

*The 5<sup>th</sup> International Conference on Nursing and Public Health (ICONPH)*

**The Effectiveness of Self-Care Enhancement Based Intervention among Type 2 Diabetes Mellitus: A Systematic Review**

**Yusron Amin<sup>1\*</sup>, Haswita Haswita<sup>2</sup>**

<sup>1,2</sup>Diploma III of Nursing, School of Health Science (STIKES) Rustida, Banyuwangi, East Java

*\*Corresponding author: [yusronamin312@gmail.com](mailto:yusronamin312@gmail.com)*

**ABSTRACT**

**Background:** The failure of glycemic control and a high incidence of complications among type 2 diabetes were closely related to poor self-care behavior. Needed an effective intervention to maintain glycemic control through enhancing self-care behavior among type 2 diabetes patients. **Object:** This study aims to conduct a systematic review of applying the interventions based on self-care enhancement among type 2 diabetes patients. **Method:** The study design used a systematic review through searching credible journal databases using related keywords. The process of identifying articles using the PRISMA systematic review and synthesis of articles using the BJI assessment. **Results:** The results show differences in findings related to the effectiveness of interventions on HbA1c values and self-care activity. The majority of studies (n=5) show that interventions were effective in both reducing HbA1c values and increasing self-care activity. Whereas, one study show that the intervention was only effective in reducing HbA1c values, and other studies (n=2) also showed that interventions was only effective in increasing self-care activity. **Conclusion:** The effectiveness of these interventions is supported by a structured personal approach through using a combination of effective educational methods, and also the availability of social support (including family and community).

**Keywords:** Self-care Behavior, Intervention, Type 2 Diabetes Mellitus

**BACKGROUND**

Diabetes mellitus is one of the dominant chronic diseases that remains a global issue (Liu et al., 2020), it is related to a high incidence per year (Sun et al., 2022), and its severe complications lead to death and disability (Hua, 2022). The incidence of diabetes mellitus globally in 2023 reached 6.1%, which means that more than half a billion people around the world suffer from diabetes mellitus (Ong et al., 2023). The majority of them (96%) are classified as type 2 diabetes mellitus (Ong et al., 2023). Although this case experienced a decrease from the previous year (2022) reached 10,5% of the world's adult population or 830 million people

(Ong et al., 2023). The majority of them live in low-and middle-income countries (Lam et al., 2021), including Indonesia (Soeatmadji et al., 2023). Indonesia is one of the 10 countries with the highest prevalence of type 2 diabetes mellitus. The prevalence of diabetes mellitus in Indonesia in 2021 reached 10.8%. This number is increasing significantly in 2023 that reaching 11,7% (Soeatmadji et al., 2023). The high incidence of diabetes mellitus is also contributes with its severe complications (Cole et al., 2020), Some studies reported that approximately 50-80% of people with diabetes are die because of cardiovascular disease,

cerebrovascular disease, or kidney failure (Bonora et al., 2020; Sheleme et al., 2020).

A better glycemic control among type 2 diabetes patients is closely associated with self-care behavior (Almomani et al., 2022). Previous studies proved that majority (52,4%) of type 2 diabetes patients have poor self-care practices (Karthik et al., 2020). It manifested with low adherence to changing their lifestyle, including diet and exercise, with particular neglect in foot care, and poor blood glucose monitoring (Chinnappan et al., 2020). Other studies also proved that majority of type 2 diabetes patients have improper lifestyle behavior including high-consumption of carbohydrate-rich diet, reducing of fruit and vegetable intake, lack of adequate exercise as well as physical activity (Zemen et al., 2025).

A strict metabolic control achieved through lifestyle modification, regular medication, as well as a periodic follow-up could early of prevention of diabetes complications among type 2 diabetes (Galaviz et al., 2018). The previous systematic review indicated that self-care interventions is not effective in modifying diet and physical activity, but it has little effect on reducing the level of glycated hemoglobin, fasting blood glucose, blood glucose level 2 hours after eating, as well as on body weight. but it need more deep studies to ignore risk of bias, imprecision, and inconsistency (Katsuragawa et al., 2025). The other systematic review also proved that intervention based on adherence to self-care strategies among type 2 diabetes patients were not effective in enhancing adherence of self-care practices, especially on physical activity and medication (Rocha et al., 2020). Whereas, other studies proved difference, there were a positive impact of self-care management intervention on reducing HbA1c level and enhancing self-care management among type 2 diabetes patients through adapting their illness (Polsook et al., 2024).

Modifying self-care behavior among type 2 diabetes is one key to maintaining blood glucose levels within normal borders and preventing early complications of diabetes. However, several systematic reviews above have difference findings about its effectiveness on changing the level of HbA1c and self-care behavior. Based on this background, the researchers intend to conduct a systematic review to identify the kinds of interventions that are effective in maintaining HbA1c levels of improving self-care behavior in people with type 2 diabetes.

## **RESEARCH METHODS**

### **Study Design and Search Method**

This study is a systematic review that aims to synthesise articles related to the application of intervention to enhance self care among type 2 diabetes mellitus through a rigorous and comprehensive that involves systematically identifying, selecting, appraising, and synthesising to enhance the reliability of findings. There are four of electronic databases using including PubMed, Science Direct, Proquest, and google scholar through using keyword "self-care" "intervention" and "type 2 diabetes mellitus". The article search is limited into four categories, including published within the last five years (2019-2024), written in English, available with full text, and primary studies.

### **Inclusion and exclusion criteria**

This study using PICO framework to formulate the precise search strategies from evidence-based practice by identifying the essential concepts for finding relevant information that consists of four components, including Patient or Population, Intervention, Comparison, and Outcome. The inclusion criteria based on PICO is the primary studies, including RCT or quasi-experiment that consist of the following: Population: People with type 2 diabetes mellitus, Intervention:

treatment focused on self-care enhancement, Control: habitual treatment, Outcome: enhancing self-care behaviour. Whereas the exclusion criteria are people with type 2 diabetes mellitus with complications and other comorbidities.

