



Impact of a Structured Family Empowerment Program on Self-Efficacy and Quality of Life among Diabetes Caregivers: A Repeated-Measures Quasi-Experimental Study

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ABSTRACT

Background: Family caregivers play a critical role in supporting patients with type 2 diabetes mellitus (T2DM); however, prolonged caregiving responsibilities may negatively affect caregivers' self-efficacy and quality of life. Strengthening caregiver empowerment through self-efficacy-oriented interventions may improve caregivers' confidence, coping ability, and overall well-being. **Purpose:** This study aimed to examine the effectiveness of a self-efficacy-based family empowerment intervention in improving caregiver self-efficacy and quality of life among family caregivers of patients with T2DM. **Methods:** A quasi-experimental pre-test–post-test control group design with repeated measurements was conducted in community-based primary healthcare centers in Malang City, Indonesia. A total of 64 family caregivers were recruited and allocated to either the intervention group (n = 32) or the control group (n = 32). The intervention group received the “Berdaya DM” program, a structured family empowerment intervention delivered over four weekly sessions focusing on diabetes care, caregiver support strategies, stress management, and self-efficacy enhancement, whereas the control group received standard diabetes education routinely provided by the primary healthcare centers. Outcome measurements were conducted at baseline, immediately after completion of the intervention (post-test 1), and eight weeks after baseline (post-test 2). Caregiver self-efficacy was assessed using the General Self-Efficacy Scale (GSES), and quality of life was measured using the WHOQOL-BREF. Data were analyzed using repeated-measures ANOVA to examine the effects of time, group, and time-by-group interaction. **Results:** Caregiver self-efficacy and quality of life improved more markedly in the intervention group than in the control group across repeated measurements. At post-test 2, mean self-efficacy scores were 32.37 ± 3.77 in the intervention group and 27.37 ± 3.77 in the control group, corresponding to a between-group mean difference of 5.00 points. Mean quality-of-life scores were 77.14 ± 7.04 and 67.14 ± 7.04 , respectively, yielding a between-group mean difference of 10.00 points. Significant time-by-group interaction effects were observed for self-efficacy ($F = 73.92$, $p < 0.001$, partial $\eta^2 = 0.54$) and quality of life ($F = 82.41$, $p < 0.001$, partial $\eta^2 = 0.57$), indicating large intervention effects over time. **Conclusion:** The self-efficacy-based family empowerment intervention effectively improved caregiver self-efficacy and quality of life among family caregivers of patients with T2DM. Integrating caregiver-centered empowerment programs into primary healthcare services may strengthen sustainable diabetes management and caregiver well-being.

KEYWORDS

Family empowerment, Self-efficacy, Caregiver, Quality of life; Type 2 diabetes mellitus

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1. BACKGROUND

Type 2 diabetes mellitus (T2DM) remains a major global public health concern due to its high prevalence, chronic progression, and long-term consequences for patients, families, and healthcare systems (IDF, 2021; WHO, 2026). The increasing number of individuals living with T2DM has expanded the role of family members as informal caregivers who provide continuous support for daily disease management (Niño-de-Guzman Quispe et al., 2023). Diabetes care requires sustained engagement in medication adherence, dietary regulation, physical activity, blood glucose monitoring, complication prevention, and healthcare decision-making (Ahmad & Joshi, 2023).

Family caregivers play a critical role in supporting patients with T2DM, particularly in community and home-based care contexts (Seng et al., 2023). Their responsibilities commonly include supervising medication, preparing appropriate meals, monitoring symptoms, accompanying patients to healthcare services, and providing emotional support (Seng et al., 2023). Although caregiver involvement may improve patient adherence and disease management, prolonged caregiving responsibilities may also affect caregivers'

physical, psychological, social, and financial well-being (Huang et al., 2024; Martínez-Melero et al., 2025). Caregiver quality of life is an important outcome in chronic disease management because caregiver well-being influences the quality and sustainability of care provided to patients. Poor caregiver quality of life may reduce caregiving capacity, weaken emotional support, and compromise continuity of diabetes management at home (Aljuaid et al., 2022; Natawirarindry & Guino-o, 2022). Self-efficacy is a key psychosocial factor influencing caregiver adaptation. It refers to an individual's belief in their ability to perform specific tasks and to manage challenging situations effectively (Bandura, 1993). In caregiving contexts, self-efficacy reflects caregivers' confidence in managing care responsibilities, solving problems, communicating effectively, and maintaining emotional control while supporting patients with chronic illness (Setyoadi et al., 2026). Caregivers with higher self-efficacy are more likely to perceive caregiving tasks as manageable, maintain adaptive coping strategies, and sustain caregiving roles over time (White et al., 2022).

