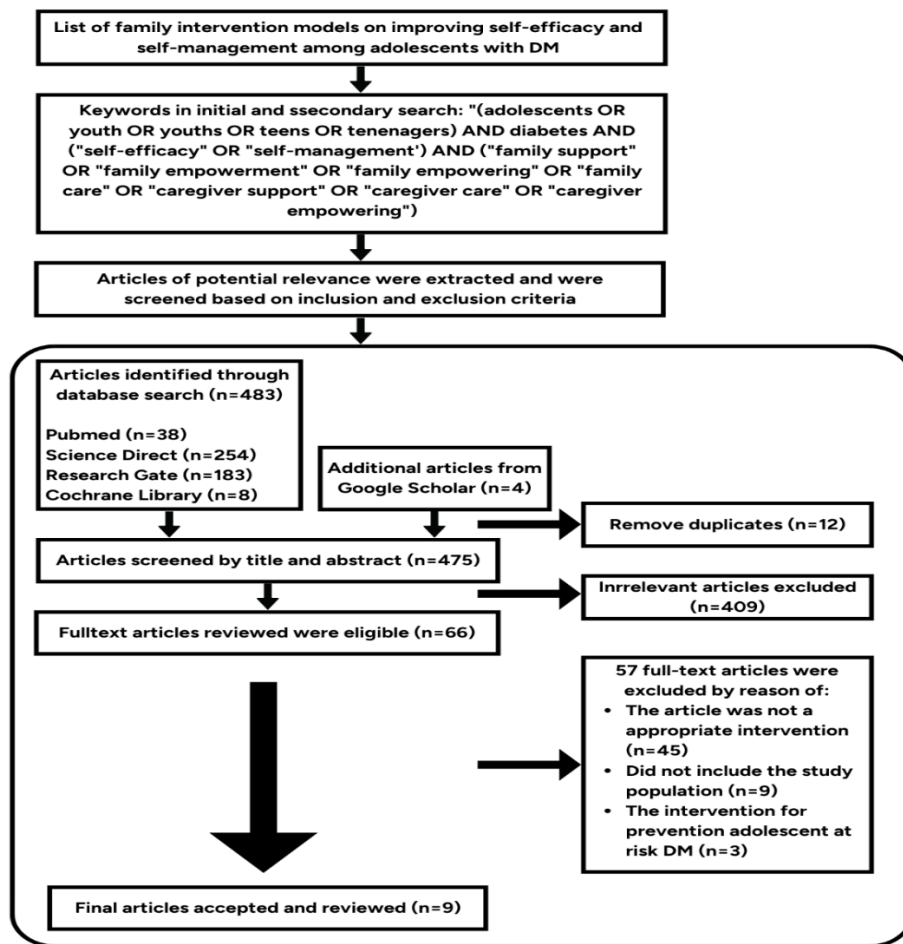


Fig. 1: Flow chart for the search strategy. PRISMA-ScR diagram showing the search and selection process of the review

The Medical and Health Research Ethics Committee (MHREC) Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada-Dr. Sardjito General Hospital approved the study (Ethic code: KE/FK/0040/EC/2020).

## Results

### Systematic Search Results

The PRISMA-ScR flowchart summarizes the search and screening processes in the database (Fig. 1). The search yielded a total of 483 titles and abstracts. A Google Scholar search identified four additional articles. During screening based on the title and abstract, we found 12 duplicate and 409 irrelevant articles that were subsequently excluded. We reviewed 66 full-text articles based on our inclusion criteria. Of the 45 inappropriate articles, nine did not include the study population, and three contained interventions that prevented adolescents at risk for DM. The selection resulted in

nine articles declared eligible to be analyzed critically and then analyzed narratively.

### The Characteristics of the Articles Selected for the Scoping Review

Various methods have been reported in the selected studies, including intervention mapping (22), an ethnographic approach (18), randomized controlled trials (RCT) (23–27), retrospective questionnaire-based service evaluation (28), and descriptive and mixed model analyses (29). Five studies were conducted in the United States (23,24,26,27,29), one in South Africa (22), one in Iran (25), one in Wales (28), and one in Germany (18). Based on the study location, it was implemented in secondary and tertiary hospitals. The participants in the articles were between the ages of children and adolescents (6-19 years old) with T1DM (eight studies) (18,23–29) and both T1DM and T2DM (one study) (22). An overview of the characteristics of the articles selected for the scoping review is presented in Table 2.