### Data extraction and synthesis

This study using PRISMA systematic review to extract and synthesis the data though four steps including identifying, screening, credibility of article, and article included. 1) Identifying process is assessing articles focus on the titles and abstracts based on the inclusion

and exclusion criteria. 2) Screening is filtering articles that have similarities in terms of title and abstract after going through a journal database search, the duplicate of title and abstract is withdrawn, 3) making credibility is reviewing each components of articles, the result have to match among title, purpose, study design including population, intervention, control, and outcome or result and its results are. 4) Included article is presenting of credible articles in the form of a table consisting of the author, country, objectives, methods, and research results. As showed in figure 1.

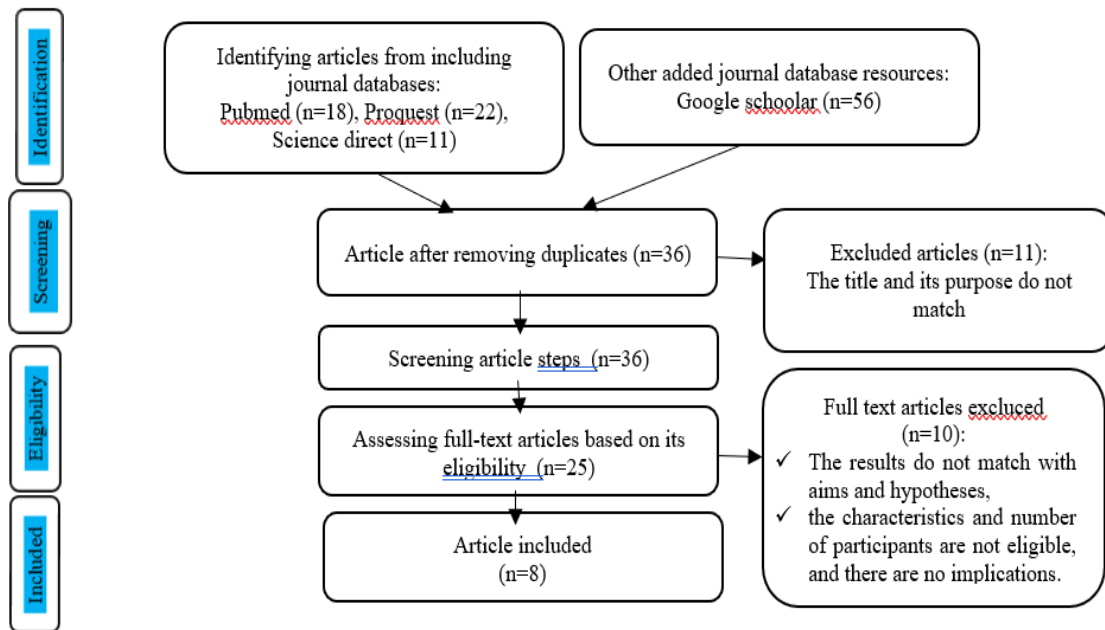


Figure 1. Studies Flow Chart

### Quality appraisal

It was conducted to ensure the feasibility of each article used as a reference in terms of methodology, results, and usefulness. The quality assessment using Joanna Briggs Institute (JBI) critical appraisal with a randomized controlled trial design with 13 question items and a quasi-experimental study with 9 question items. The answer of each question item is classified into four closed answer options

"Yes" "No" "Unclear" and "Not Applicable" as presented in Table 1. Table 1 showed that based on the parameters of JBI screening articles for Randomized Controlled Trials (RCTs), gotten that majority of articles (8 articles) are completing all parameter of JBI (gotten score 100), only 2 articles got score 80. Its mean that all articles are appropriate requirements as included articles.

Table 1. Quality Appraisal

Study design	Author	Items of quality appraisal												
		1	2	3	4	5	6	7	8	9	10	11	12	13
RCT	1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	4	Y	Y	Y	U	U	Y	Y	Y	Y	Y	Y	Y	Y
	5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	6	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
	7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y: yes, N: no, U: unclear, NA: not applicable

Table 1 showed that based on the parameters of JBI screening articles for Randomized Controlled Trials (RCTs), gotten that majority of articles (7 articles) are completing all parameter of JBI (gotten score 100), only 1 articles got score 80. Its mean that all articles are appropriate requirements as included articles.

### Data analysis

Data This study using narrative analysis and meta-analysis. The narrative review was conducted by identifying study characteristics, intervention and control type, as well as the effectiveness of the intervention on its outcomes. Meanwhile, a meta-analysis was conducted to comparing the articles which has a strong effect statistically on self-care enhancement and other outcomes.

## RESULTS AND DISCUSSION

Author	Country	Study design	Population	Intervention	Control	Outcome
Park et al. (2024) 18	South korea	RCT	404 T2DM patients were identified that 32 patients were enrolled that classified into two group; intervention (n=19), control (n=13).	<ul style="list-style-type: none"> <li>✓ Automated Personalized Self-care Program</li> <li>✓ Duration: 4 weeks (@50 minutes per session, seven days a week)</li> <li>✓ Strategy: Education: self-care (5 days/ week), Monitoring: exercise, diet, BG, medication intake (5 days/ week)</li> <li>✓ Evaluation time: 3 months</li> </ul>	Receiving usual care	<ul style="list-style-type: none"> <li>✓ Primary: reducing level of HbA1c (p=0,029) in both group</li> <li>✓ Secondary: enhancement in self-measured blood glucose testing (p=0,005) and grain intake (p=0,024) in the intervention group.</li> </ul>