Family empowerment interventions have increasingly been recognized as a promising approach to strengthening

caregivers' competence and adaptation in the care of people with chronic disease (Guo et al., 2024). Empowerment-based interventions emphasize active participation, education, skill development, role clarification, shared decision-making, problem-solving, and confidence building (Stepanian et al., 2023). These components may improve caregivers' knowledge, practical caregiving skills, emotional resilience, and ability to support diabetes self-management.

Existing caregiver education programs often emphasize information delivery but may offer limited support for confidence-building, coping skills, emotional regulation, and sustained behavioral reinforcement. For caregivers of patients with T2DM, knowledge alone may be insufficient to improve caregiving adaptation because daily diabetes care requires continuous decision-making, problem-solving, and emotional resilience (Rondhianto et al., 2022). Therefore, integrating self-efficacy enhancement into family empowerment programs may offer a more comprehensive approach to improving caregiver confidence and quality of life (Pamungkas et al., 2017). Community-based primary healthcare settings provide an appropriate platform for implementing caregiver-focused interven-

tions because they are closely connected to long-term diabetes care and family-based disease management (Mphasha et al., 2023). Nurses and healthcare professionals in primary care can support caregivers through structured education, counseling, skill training, follow-up monitoring, and psychosocial support (Dailah, 2024). In Indonesia, where family involvement is strongly embedded in chronic illness care, caregiver empowerment may be particularly relevant for sustaining diabetes management at home (Setyoadi et al., 2023).

Despite the important role of family caregivers in T2DM care, structured interventions specifically designed to improve caregiver self-efficacy and quality of life remain limited, particularly in Indonesian primary healthcare settings. Moreover, few studies have evaluated the sustained effects of self-efficacy-based family empowerment interventions using repeated measurements. Therefore, this study aimed to examine the effectiveness of a self-efficacy-based family empowerment intervention in improving caregiver self-efficacy and quality of life among family caregivers of patients with T2DM.

2. METHODS

Design

This study employed a quasi-experimental pre-test–post-test control group design with repeated measurements to evaluate the effectiveness of a self-efficacy-based family empowerment intervention on caregiver self-efficacy and quality of life. Measurements were conducted at three time points: baseline (To), immediately after completion of the four-week intervention (T1), and eight weeks after baseline (T2). This design enabled the assessment of both immediate and sustained effects of the intervention over time while comparing outcomes between intervention and control groups.

Sample and setting

The study was conducted in community-based primary healthcare centers in Malang City, East Java, Indonesia, where patients with type 2 diabetes mellitus (T2DM) routinely receive chronic disease management services, health education, and clinical monitoring. The study population consisted of patients with T2DM and their primary family caregivers. A total of 64 patient caregiver dyads were recruited, including 32 dyads in the

intervention group and 32 dyads in the control group.

The sample size was determined based on the requirements of a quasi-experimental repeated-measures design, considering a significance level of 0.05, 80% power, and potential participant attrition. Participants were selected using purposive sampling. To minimize contamination between groups, allocation was based on comparable primary healthcare service areas. Eligible caregivers were adults who lived with or regularly assisted patients with T2DM, were able to communicate effectively, and consented to participate. Caregivers of patients with severe cognitive impairment, severe visual impairment, or acute medical conditions requiring hospitalization were excluded from the study.

Variable

The independent variable was a self-efficacy-based family empowerment intervention delivered through the *Berdaya DM* educational module. The primary outcome variables were caregiver self-efficacy and caregiver quality of life. In addition, patient and caregiver sociodemographic characteristics and patients' glycemic status were collected to describe the study population. Glycemic status was

assessed using random blood glucose measurements and categorized as <200 mg/dL or ≥ 200 mg/dL.

Instruments

Caregiver self-efficacy was assessed using the General Self-Efficacy Scale (GSES), developed by Schwarzer and Jerusalem (1995). The instrument consists of 10 items scored on a four-point Likert scale, with higher scores indicating greater perceived self-efficacy. Prior to the main study, the adapted version of the GSES was pilot tested among family caregivers of patients with T2DM. The item-total correlation coefficients ranged from 0.42 to 0.78, and the instrument demonstrated excellent internal consistency with a Cronbach's alpha coefficient of 0.89.