**Table 2:** Overview of Characteristics Articles Selected

<i>Authors</i>	<i>Year</i>	<i>Country</i>	<i>Study Design</i>	<i>Clinical Setting</i>	<i>Respondent</i>	<i>Type of DM</i>
D'Souza, et al. (28)	2021	Wales	Retrospective questionnaire-based service evaluation	12 Pediatric diabetes centers (1 tertiary hospital, 11 secondary hospitals)	334 adolescents	T1DM
Esfahani, et al. (25)	2021	Iran	RCT	Endocrine and Metabolism Research Center (secondary hospital)	46 adolescents 13 – 19 yr	T1DM
Mayer-Davis, et al. (24)	2018	US	RCT	Secondary hospital	258 adolescents 13 – 16 yr and caregiver	T1DM
Berger et al. (18)	2017	Germany	Ethnography approach	Secondary hospital	children and early adolescents 6 – 12 yr	T1DM
Fiallo-Scharer, et al. (23)	2017	US	RCT	Tertiary hospital	214 children and adolescents 8 – 16 yr and parents	T1DM

Kichler et al. (26)	2017	US	RCT	Tertiary pediatric center	251 Adolescents 13 – 16 yr, and the parents	T1DM
Eisenberg, et al. (27)	2016	US	RCT	Tertiary diabetes center	90 adolescent ≥ 13 yr	T1DM
Whittemore et al. (29)	2015	US	A descriptive and mixed-method analysis	Tertiary hospital	124 adolescents 11-14 yr	T1DM
Dhada & Blackbeard (22)	2013	South Africa	IM	Tertiary hospital	50 children and adolescents ≤ 14 yr and 50 caregivers	T1DM and T2DM

yr = years old; RCT = Randomized Controlled Trial; T1DM = Type 1 Diabetes Mellitus; T2DM = Type 2 Diabetes Mellitus; US = United States; IM = Intervention Mapping

### *Intervention Characteristics/ Method Activity Modification*

Each study implemented a different model and various activities. Structured Education Reassuring Empowering Nurturing (SEREN) 'Diabetes at Diagnosis' delivers structured education to empower children and families with self-management of T1DM—resources developed by the diabetes team. The topic includes 'Eating Well and Keeping Active,' 'Carbohydrate Counting and Insulin Adjustment' Folders,' and 'Insulin, Food, and Blood Glucose Monitoring Diary' (28).

HOPE Therapy aims to increase children's self-efficacy with DM, with the primary learning domain social, educational, and emotional aspects (25).

The Flexible Lifestyles Empowering Change (FLEX) model for adolescents with T1DM is a motivational interviewing (MI) and problem-solving skills training (PSST) model that aims to enhance self-management. This model was applied by Mayer et al. (24) and Kichler et al. (26) in various hospital settings. However, the results reached similar conclusions.

The Childhood Adaptation Model to Chronic Illness (CAMCI-DM) (22) is a support model for managing children with DM. This study model aimed to build and strengthen psychosocial support for patients and caregivers using a patient-centered approach that uses the basic concepts of multidisciplinary team collaboration, patients and

families to enhance the Patient-Centered Care Model for Childhood Diabetes (PPCM-CD).

Part of the evaluation of the Herdecker Kids with Diabetes (HeKiDi) intervention model is expected to provide an overview of the self-management model's design and analyze the model's learning objectives and relevant structure. This model is based on an anthropomorphism that views human nature and uses Waldorf-pedagogical concepts in its implementation. Middle childhood is classified according to anthropological status as a relevant period for self-development, focusing on acquiring the necessary cultural technologies and, in particular, developing the acquisition of emotional and social competence.