Author	Country	Study design	Population	Intervention	Control	Outcome
Feng et al. (2023) 19	China	RCT	225 patients with type 2 diabetes in 2 community that divided into two group: intervention (n=113) and control (n=112).	eHealth family-based health education. Duration: 3 months Strategy: ✓ Using official WeChat to access patient's family (online) ✓ On-site health education (diabetes and its complication, patient perception, self-care activities (in-person)) ✓ Evaluation time: after intervention, 1 year after	Usual care (diet control, glucose testing, and auxiliary activities during exercise)	✓ Primary: decreasing level of HbA1c significantly ( $P<.001$ ) in intervention group ✓ Secondary : improving in self-care activities (score): general diet ( $p<0,001$ ); specific diet ( $p<.001$ ), exercise ( $p=0,002$ ), blood sugar testing ( $p=0,02$ ), and foot care ( $p<0,001$ ). Increasing score risk perception of diabetes: risk knowledge ( $p<.001$ ), personal control ( $p<.001$ ), worry ( $p=.001$ ), and optimism

Author	Country	Study design	Population	Intervention	Control	Outcome
						bias (p=.003). Enhancing score of family support: supportive behaviors (p<.001) and non-supportive behaviors (p=0,03).
Hessler et al. (2022) 20	USA	RCT	734 individuals with T2DM that classified into two group: intervention (n=408), control (n=326).	<ul style="list-style-type: none"> <li>✓ Self-management support (SMS) through combine Connection to Health (CTH) and Enhanced Engagement Connection to Health (EE-CTH) program</li> <li>✓ Duration: 3 months</li> <li>✓ Strategy: face to face training program (structured education, live tutorial with role play)</li> <li>✓ Evaluation periods: 6 to 12 month post enrollment.</li> </ul>	Combine Connection to Health (CTH) alone	Individuals in both programs reported significant improvements in self-management behaviors (sugary drinks (p=0,0019; p<0,0001), missed medications (p=0,0296); (p<0,0001), psychological outcomes (stress (p=0,0355; p<0,0001), health-related distress (p=,0002); (p<0,0001), and social risks (food security (p=0,0079); (p=0,0373), utilities (p=0,0072); (p=0,0362).

Author	Country	Study design	Population	Intervention	Control	Outcome
Diriba et al. (2023) 21	Ethiopia	RCT	76 people with T2D and family caregiver that classified into two groups: intervention (n=38), control (n=38).	<ul style="list-style-type: none"> <li>✓ Family-based diabetes self-management education and support programme</li> <li>✓ Duration: 4 weeks</li> <li>✓ Strategy: face to face education</li> <li>✓ Evaluation periods: T0 (baseline at recruitment), T1 (immediately after intervention completed), T2 (2 months after T1)</li> </ul>	Usual care	<ul style="list-style-type: none"> <li>✓ Perceived support status: There is a significant different between two group in support needed (p&lt;0,001) and support received (p&lt;0,001) at T1 and T2.</li> <li>✓ Family caregiver' supportive behavior: there is a significant different of supportive behaviour between two group at T1 (p=0,002) and T2 (p&lt;0,001), and non-supportive behavior at T2 (p&lt;0,001).</li> </ul>
Presley et al. (2020) 22	USA	RCT	97 T2DM patients that classified into intervention group (n=62), and control	<ul style="list-style-type: none"> <li>✓ Community-based diabetes self-management education (DSME) plus mobile health (mHealth)–</li> </ul>	Community-based DSME alone	The result shows reducing value of HbA1C between two group (p=0,004) after 6 months, and also reducing

Author	Country	Study design	Population	Intervention	Control	Outcome
			group (n=35).	<ul style="list-style-type: none"> <li>✓ Duration: 6 months (3 for course, 3 months for phone calls)</li> <li>✓ Strategy: direct course, phone calls</li> <li>✓ Evaluation periods: 6 months after intervention</li> </ul>		diabetes distress on intervention group after 6 months (p=0,004).
Binesh et al. (2023) 23	Iran	RCT	30 subjects with diabetes type-2 were assigned to two groups of intervention and control (IG=15; CG=15).	<ul style="list-style-type: none"> <li>✓ Occupational Therapy Diabetes Self-Management (OTDSM).</li> <li>✓ Duration: 10 weeks</li> <li>✓ Strategy: group and individual visit</li> <li>✓ Strategy: individual or group training</li> <li>✓ Evaluation periods: 3 months after intervention</li> </ul>	individual session and phone calls.	The result shows significant differences between two groups in HbA1C levels, self-management behaviors, self-efficacy, and performance and satisfaction with daily routines after the intervention (p < 0.05) at 3 months, but not significant in diabetes distress and depressive symptoms.
Asmat et al. (2024) 24	USA	RCT	612 adults with T2DM and HbA1c ≥ 7% that classified	<ul style="list-style-type: none"> <li>✓ Patient-centered self-management intervention</li> </ul>	Usual care plus nurse-led	Primary: there is a significant difference between two group in HbA1c level

Author	Country	Study design	Population	Intervention	Control	Outcome
			into two group: control (n = 310) and intervention (n = 302)	(PACE-SMI) ✓ Duration: 8 weeks ✓ Strategy: ✓ Individualized education, counseling, behavioral training, and home visit ✓ Evaluation periods: 3 months		after 3 months (p = 0.03). Secondary: There is an increasing level of self-efficacy (p < 0.0001) and self-care behaviors between the two groups (p < 0.0001).
Ewen et al. (2024) 25	USA	RCT	25 adults with T2DM that classified into two group: intervention (n=12) and control group (n=13).	✓ Diabetes Self-Management Education and Support (DSME) ✓ Duration: 3 months ✓ Strategy: peer-lead and Empowerment-Based ✓ Evaluation periods: 3 months	Usual care (DMSE)	Primary: There is a decreasing level of HbA1c in the intervention group (p =0.03), Secondary: enhancing blood glucose monitoring (p= 0,05), and decreasing diabetes distress level (p=0,003), whereas not significant change in general diet scores (p = .08)

### Type of intervention

Based on the target or object, the types of intervention are classified into three approaches, namely personal, family, and community. The personal approach is carried out through automated personalized self-care program, self-management support (SMS), occupational

therapy diabetes self-management, as well as patient-centered self-management. Meanwhile, family based approach using eHealth family-based health education, and family-based diabetes self-management education and support program. Community-based approach is also used through community-based

diabetes self-management education (DSME) plus mobile health (mHealth).