Caregiver quality of life was measured using the World Health Organization Quality of Life-BREF (WHOQOL-BREF), which assesses physical, psychological, social relationship, and environmental domains of quality of life. Higher scores represent a better perceived quality of life. Pilot testing of the adapted instrument showed item-total correlation coefficients ranging from 0.36 to 0.81 and a Cronbach's alpha coefficient of 0.86, indicating satisfactory validity and reliability.

Structured questionnaires were also used to obtain demographic and clinical information from patients and caregivers.

Intervention

The intervention was delivered through the *Berdaya DM* module, a structured, culturally adapted family empowerment program designed to enhance caregiver self-efficacy and strengthen caregiving capacity for diabetes management. The program was developed based on Bandura's self-efficacy theory and family-centered care principles, with particular emphasis on the four sources of self-efficacy: mastery experience, vicarious experience, verbal persuasion, and physiological and affective states.

The program consisted of four weekly sessions, each lasting approximately 40–80 minutes. Each session incorporated one or more sources of self-efficacy (Table 1). Session 1, which focused on understanding T2DM and caregiving challenges, primarily addressed physiological and affective states by helping caregivers recognize caregiving-related stress, emotional responses, and perceived difficulties, while providing information to reduce uncertainty and anxiety related to diabetes care. Session 2, which focused on supporting diabetes self-

management, emphasized mastery experience through demonstrations, guided practice, and caregiver participation in diabetes-related caregiving activities. Vicarious experience was also promoted through facilitator demonstrations and observation of appropriate caregiving practices.

Session 3, which addressed caregiver self-care and family support strategies, incorporated physiological and affective regulation through stress-management and coping strategies. Verbal persuasion was reinforced through facilitator feedback, encouragement, and group discussion to strengthen caregivers' confidence in managing caregiving demands. Session 4, which focused on strengthening self-efficacy through goal setting and sustainable caregiving planning, primarily emphasized mastery experience and verbal persuasion. Caregivers reflected on previously acquired skills, identified achievable caregiving goals, developed

individualized caregiving plans, and received constructive feedback and encouragement from facilitators. Vicarious experience was additionally supported through group discussions and the sharing of caregiving experiences among participants.

Across the four sessions, educational content was delivered through interactive lectures, group discussions, demonstrations, guided practice, feedback sessions, problem-solving activities, and self-efficacy enhancement strategies. Educational materials included a printed caregiver module, illustrated leaflets, flipcharts, visual posters, caregiver self-monitoring checklists, and demonstration tools. All sessions were facilitated by trained healthcare professionals experienced in diabetes education, family nursing, and chronic disease management. Intervention fidelity was maintained through standardized facilitator guidelines, supervision, and consistent implementation of module-based content.

Table 1. Mapping of *Berdaya DM* Sessions to Bandura's Sources of Self-Efficacy

Session	Main focus	Bandura's source of self-efficacy	Intervention strategies
1	Understanding T2DM and caregiving challenges	Physiological/affective states; verbal persuasion	Education, discussion, emotional clarification, facilitator encouragement
2	Supporting diabetes self-management	Mastery experience; vicarious experience	Demonstration, guided practice, observation, feedback
3	Caregiver self-care and family support	Physiological/affective states; verbal persuasion	Stress management, coping strategies, group discussion, encouragement
4	Goal setting and sustainable caregiving planning	Mastery experience; verbal persuasion; vicarious experience	Goal setting, caregiving planning, reflection, peer sharing, feedback

Control Group Condition

Participants in the control group received standard diabetes education routinely provided within the participating primary healthcare centers and did not receive the structured *Berdaya DM* family empowerment program during the study period. Standard care represented the usual educational services available to patients with T2DM and their family caregivers within routine primary healthcare practice. Outcome assessments for the control group were conducted at the same three measurement points as those for the intervention group: baseline (T₀), immediately after the four-week intervention period (T₁), and eight weeks after baseline (T₂).

Data collection

Data collection was conducted at three assessment points: baseline prior to intervention implementation (T₀), immediately following completion of the four-week intervention (T₁), and eight weeks after baseline (T₂). Sociodemographic and clinical data were obtained using structured questionnaires and standardized assessment forms. Caregiver self-efficacy and quality of life were assessed using validated instruments administered at

each measurement point. To ensure consistency and reduce measurement bias, data were collected by trained enumerators who underwent standardized training prior to study implementation. Uniform data collection procedures were applied across all assessment periods for both intervention and control groups.