Achieving control, connecting resources, and the empowering families (ACE) model were implemented in adolescents with T1DM to evaluate the impact of self-management on A1c improvement and quality of life. The ACE model was designed as a multisite study that compiled evidence-based scientific outcomes and interventions to meet the needs of families. The intervention consisted of material on self-management in the family after the researchers identified the things needed to build and coordinate self-management. Patients visit the clinic every three months to examine and discuss the latest HbA1c and blood glucose data,



physical examination, insulin regimen adjustments, management challenges, and planning for further DM management (23).

TEENCOPE is a psychoeducational internet model that connects to the website discussion forum Planet D, an open website about DM for adolescents. Adolescents diagnosed with T1DM at least six months earlier were given an approach without a particular direction from the treating doctor to determine their interest in participating

in the program via the Internet and provided a link to the *Teens. Connect*. All adolescents received three automated emails reminding them to sign in, two phone calls or voice messages from researchers at the program launch, and one follow-up after two weeks to determine if any problems had started (29).

A summary of the intervention models used to improve self-efficacy and self-management among adolescents with DM is presented in Table 3.

**Table 3:** Summary of Intervention Model to Improve Self-Efficacy and Self-Management for Adolescents with DM

Author(s), year of publication	Intervention Model	Duration of Intervention	Learning materials	Trainer / educators	Procedures Intervention Model	Variable and outcome measurement instrument	Result/ conclusion
D'Souza, et al. (28)	SEREN 'Diabetes at Diagnosis' model	12 months	The pathophysiology of T1DM, carbohydrate counting, insulin dose adjustment, management of hypoglycemia, sick-day rules, management of diabetic ketoacidosis, complications, and exercise impact	pediatric diabetes specialist nurses and dietitians	face-to-face sessions of 1–2 hours each over six weeks	1. Pre- and post-SEREN score (my Diabetes, my treatment, worry, communication) 2. HbA1c 3. PedsQL score	There was a positive feedback response to the program but no positive change in the PedsQL or HbA1c scores for one year.
Esfahani, et al. (25)	Hope therapy using Snyder's method.	Four months	The importance of having hope in life, listing current events and important aspects of life, Snyder's theory in optimistic subjects, and the problem-solving process	Team HOPE therapy did not mention	eight 90-min sessions twice a week	Domains of self-efficacy	1. Hope therapy could be an effective method in increasing the self-efficacy of adolescents with T1DM 2. Ways adapting to the disease, changes in puberty, and changes in the influence of parents and peers on attributes on the decision-making of adolescent
Mayer-Davis, et al. (24)	FLEX Model	18 months	Behavioral Family Systems Therapy-Diabetes (guidance for diet and physical activity relative to insulin dosing, social support, and the use of communication technology)	T1DM care team (doctor, dietitian, nurse educator)	MI and PSST to enhance self-management given in the clinic Four sessions, each 3 – 4 times	1. HbA1c 2. Motivation and intention 3. Problem-solving skills 4. Self-management behavior 5. Symptoms of depression 6. HRQOL	The FLEX intervention did not significantly change HbA1c levels but positively impacted several psychosocial outcomes