### Periods

The periods of Intervention are classified into two categories, including less than 3 months, and between 3 and 6 months. Interventions provided for less than 3 months are mostly conducted on a personal or with their family using simple education and practice methods related to diabetes care (automated personalized self-care program, family-based diabetes self-management education and support program, occupational therapy diabetes self-management, and patient-centered self-management intervention).

Whereas, interventions carried out between 3 to 6 months are types of interventions that using both education and training, that are more intensive, structured, focused on empowerment, as well as using supporting devices (applications on mobile devices) aimed at individuals (Diabetes Self-Management, Education, Self-management support (SMS) through combining of the Connection to Health (CTH) and Enhanced Engagement Connection to Health (EE-CTH) programs), families (eHealth family-based health education), and community (Community-based diabetes self-management education (DSME) plus mobile health (mHealth)

### Achieved outcomes

#### Primary outcomes

HbA1c levels: All articles (n=8) show a decrease in HbA1c values (HbA1c values less than 5.7%) after given interventions ( $p < 0.05$  and  $p < 0.001$ ). There were differences in the significant level of HbA1c decrease. Some articles demonstrate a decrease in HbA1c ( $p < 0.05$ ) (Park et al., 2024; Presley et al., 2020; Binesh et al., 2023; Asmat et al., 2024). Other studies demonstrated a more significant decrease in HbA1c values ( $p < 0.001$ ) (Feng et al., 2023). Whereas, several studies reported no significant

result in decreasing level of HbA1c after given interventions (Hessler et al., 2023; Diriba et al., 2023; Ewen et al., 2024).

### Secondary outcomes

There is a significant difference result in  $p$ -value  $< 0.05$  and  $p$ -value  $< 0.0001$  for the categories of self-efficacy, self-care behavior, and diabetes self-care activities (diet, exercise, blood glucose testing). For  $p$ -value  $< 0.05$  found in self-care activities including: diet (Feng et al., 2023; Binesh et al., 2023; Ewen et al., 2024), exercise (Feng et al., 2023), and BG testing, (Park et al., 2024). Whereas,  $p$ -value  $< 0.0001$  found on studies with categories including self-efficacy (Diriba et al., 2023; Presley et al., 2020; Asmat et al., 2024), self care behavior (Asmat et al., 2024), self care activities: diet (Hessler et al., 2022; Asmat et al., 2024) and BG testing (Binesh et al., 2023). Based on result of studies, more significant value ( $p < 0.0001$ ) of self-efficacy, self-care behavior, and self-care activities were found in the studies that involved personalized structure, family, peer, and community approaches. This is evidenced by the significant influence between social support and increased self-efficacy, self-care behavior, and self-care events (Asmat et al., 2024; Ewen et al., 2024).

### Discussion

The results show differences in findings related to the effectiveness of interventions on HbA1c values and self-care activity. The majority of studies (n=5) show that interventions are effective in both reducing HbA1c values and increasing self-care activity (Park et al., 2024; Feng et al., 2023; Persley et al., 2020; Asmat et al., 2024; Ewen et al., 2024). Whereas, one study show that the intervention is only effective in reducing HbA1c values, but is not effective in increasing self-care activity (Asmat et al., 2024). Other studies (n=2) also show that interventions are only effective in increasing self-care activity, but are not

effective in reducing HbA1c values (Hessler et al., 2022; Diriba et al., 2023). Beside that, regarding to self-care activities including diet, physical exercise, and blood glucose testing (Lee et al., 2019), the majority of studies are effective in improving dietary patterns (Feng et al., 2023; Hessler et al., 2022; Binesh et al., 2023; Asmat et al., 2024; Ewen et al., 2024), and blood glucose testing (Park et al., 2024; Feng et al., 2023; Binesh et al., 2023), but only one study is effective in increasing physical exercise (Feng et al., 2023).

The result is consistent with the previous studies that interventions improving self-care behavior focused on person-centered care through structured education using mobile applications is significant in improving dietary patterns, self-efficacy, and reducing the level of HbA1c among type 2 diabetes patients (Ernawati et al., 2021; Lee et al., 2019; Mikhael et al., 2020; Cunningham et al., 2018; Young et al., 2020; Asmat et al., 2022; Racey et al., 2022; Adu et al., 2020). Meanwhile, the interventions that also use optimizing family and community empowerment are also effective in increasing self-care management and have a significant impact on long-term care effects (Bailey et al., 2020; Gong et al., 2020; Yang et al., 2020; Park et al., 2022; Lakka et al., 2023; Chuman et al., 2021; Chen et al., 2021; Aminuddin et al., 2021; Jiang et al., 2022; Hawkins et al., 2015).