Data analysis

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant characteristics and study variables. Prior to inferential analysis, the distributions of continuous variables were examined to assess the normality assumption. Repeated-measures analysis of variance (RM-ANOVA) was employed to examine changes in caregiver self-efficacy and quality of life across the three measurement points and to compare trajectories between intervention and control groups. The analysis assessed the main effects of time and group, as well as the time-by-group interaction effect. Mauchly's test was used to evaluate the assumption of sphericity. When violations occurred, Greenhouse–Geisser corrections

were applied. Pairwise comparisons were subsequently conducted to identify significant differences between assessment periods. Effect sizes were reported using partial eta squared (η^2). Statistical significance was established at $p < 0.05$.

Ethical consideration

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Health Sciences, Universitas Brawijaya (Approval No. 251/UN10.F17.10.4/TU/2025; Protocol No. 25F171111147M). All participants provided written informed consent before enrollment. Participant anonymity and confidentiality were strictly maintained throughout the study. Participants were informed of the study objectives, procedures, potential benefits and risks, and their right to withdraw from the study at any time without affecting their access to healthcare services.

3. RESULTS

Baseline demographic and caregiving characteristics were generally balanced

between the intervention and control groups (Table 2). Female caregivers accounted for 75.0% of the intervention group and 65.6% of the control group. Most caregivers were adults aged 19–44 years (50.0–56.3%), Muslim (93.8–100%), and of Javanese ethnicity (93.8%). Senior high school was the predominant educational level, particularly in the intervention group (62.5%). More than half of caregivers reported monthly incomes below the regional minimum wage, and the majority had been providing care for more than five years (65.6–78.1%). Most caregivers were the patients' children (50.0–59.4%) and lived in nuclear family households (81.3–90.6%). Among patients, women represented the majority (75.0–81.3%), and approximately two-thirds had random blood glucose levels between 80 and 200 mg/dL. These findings suggest that the two groups were comparable at baseline, thereby reducing the likelihood of demographic confounding in the evaluation of the intervention (Table 2).

Table 2. Frequency Distribution of Caregiver and Patient Characteristics (n=64)

Demographic Aspects	Caregiver				Patient			
	Control		Intervention		Control		Intervention	
	n	(f%)	n	(f%)	n	(f%)	n	(f%)
Age Caregiver								
10-18 years old	0	0	3	9.4%	0	0	0	0
19-44 years old	18	56.3%	16	50%	0	0	0	0
>45 years old	14	43.8%	13	40.6%	32	100%	32	100%
Religion								
Islam	30	93.8%	32	100%	30	93.8%	32	100%
Protest	2	6.3%	0	0	2	6.3%	0	0
Gender								
Man	11	34.4%	8	25%	6	18.8%	8	25%
Woman	21	65.6%	24	75%	26	81.3%	24	75%
Education								
No School	0	0	1	3.1%				
Elementary School	6	18.8%	3	9.4%				
Junior High School	3	9.4%	2	6.3%				
Senior High School	12	37.5%	20	62.5%				
College	11	34.4%	6	18.8%				
Ethnic								
Java	30	93.8%	30	93.8%	30	93.8%	30	93.8%
Non Java	2	6.3%	2	6.3%	2	6.3%	2	6.3%
Occupation								
Not Working	16	50%	15	46.9%	23	71.9%	23	71.9%
Civil Servant	5	15.6%	2	6.3%	2	6.3%	3	9.5%
Private Employees	10	31.3%	10	31.3%	7	21.9%	1	3.1%
Self employed	1	3.1%	5	15.6%	0	0	5	15.6%
Income (Min wage)								
<IDR 3,309,144	21	65.6%	26	81.3%				
>Rp 3,309,144	11	34.4%	6	18.8%				
Patient Relations								
Father/Mother	2	6.3%	2	6.3%				
Child	16	50%	19	59.4%				
Husband/Wife	11	34.4%	8	25%				
Siblings	3	9.4%	3	9.4%				
Duration of Care								
<5 years old	11	34.4%	7	21.9%				
>5 years	21	65.6%	25	78.1%				
Family Type								
The Core Family	29	90.6%	26	81.3%				
Big Family	3	9.4%	6	18.8%				
Family Development								
Teenage Families	6	18.8%	2	6.3%				
Adult Family	21	65.6%	23	71.9%				
Elderly Families	5	15.6%	7	21.9%				
Random Blood Glucose								
>200 mg/dL					10	31.3%	10	31.3%
80-200 mg/dL					22	68.8%	22	68.8%