						<ol style="list-style-type: none"> <li>7. Fear of hypoglycemia</li> <li>8. Diabetes family conflict</li> <li>9. Risks factors for T1DM complications</li> </ol>	
Berger et al. (18)	HeKiDi	One-week	self-development, emotional competency development, life forces, autoregulatory processes, and substitution of insulin	DM team caring	a group-based, additional training program, including elements of face-to-face contact (daily visits)	<ol style="list-style-type: none"> <li>1. HbA1c</li> <li>2. Self-efficacy</li> </ol>	Better outcomes regarding self-efficacy and HbA1c level.
Fiallo-Scharer, et al. (23)	ACE Model	Nine months	<p>“Tips and Tools” content from ADA: self-management</p> <p>“Your Diabetes, Your Choices” motivation content</p> <p>Family teamwork content</p>	Nurses and certified diabetes educators	Four groups sessions tailored to families' self-management barriers	<ol style="list-style-type: none"> <li>1. diabetes-specific PedsQL</li> <li>2. PedsQL Family Impact Module</li> <li>3. PRISM score</li> <li>4. Hypoglycemia Fear Scale</li> <li>5. Confidence in Diabetes Self-Care scale</li> <li>6. Self Care Inventory</li> </ol>	Inform implementation and dissemination of family-centered approaches to address self-management barriers
Kichler et al. (26)	FLEX Model	18 months	Self-management, including medical management, diet, physical activity, social and communication support	FLEX coach	<p>MI and PSST to enhance self-management given in the clinic</p> <p>Four sessions, each 3 – 4 times</p>	<ol style="list-style-type: none"> <li>1. Glycemic index</li> <li>2. Motivation</li> <li>3. Troubleshooter</li> <li>4. QoL</li> <li>5. Risk factors associated with complications</li> <li>6. Behavior and self-management</li> <li>7. Family conflict</li> <li>8. Responsibility</li> </ol>	<p>There were no significant differences in HbA1c levels among the other measures.</p> <p>Need to assess the efficacy and effectiveness of the model</p>
Eisenberg, et al. (27)	CHEF Model	18 months	technique and education about nutrition behavioral	health care professional	The intervention included nine sessions	<ol style="list-style-type: none"> <li>1. Self-efficacy for healthy eating</li> <li>2. Motivation: SRQ</li> <li>3. Disordered eating: DEPS-R</li> <li>4. Demographic data</li> </ol>	Motivation and self-efficacy for healthy eating represent potential intervention targets for reducing DEB among adolescents with T1DM.



Whittemore et al. (29)	Internet psychoeducational model for Teens with T1DM through the Internet-based platform (TEENCOPE™) and Managing Diabetes	18 months	<ol style="list-style-type: none"> <li>1. TEENCOPE coping mechanism and social self-efficacy</li> <li>2. Managing Diabetes (problem-solving)</li> <li>3. Social networking discussion boards on DM</li> </ol>	Healthcare professional team	<p>Participants logged on to the websites at least twice weekly for 30 minutes each over four weeks.</p> <ol style="list-style-type: none"> <li>1. An interactive internet program (five interactive sessions) and asynchronous moderated discussion board</li> <li>2. Diabetes management uses interactive Internet (5 lessons), case studies, and interactive exercises to make diabetes-related decisions.</li> <li>3. Planet D</li> </ol>	<p>Obtained self-reported data with an interactive website and a secure Internet website at baseline, three months, and six months.</p> <ol style="list-style-type: none"> <li>1. HbA1c: The Bayer Diagnostics DCA2000</li> <li>2. QoL: PedsQL (Teen version)</li> <li>3. Diabetes self-efficacy: SEDS</li> <li>4. Self-care: SCI</li> <li>5. Perceived stress: PSS</li> <li>6. Depressive symptoms: CDI</li> <li>7. Sociodemographic data (ethnicity, socioeconomic status, number of children, and sex of child with Diabetes)</li> <li>8. Clinical variables</li> </ol>	HbA1C and quality of life, psychosocial and behavioral factors (self-care, self-efficacy, perceived stress, and depressive symptoms)
Dhada & Blackbeard (22)	CAMCI-DM Model	18 months	Psychosocial support, diabetes education	Cohesive MDT	Implementation of PPCM-CD to several groups of children and their parents	Metabolic control, QoL	Better metabolic control and quality of life built by a collaboration between patient, caregiver, and MDT

SEREN = Structured Education Reassuring Empowering Nurturing; T1DM = Type 1 Diabetes Mellitus; HbA1c = Haemoglobin A1c; PedsQL = Pediatrics Quality of Life Score; FLEX = The Flexible Lifestyles Empowering Change; MI = Motivational Interviewing; PSS = Problem-Solving Skills Training; HRQOL = Health Related-Quality of Life; HeKiDi = Herdecker Kids with Diabetes; ACE model = Achieving control, Connecting resources, Empowering families model; ADA = American Diabetic Association; PRISM Score = The Pediatric Risk of Mortality; CHEF = Cultivating Healthy Environments in Families with T1DM; SRQ = Self-regulation Questionnaire; DEPS-R = The Diabetes Eating Problem Survey-Revised; DEB = Disordered Eating Behaviours; SEDS = The Self-Efficacy for Diabetes Scale; SCI = Self-Care Inventory; PSS = the Perceived Stress Scale; CDI = The Children's Depression Inventory; CAMCI-DM = Childhood Adaptation Model to Chronic Illness; PPCM-CD = the Patient-Centered Care Model for Childhood Diabetes; QoL = Quality of Life; MDT = Multidisciplinary Team