There are several factors that contributed to the effectiveness of the program, including psychological factors (low self-efficacy, depression, and lack of motivation) (Derese et al., 2022; Jiang et al., 2023; MOfaghi et al., 2023), physical factors such as the presence of comorbidities or disease complications and functional limitations (Letta et al., 2021; Alrasheeday et al., 2024; Nebhinani et al., 2022), as well as social and environmental factors, such as lack of social support and an unsupportive environment (Jokar et al., 2025; Hasan et

al., 2022; Chen et al., 2025; El-Radad et al., 2023). This is proven by study results that interventions that only focused on personal short-term approaches without involving family or social support and a lack of long-term monitoring, only have an impact on reducing HbA1c levels, whereas do not have an impact on improving the self-care behavior [24]. Meanwhile, the other results show that some interventions are only effective in improving self-care behavior, but do not have a significant impact on reducing HbA1c levels (Hessler et al., 2022; Diriba et al., 2023). This is because the majority of participants have comorbidities or disease complications, that impact on nonoptimally achievement of the intervention related to metabolic impairment.

The effectiveness of interventions in both reducing HbA1c values and increasing self-care activity is a kind of interventions that more emphasize a structured personal approach through using a combination of educational methods (face-to-face education, practice, training, monitoring, also using of supporting devices) (Park et al., 2024), as well as social support (family and community) (Feng et al., 2023; Presley et al., 2020). Whereas, there are no inhibiting factors (such as clients with psychological problems that may be less cooperative, so that they need a longer time for the intervention to be effective (Hessler et al., 2022; Diriba et al., 2023).

An automated personalized self-care program is a kind of educational program that applies to diabetes patients through using technology, including a mobile app, to create a customized routine activities, by analyzing user data and providing tailored recommendations, reminders, and feedback (Park et al., 2022). These programs can help individuals manage health behaviors, reduce stress, and establish self-efficacy by combining components like goal setting, education, progress monitoring, and automated support systems (Lee et al.,

2024). This application has also been widely used as an intervention to enhance self-care behavior in diabetes patients and reduce HbA1c levels, and has shown positive results (Aragón et al., 2019; Piette et al., 2020).

Meanwhile, application methods through using mobile devices that are also given to their families and communities, such as eHealth family-based health education and community-based diabetes self-management education (DSME) plus mobile health (mHealth), also show positive results (Feng et al., 2023; Preslet et al., 2020). This is because the family and community support, including emotional, instrumental, and informational, can increase patient compliance in carrying out self-care activities such as monitoring blood glucose, taking medication, and maintaining a healthy diet (El-Radad et al. 2022; Adu et al., 2024). This also helps the patients stay motivated and consistent, which ultimately can help maintain stable blood glucose levels and prevent early complications (Lontaan et al., 2024).

## CONCLUSION

The results of the systematic review indicate that the effectiveness of self-care enhancement-based interventions, especially the Automated Personalized Self-care Program, eHealth family-based health education, and Community-based diabetes self-management education (DSME) plus mobile health (mHealth), has been proven to be effective in improving self-efficacy, self-care behaviors, and self-care activities, including diet, physical exercise, and blood glucose testing. The effectiveness of these interventions is supported by a structured personal approach through using a combination of effective educational methods, and also the availability of social support (including family and community).

## ACKNOWLEDGMENT

The results of the systematic review indicate that the effectiveness of self-care enhancement-based interventions, especially the Automated Personalized Self-care Program, eHealth family-based health education, and Community-based diabetes self-management education (DSME) plus mobile health (mHealth), has been proven to be effective in improving self-efficacy, self-care behaviors, and self-care activities, including diet, physical exercise, and blood glucose testing. The effectiveness of these interventions is supported by a structured personal approach through using a combination of effective educational methods, and also the availability of social support (including family and community).

## REFERENCES

- A. Derese, Y. Gebreegziabhere, G. Medhin, S. Sirgu, C. Hanlon. (2024). "Impact of depression on self-efficacy, illness perceptions and self-management among people with type 2 diabetes: A systematic review of longitudinal studies," *Plos one*, vol. 19, no. 5, pp. e0302635.
- A. Hasan, A. Ismail, H. Noor. (2024). "The influence of social support on self-care behavior among T2DM patients," *SAGE Open Nursing*, vol. 10, no. 5, pp. 23779608231219137.
- A. Lontaan, Y. Adam, F. Keintjem, and S. Sumiyati. (2024). "The role of family in improving the management of diabetes mellitus patients," *Jurnal Edukasi Ilmiah Kesehatan*, vol. 2, no. 2, pp. 33-40.
- A.A. Lam, A. Lepe, S.H. Wild, and C. Jackson. (2021). "Diabetes comorbidities in low-and middle-income countries: an umbrella review," *Journal of global health*, vol. 11, no.2, pp. 1-16.