Table 3. Descriptive Statistics of Caregiver Self-Efficacy and Quality of Life Across Measurement Points

Outcome Variable	Assessment Stage	Intervention Group (n = 32), Mean $\pm$ SD	Control Group (n = 32), Mean $\pm$ SD
Self-Efficacy	Baseline	24.04 $\pm$ 3.94	23.64 $\pm$ 3.94
	Post-test 1	30.15 $\pm$ 3.78	26.15 $\pm$ 3.78
	Post-test 2	32.37 $\pm$ 3.77	27.37 $\pm$ 3.77
Quality of Life	Baseline	58.92 $\pm$ 7.88	57.92 $\pm$ 7.88
	Post-test 1	71.96 $\pm$ 7.24	63.96 $\pm$ 7.24
	Post-test 2	77.14 $\pm$ 7.04	67.14 $\pm$ 7.04

As shown in Table 3, baseline self-efficacy and quality-of-life scores were relatively comparable between the intervention and control groups. Following the intervention, both outcomes improved in both groups; however, the magnitude of improvement was consistently greater in the intervention group. Self-efficacy in the intervention group increased from 24.04 $\pm$ 3.94 at baseline to 30.15 $\pm$ 3.78 at post-test 1 and 32.37 $\pm$ 3.77 at post-test 2, whereas the

control group increased from 23.64 $\pm$ 3.94 to 26.15 $\pm$ 3.78 and 27.37 $\pm$ 3.77, respectively. Similarly, quality of life increased from 58.92 $\pm$ 7.88 to 71.96 $\pm$ 7.24 and 77.14 $\pm$ 7.04 in the intervention group, compared with 57.92 $\pm$ 7.88, 63.96 $\pm$ 7.24, and 67.14 $\pm$ 7.04 in the control group. These descriptive trends indicate greater and sustained improvements among caregivers receiving the *Berdaya DM* intervention.

Table 4. Mauchly's Test of Sphericity Caregiver Self-Efficacy and Quality of Life

Outcome Variable	Mauchly's W	Approx. Chi-Square	df	p-value
Self-Efficacy	0.957	2.11	2	0.348
Quality of Life	0.944	2.84	2	0.241

Table 4 presents the results of Mauchly's test of sphericity for caregiver self-efficacy and quality of life across the three measurement occasions. The analysis indicated that the assumption of sphericity was satisfied for both outcome variables, with non-significant results for self-efficacy ($W = 0.957$, $\chi^2 = 2.11$, $df = 2$, $p = 0.348$) and quality of life ($W = 0.944$, $\chi^2 = 2.84$, $df = 2$, $p =$

0.241). Since the p-values exceeded the predetermined significance level of 0.05, the variance-covariance matrices of the repeated measures were considered equal. Therefore, the repeated-measures ANOVA results were interpreted using the sphericity-assumed estimates without applying Greenhouse–Geisser or other correction procedures.

Table 5. Tests of Within-Subjects Effects of Caregiver Self-Efficacy and Quality of Life

Outcome Variable	Source	F	p-value	Partial Eta Squared (η^2)
Self-Efficacy	Time	79.84	<0.001*	0.56
	Time $\times$ Group	73.92	<0.001*	0.54
Quality of Life	Time	88.67	<0.001*	0.59
	Time $\times$ Group	82.41	<0.001*	0.57

As shown in Table 5, significant time effects were observed for caregiver self-efficacy ($F = 79.84$, $p < 0.001$, $\eta^2 = 0.56$) and quality of life ($F = 88.67$, $p < 0.001$, $\eta^2 = 0.59$), indicating significant changes across the three assessment points. Significant time-by-group interaction effects were also found for self-efficacy ($F = 73.92$, $p < 0.001$, $\eta^2 =$

0.54) and quality of life ($F = 82.41$, $p < 0.001$, $\eta^2 = 0.57$), demonstrating greater improvements in the intervention group than in the control group over time. The large effect sizes further indicate a substantial impact of the family empowerment intervention on both outcomes.