### ***Patient and Family-Centered Approach in The Models***

All articles described the use of a patient-centered approach in the model. Four studies (22–24,26) involve caregivers and parents in the comprehensive care team. Specifically, two articles (22,23) stated

the importance of breaking down the barriers between parents and their children in managing adolescents with DM using a family-centered approach. A multidisciplinary team was tasked with providing education based on their respective

roles in each adolescent group. They took a personal approach to building a close relationship with each patient to determine their needs.

### *Self-Efficacy/ Self-Management Problems in Adolescents with DM*

Self-efficacy and self-management were described as the primary outcomes of all models implemented in the articles. Self-efficacy and self-management were assessed using the tools listed in Table 3.

Two main aspects were obtained from this scoping review: 1) the application of a patient- and family-centered approach, and 2) the outcomes of glycemic index, self-efficacy, self-management, and quality of life of the interventions provided. In several articles, parental involvement in collaborative teams with health workers was a priority. However, not all articles showed significant results—the training materials covered efforts to open barriers to communication between parents and children and family teamwork. However, most models focus on the treatment of adolescents without direct parental involvement. It also needs to be clarified how the interventions are given to caregivers to support the improvement of self-efficacy and self-management in adolescents with DM.

## **Discussion**

This scoping review reveals several intervention models that can be utilized for the comprehensive care of adolescents with DM, involving adolescents, parents, caregivers, and multidisciplinary care teams. A good relationship between these parties is essential to building trust and comfort in therapy (22,23). Barriers to family interactions reflect the challenges of balancing adolescent autonomy with family support and supervision. We should consider a behavioral family system therapy approach in treating adolescents with DM (14,23,30).

The review results showed that the intervention model for adolescents with DM in primary care needs to be improved. All intervention models

were conducted in pediatric diabetes clinics at secondary and tertiary referral hospitals. Meanwhile, there is a model in primary care or community settings, but the focus is on prevention models for adolescents at risk for DM (31–33).

However, the methods used were varied. Seven studies (18,23,24,26–29) evaluated similar outcomes, including HbA1c levels and quality of life in adolescents. All models emphasize the importance of motivation or hope, in life and problem-solving abilities.

The CAMCI model (22) uses intervention mapping adapted to local needs to assess the paradigm of the collaborative care team with adolescents and their parents. The ACE model (23) and the SEREN ‘Diabetes at Diagnosis’ model (28) provide an intervention model from the American Diabetes Association (ADA) educational curriculum. The HeKiDi model (18) highlights the strengthening of the formation of self-management for early adolescents, which is relevant to the period of self-development that can shape adolescents' emotional and social competence by adopting cultural technology. The TEENCOPE model (29) used an online education program for adolescents delivered through the Teens Connect website and the Planet D web discussion forum. FLEX (24,26) and CHEF (27) focused on healthy behavior self-efficacy and building motivational self-management. HOPE therapy (25) increases self-efficacy through its primary approach to how adolescents solve problems.

Most articles show that outcome assessment provides a self-efficacy scheme for adolescents and caregivers as a mediator variable closely related to everything that can affect adolescents' health-related behavior. Adolescents with DM have significant risks for psychological problems, including depression, anxiety, eating disorders, and externalizing conditions that increase exponentially during adolescence (31,32,34–36). Adolescents with DM experience increased psychological distress with potentially damaging consequences for self-care related to poor glucose control (35,36).

Family cohesion, authoritative parenting, agreement on DM management responsibilities, sup-

portive behavior, and collaborative problem-solving are integral to managing DM in children (9,15). These factors are associated with regimen adherence and improved glycemic control (5). Parental monitoring is an essential factor in adolescents' perception of trust in parents, which also indirectly improves adolescents' confidence in their parents by affecting the quality of parent-adolescent communication (23,37).