- A.M. Alrasheeday, H.S. Alshammari, B. Alshammari, S.A. Alkubati, J.H. Llego, A.D. Alshammari, F. Alshammari. (2024). "Perceived barriers to healthy lifestyle adherence and associated factors among patients with type 2 diabetes mellitus: Implications for improved self-care," *Patient preference and adherence*, vol. 27, no. 6, pp. 2425-2439.
- A.M. Ewen, J.M. Hawkins, K.A. Kloss, R. Nwankwo, M.M. Funnell, S. Sengupta, G. Piatt. (2024). "The Michigan Men's Diabetes Project Randomized Clinical Control Trial: A Pilot/Feasibility Study of a Peer-Led Diabetes Self-Management and Support Intervention for Black Men With Type 2 Diabetes," *American Journal of Men's Health*, vol. 18, no. 3, pp. 15579883241258318.
- A.T. Cunningham, D.R. Crittendon, N. White et al. (2018). "The effect of diabetes self-management education on HbA1c and quality of life in African-Americans: A systematic review and meta-analysis," *BMC Health Serv Res*, vol. 18, pp. 1-13.
- C. Presley, A. Agne, T. Shelton, R. Oster, and A. Cherrington. (2020). "Mobile-enhanced peer support for African Americans with type 2 diabetes: a randomized controlled trial," *Journal of General Internal Medicine*, vol. 35, pp. 2889-2896.
- D. Hessler, L. Fisher, M. Dickinson, P. Dickinson, J. Parra, and M.B. Potter. (2022). "The impact of enhancing self-management support for diabetes in Community Health Centers through patient engagement and relationship building: a primary care pragmatic cluster-randomized trial," *Translational Behavioral Medicine*, vol. 12, no. 9, pp. 909-918.
- D.C. Diriba, D. Y. Leung, L.K. Suen. (2023). "Effects of family-based diabetes self-management education and support programme on support behaviour amongst adults with type 2 diabetes in Western Ethiopia," *Scientific Reports*, vol. 13, no. 1, pp. 20867.
- D.P. Bailey, L.H. Mugridge, F. Dong, X. Zhang, A.M. Chater. (2020). "Randomised controlled feasibility study of the MyHealthAvatar-diabetes smartphone app for reducing prolonged sitting time in type 2 diabetes mellitus," *Int J Environ Res Public Health*, vol.17, no.12, pp. 4414-4420. <https://doi.org/10.3390/ijerph17124414>
- D.W. Soeatmadji, R. Rosandi, M.R. Saraswati, R.P. Sibarani, and W.O. Tarigan. (2023). "Clinicodemographic profile and outcomes of type 2 diabetes mellitus in the Indonesian cohort of DISCOVER: A 3-year prospective cohort study," *Journal of the ASEAN Federation of Endocrine Societies*, vol. 38, no. 1, pp. 68-78, 2023.
- E. Bonora, M. Trombetta, M. Dauriz, D. Travia, V. Cacciatori, C. Brangani, and R.C. Bonadonna. (2020). "Chronic complications in patients with newly diagnosed type 2 diabetes: prevalence and related metabolic and clinical features: the Verona Newly Diagnosed Type 2 Diabetes Study (VNDS) 9," *BMJ Open Diabetes Research and Care*, vol. 8, no. 1, pp. e001549.
- E. Gong, S. Baptista, A. Russell, P. Scuffham, M. Riddell, J. Speight et al. (2020). "My diabetes coach, a mobile app-based interactive conversational agent to support type 2 diabetes self-management: randomized effectiveness implementation trial," *J Med Internet Res*, vol. 22,

- no. 11, pp. e20322.  
<https://doi.org/10.2196/20322>
- E. Zemen, Y.S. Yimer, N.D. Kabeta, Y. Abebe. (2025). "Self-care practices and associated factors among type 2 diabetes mellitus patients attending public hospitals in Bale zone, Oromia region, Ethiopia," *PeerJ*, vol. 20, no. 3, pp. e19529. doi: 10.7717/peerj.19529.
- E.M. Mikhael, M.A. Hassali, S.A.Hussain. (2020). "Effectiveness of diabetes self-management educational programs for type 2 diabetes mellitus patients in middle east countries: A systematic review," *Diabetes Metab Syndr Obes*, vol. 13, no. 4, pp. 117-125.
- F. Hua. (2022). "New insights into diabetes mellitus and its complications: a narrative review. *Annals of translational medicine*, vol. 24, no. 8, pp. 1-8.
- F.A. Adu, C.A. Poku, A.P. Adu, L.B. Owusu. (2024). "The role of social support and self-management on glycemic control of type 2 diabetes mellitus with complications in Ghana: A cross-sectional study," *Health Sci Rep.*, vol. 7, no. 4, pp. e2054. doi: 10.1002/hsr2.2054. PMID: 38650722; PMCID: PMC11033339.
- G. Park H. Lee A.R. Khang. (2022). "The Development of Automated Personalized Self-Care (APSC) Program for Patients with Type 2 Diabetes Mellitus," *Journal of Korean Academy of Nursing*, vol. 52, no. 5, pp. 535-549.
- G. Park, H. Lee, A.R. Khang. (2022). "The development of Automated Personalized SelfCare (APSC) program for patients with type 2 diabetes mellitus," *J Korean Acad Nurs*, vol. 52, no. 5, pp. 535e49. <https://doi.org/10.4040/jkan.22046>
- G. Park, H. Lee, Y. Lee, M.S. Kim, S. Jung, A. R. Khang, and D. Yi. (2024). "Automated Personalized Self-Care program for patients with type 2 diabetes mellitus: A pilot trial," *Asian Nursing Research*, vol.18, no.2, pp.114-124.
- H. Lee, G. Park, D. Lee, A.R. Khang, and M.J. Lee. (2024). "Long-Term Effects of an Automated Personalized Self-Care Program for Patients With Type 2 Diabetes," *Nursing & Health Sciences*, vol. 26, no. 4, pp. e70008.
- H. Sun, P. Saeedi, S. Karuranga, M. Pinkepank, K. Ogurtsova, B.B. Duncan, and D.J. Magliano. (2022). "IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045," *Diabetes research and clinical practice*, vol. 15, no. 2, pp. 183-190.
- H.B. Aminuddin, N. Jiao, Y.,Jiang, J. Hong, W. Wang. (2021). "Effectiveness of smartphone-based self-management interventions on self-efficacy, self-care activities, health-related quality of life and clinical outcomes in patients with type 2 diabetes: a systematic review and meta-analysis," *Int J Nurs Stud*, vol. 116, no. 4, pp. 103286. <https://doi.org/10.1016/j.ijnurstu.2019.02.003>..
- H.M. El-Radad, H.A. Sayed Ahmed, N.A. Eldahshan. (2022). "The relationship between self-care activities, social support, and glycemic control in primary healthcare patients with type 2 diabetes," *Diabetol Int*, vol. 14, no. 1, pp. 65-75.
- H.M. El-Radad, H.A. Sayed Ahmed, N.A. Eldahshan. (2023). "The relationship between self-care activities, social support, and glycemic control in primary

- healthcare patients with type 2 diabetes,” *Diabetology International*, vol. 14, no. 1, pp. 65-75.
- H.M. Young, S. Miyamoto, M. Dharmar, Y. Tang-Feldman. (2020). ”Nurse coaching and mobile health compared with usual care to improve diabetes self-efficacy for persons with type 2 diabetes: randomized controlled trial,” *JMIR Mhealth Uhealth*, vol. 8, no. 3, pp. e16665.  
<https://doi.org/10.2196/16665>
- J. Chinnappan, A. KP, F. Iqbal, J. V, P. Ashok, and R. S. Varghese. (2020). ”Assessment of Self-Care Practices among Type 2 Diabetic Patients in a Secondary Care Teaching Hospital”, *J. Drug Delivery Ther.*, vol. 10, no. 3, pp. 119–124.  
doi: [10.22270/jddt.v10i3.4098](https://doi.org/10.22270/jddt.v10i3.4098).
- J. Hawkins, D.C. Watkins, E. Kieffer, M. Spencer, N. Espitia, M. Anderson. (2015). ”Psychosocial factors that influence health care use and self-management for African American and Latino men with type 2 diabetes: An exploratory study,” *Journal of Men’s Studies*, vol. 23, pp. 161–176.  
<https://doi.org/1060826515582495>
- J. Liu, Z. H. Ren, H. Qiang, J. Wu, M. Shen, L. Zhang, and J. Lyu. (2020). ”Trends in the incidence of diabetes mellitus: results from the Global Burden of Disease Study 2017 and implications for diabetes mellitus prevention,” *BMC public health*, vol. 20, no. 4, pp. 1-12.
- J.B. Cole, and J.C. Florez. (2020). ”Genetics of diabetes mellitus and diabetes complications,” *Nature reviews nephrology*, vol. 16, no.7, pp. 377-390, 2020.
- J.D. Piette, M. Weinberger, S.J. McPhee, C.A. Mah, F.B. Kraemer, and L.M. Crapo. (2020). ”Do automated calls with nurse follow-up improve self-care and glycemic control among vulnerable patients with diabetes?,” *The American journal of medicine*, vol. 108, no. 1, pp. 20-27.
- K. Asmat, E. Sivarajan Froelicher, K.A. Dhamani, R. Gul, and N. Khan. (2024). ”Effect of patient-centered self-management intervention on glycemic control, self-efficacy, and self-care behaviors in South Asian adults with type 2 diabetes mellitus: A multicenter randomized controlled trial,” *Journal of Diabetes*, vol. 16, no. 9, pp. e13611.
- K. Asmat, K. Dhamani, R. Gul, E.S. Froelicher. (2022). ”The effectiveness of patient-centered care vs. usual care in type 2 diabetes self-management: a systematic review and meta-analysis,” *Front Public Health*, vol. 10, no.2, pp. 994766.  
<https://doi.org/10.3389/fpubh.2022.994766>
- K. L. Ong, L.K. Stafford, S.A. McLaughlin, E.J. Boyko, S.E. Vollset, A.E. Smith, and M. Brauer. (2023). ”Global, regional, and national burden of diabetes from 1990 to 2021, with projections of prevalence to 2050: a systematic analysis for the Global Burden of Disease Study 2021,” *The Lancet*, vol. 40, no. 2, pp. 203-234.
- K.I. Galaviz, K.V. Narayan, F. Lobelo, M.B. Weber. (2018). ”Lifestyle and the prevention of type 2 diabetes: a status report,” *American journal of lifestyle medicine*, vol. 12, no. 1, pp. 4-20.
- M. Binesh, N. Shafaroodi, M. Mirmohammadkhani, R. Aghili, F. Motaharinezhad, M. Khanipour, and A.H. Mehraban. (2023). ”A randomized controlled trial for evaluating an occupational therapy

- self management intervention in adults with type 2 diabetes,” *Scientific Reports*, vol. 13, no. 1, pp. 10128.
- M. Jokar, M. Zandi, A. Ebadi *et al.* (2025). “Barriers and facilitators of self-care in adults with pre-diabetes: a directed qualitative content analysis,” *BMC Health Serv Res*, vol. 25, no. 4, pp. 332-340.
- M. Nebhinani, R.D. Avasthi, M. Meena, M. Parihar, M. Sharma, M. Nagar. (2022). “Barriers related to self-care management among people with diabetes mellitus-A narrative review,” *Biomedicine*, vol. 42, no. 4, pp. 628-634, 2022.
- M. Racey, M. Jovkovic, P. Alliston, M.U. Ali, D. Sherifali. (2022). “Diabetes health coach in individuals with type 2 diabetes: a systematic review and meta analysis of quadruple aim outcomes,” *Front Endocrinol*, vol. 13, pp. 1069401. <https://doi.org/10.3389/fendo.2022.1069401>
- M.D. Adu, U.H. Malabu A.E.O. Malau-Aduli, A. Drovandi, B.S. Malau-Aduli. (2020). “Efficacy and acceptability of my care hub mobile app to support self-management in Australians with type 1 or type 2 diabetes,” *Int J Environ Res Public Health*, vol. 17, no. 7, pp. 2573-2583. <https://doi.org/10.3390/ijerph17072573>
- M.H. Almomani, and S. Al-Tawalbeh. (2022). “Glycemic control and its relationship with diabetes self-care behaviors among patients with type 2 diabetes in Northern Jordan: a cross-sectional study,” *Patient preference and adherence*, 449-465.
- N. Chuman, C. Hatamochi. (2021). “Intervention effect based on self-regulation to promote the continuation of self-care behavior of patients with type-2 diabetes mellitus,” *Health*, vol. 13, no. 4, pp. 472-478. <https://doi.org/10.4236/health.2021.134037>
- R. Jiang, X. Ta, M. Xu, Z. Luo, Y. Du, X. Zhong, X. Cao. (2023). “Mediating role of depression between diabetes management self-efficacy and diabetes self-care behavior among elderly type 2 diabetes mellitus patients in China,” *Psychology Research and Behavior Management*, vol. 14, no. 2, pp. 1545-1555.
- R. Polsook, Y. Aunguroch, and A. Thontham. (2024). “The effect of self-management intervention among type 2 diabetes: A systematic review and meta-analysis,” *Worldviews on Evidence-Based Nursing*, vol. 21, no. 1, pp. 59-67.
- R.B. da Rocha, C.S. Silva, V.S. Cardoso. (2020). “Self-Care in Adults with Type 2 Diabetes Mellitus: A Systematic Review,” *Curr Diabetes Rev*, vol. 16, no. 6, pp. 598-607.
- R.C. Karthik, A. Radhakrishnan, A. Vikram, B. Arumugam, and S. Jagadeesh. (2020). “Self-care practices among type II diabetics in rural area of Kancheepuram district, Tamil Nadu,” *Journal of family medicine and primary care*, vol. 9, no. 6, pp. 2912-2918.
- S. Katsuragawa, T. Mai, A. R. McDougall, L. Romero, J.P. Vogel, and M. Makama. (2025). “Effectiveness of self-care interventions for the prevention of type 2 diabetes among women with previous gestational diabetes: a systematic review and meta-analysis,” *American Journal of Obstetrics & Gynecology MFM*, vol. 10, no.1, pp. 73-79.
- S. Letta, F. Aga, T.A. Yadeta, B. Geda, Y. Dessie. (2021). “Barriers to