Adolescence is an especially vulnerable time for building self-efficacy and diabetes self-management (23,25,38). The challenges are biopsychosocial changes, increased experimentation, risk-taking behaviors, and increasing autonomy (35,36,39,40). Communication barriers between parents and adolescents significantly affect maintaining adolescent self-management (22,23,29,41). Enhancing family empowerment capacity and adolescent engagement may help prevent the deterioration of adolescents with DM (6,23). Training to introduce self-efficacy to adolescents and their parents must be considered (22–24).

A pediatric endocrinologist diagnosed the patient, and a multidisciplinary team performed further treatment. A cohesive team comprises doctors, nurse educators (24), certified diabetes educators (23), psychologists, emotional trainers (18,25), and dietitians (24,26,28). Solid interdisciplinary teams (MDT) are essential for building integrated diabetes care, focusing on psychosocial and biomedical aspects (22). MDT must be able to explore the needs of adolescents and their families so that they can provide professional health educators according to their respective roles (23). Doctors, psychologists, and the DM educator team identified adolescent psychological problems early, basic knowledge about DM, and barriers to teenage relationships with parents. They discuss the intervention plan, arrange the therapy schedule, the team personnel needed, and the materials and methods to be provided (18,23,24,27,29).

Continuing care is needed to manage collaborative transitions between multidisciplinary teams and support families and caregivers (42). Therefore, it is necessary to provide holistic and comprehensive care to adolescents with DM (43). According to this article, continuous care can be provided by

scheduling routine treatment programs. The time for a patient to visit the clinic and the necessary follow-up can be done through home visits, maintaining coaching sessions by phone calls, and online discussions (24) that could implement family-centered approaches.

In the CAMCI-DM Model (22) and ACE Model (23), self-efficacy is a mediator variable influencing self-management. However, further descriptions of self-efficacy should be provided in more detail. The learning objectives and methods are specified in the HeDiKi curriculum model (18). Further research is necessary to determine whether this model provides better outcomes for self-efficacy and glycemic indexes. The ACE model (23) involves stakeholders essential for a program's success. The role of stakeholders in recruiting participants was significant. Stakeholders' input supports the development of appropriate forms of intervention to be implemented and disseminated in the healthcare system. There has yet to be a single article explicitly providing a curriculum to build self-efficacy in adolescents with DM.

However, several models illustrate that building self-efficacy and self-management in adolescents with DM requires family empowerment and collaboration with multidisciplinary teams to organize patient and family-centered care. Almost all studies mention the importance of self-efficacy in helping adolescents manage themselves and overcome their diseases. The team trained adolescents in DM education, problem-solving skills, coping skills, self-development, emotional competency development, behavioral nutrition, family team building, and social networking.

Motivation building, coping mechanisms, problem-solving, nutrition, psychosocial, and behavioral management are needed to improve their quality of life (10,20,34,44). A structured curriculum model is required to provide excellent primary health services. Therefore, this scoping review may help to design a better comprehensive care model for adolescents with DM. The involvement of the adolescent social environment, whether peers, schoolmates, or teachers, apart from family and caregivers, in the home environment also needs to be considered in the initial exploration of

adolescent needs (22,43). Thus, more research is required to develop and test a holistic and comprehensive chronic care model for adolescents with DM in a broader setting.

This study had several limitations. We synthesized the findings from relatively few studies using diverse intervention models. Hence, the synthesis needs to provide more evidence on the interventions of family-based comprehensive care in specific adolescent populations, such as early adolescents. However, there is limited evidence of intervention models for self-efficacy improvement among adolescents with DM in primary care settings. In addition, we only searched for articles reported in English, which means that publications in other languages and theses, dissertations, and trial registries were not considered, which may have resulted in some missing evidence.

## Conclusion

A holistic and comprehensive chronic care model is essential to increasing the self-efficacy and self-management of adolescents with DM. These models have only been piloted in limited settings, such as South Africa and the United States, and are limited to secondary and tertiary care. Therefore, further implementation of similar research in a broader context is required.

## Journalism Ethics Considerations

The authors have entirely observed ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy).

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## Conflict of Interest

The authors declare that there is no conflict of interest.

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