- diabetes patients' self-care practices in Eastern Ethiopia: a qualitative study from the health care providers perspective," *Diabetes, Metabolic Syndrome and Obesity*, vol. 24, no. 6, pp. 4335-4349.
- S. Motaghi, I.R. Boogar, S. Moradi, N.S. Asl. (2023). "The effectiveness of cognitive behavioral stress management on health-related quality of life, diabetes management self-efficacy, and treatment adherence in type 2 diabetes," *Iranian journal of diabetes and obesity*, vol. 15, no. 4, pp. 234-242.
- S.K. Lee, D.H. Shin, Y.H. Kim, K.S. Lee. (2019). "Effect of diabetes education through pattern management on self-care and self-efficacy in patients with type 2 diabetes," *International journal of environmental research and public health*, vol. 16, no. 8, pp. 3323.
- T. Sheleme, G. Mamo, T. Melaku, T. Sahilu. (2020). "Prevalence, patterns and predictors of chronic complications of diabetes mellitus at a large referral hospital in Ethiopia: a prospective observational study," *Diabetes, Metabolic Syndrome and Obesity*, pp. 4909-4918.
- T.A. Lakka, K. Aittola, E.E. Jarvel, E. a-Reijonen, T. Tilles-Tirkkonen, R. annikko, N. Lintu. (2023). "Real-world effectiveness of digital and group-based lifestyle interventions as compared with usual care to reduce type 2 diabetes risk - a stop diabetes pragmatic randomised trial," *Lancet Reg Health Eur*, vol. 24, pp. 100527.
- U. Ernawati, T.A. Wihastuti, Y.W. Utami. (2021). "Effectiveness of diabetes self-management education (DSME) in type 2 diabetes mellitus (T2DM) patients: systematic literature review," *Journal of public health research*, vol. 10, no. 2, pp. 1-5.
- V. Alcántara-Aragón. (2019). "Improving patient self-care using diabetes technologies," *Therapeutic advances in endocrinology and metabolism*, vol. 10, pp. 2042018818824215.
- W.C. Chen, C.C. Lin, C.C. Kuo, C.C. Wu, T.J. Liu, M.T. Chen. (2021). "A theory-based selfmanagement training program for older adult peer leaders with diabetes: a feasibility assessment," *J Multidiscip Healthc*, vol. 14, no. 2, pp. 33e44. <https://doi.org/10.2147/jmdh.S286186>
- W.J. Chen, L.Y. Lin. (2025). "The Impact of Diabetes Self-Care, Healthy Lifestyle, Social Support, and Demographic Variables on Outcomes HbA1c in Patients With Type 2 Diabetes," *Clinical Medicine Insights: Endocrinology and Diabetes*, vol. 18, no. 8, pp. 11795514251331907.
- Y. Feng, Y. Zhao, L. Mao, M. Gu, H. Yuan, J. Lu, and X. Li. (2023). "The effectiveness of an eHealth family-based intervention program in patients with uncontrolled type 2 diabetes mellitus (T2DM) in the community via WeChat: randomized controlled trial," *JMIR mHealth and uHealth*, vol. 11, no. 1, pp. e40420.
- Y. Jiang, H.J. Ramachandran, J.Y.C. Teo, F.L. Leong, S.T. Lim, H.D. Nguyen et al. (2022). "Effectiveness of a nurse-led smartphone-based self-management programme for people with poorly controlled type 2 diabetes: a randomized controlled trial," *J Adv Nurs*. Vol. 78, no. 4, pp.1154e65. <https://doi.org/10.1111/jan.15178>.
- Y. Yang, E.Y. Lee, H.S. Kim, S.H. Lee, K.H. Yoon, J.H. Cho. (2020).

“Effect of a mobile phonebased glucose-monitoring and feedback system for type 2 diabetes management in multiple primary care clinic settings: cluster randomized controlled trial,” JMIR

Mhealth Uhealth, vol. 8, no. 2, pp. e16266.  
<https://doi.org/10.2196/16266>