Table 6. Tests of Between-Subjects Effects of Caregiver Self-Efficacy and Quality of Life

Outcome Variable	Source	F	p-value	Partial Eta Squared (η^2)
Self-Efficacy	Group	27.38	<0.001*	0.31
Quality of Life	Group	31.56	<0.001*	0.34

As presented in Table 6, significant between-group differences were observed for caregiver self-efficacy ($F = 27.38$, $p < 0.001$, $\eta^2 = 0.31$) and quality of life ($F = 31.56$, $p < 0.001$, $\eta^2 = 0.34$). These findings indicate that caregivers in the intervention group achieved significantly higher self-efficacy and quality of life scores than those in the control group, with moderate-to-large effect sizes.

Pairwise comparisons were conducted separately within the intervention and control groups. In the intervention group, caregiver self-efficacy significantly improved from baseline to post-test 1 (mean

difference = -6.11, $p < 0.001$), baseline to post-test 2 (mean difference = -8.33, $p < 0.001$), and post-test 1 to post-test 2 (mean difference = -2.22, $p < 0.001$). Similar patterns were observed for quality of life, with significant improvements from baseline to post-test 1 (mean difference = -13.04, $p < 0.001$), baseline to post-test 2 (mean difference = -18.22, $p < 0.001$), and post-test 1 to post-test 2 (mean difference = -5.18, $p < 0.001$). Although significant changes were also observed in the control group, the magnitude of improvement was consistently smaller than in the intervention group (Table 7).

Table 7. Within-Group Pairwise Comparisons of Caregiver Self-Efficacy and Quality of Life Across Measurement Point

Variable	Study Group	Comparison	Mean Difference	SE	P-value	95% CI
Self-Efficacy	Intervention	Baseline vs Post-test 1	-6.11	0.79	<0.001	-7.72 to -4.50
		Baseline vs Post-test 2	-8.33	0.86	<0.001	-10.08 to -6.58
		Post-test 1 vs Post-test 2	-2.22	0.55	<0.001	-3.34 to -1.10
	Control	Baseline vs Post-test 1	-2.51	0.79	0.003	-4.12 to -0.90
		Baseline vs Post-test 2	-3.73	0.86	<0.001	-5.48 to -1.98
		Post-test 1 vs Post-test 2	-1.22	0.55	0.034	-2.34 to -0.10
Quality of Life	Intervention	Baseline vs Post-test 1	-13.04	1.67	<0.001	-16.45 to -9.63
		Baseline vs Post-test 2	-18.22	2.02	<0.001	-22.34 to -14.10
		Post-test 1 vs Post-test 2	-5.18	1.37	<0.001	-7.97 to -2.39
	Control	Baseline vs Post-test 1	-6.04	1.67	0.001	-9.45 to -2.63
		Baseline vs Post-test 2	-9.22	2.02	<0.001	-13.34 to -5.10
		Post-test 1 vs Post-test 2	-3.18	1.37	0.027	-5.97 to -0.39

Note: Negative mean difference indicates an increase in scores from baseline to post-test

4. DISCUSSION

This study demonstrated that a self-efficacy-based family empowerment intervention significantly improved caregiver self-efficacy and quality of life among family caregivers of patients with type 2 diabetes mellitus (T2DM). Caregivers in the intervention group showed greater improvement across repeated measurements than those receiving standard education alone. These findings indicate that caregiver empowerment is not only beneficial for improving caregiving knowledge but also for strengthening confidence, coping ability, and multidimensional well-being (Jiang & Wang, 2025). This is particularly important because family caregivers often provide long-term daily support for patients with T2DM, including medication reminders, dietary

supervision, symptom monitoring, emotional support, and facilitation of healthcare access (Setyoadi et al., 2023).

The intervention's structure may explain the improvement in caregiver self-efficacy. The program combined interactive education, guided practice, discussion, caregiver self-monitoring, problem-solving, and follow-up reinforcement. These components may have helped caregivers develop mastery experience, clarify caregiving roles, and increase confidence in managing diabetes-related care demands (Meyer et al., 2023; Zhang et al., 2023). Previous studies have shown that self-efficacy is closely associated with diabetes self-management, quality of life, and adaptation to long-term disease care (Eshtaya et al., 2025; Pahn et al., 2025). In the caregiver context, stronger self-efficacy may

improve emotional regulation, reduce uncertainty, and support more effective caregiving behavior. The significant improvement in caregiver quality of life suggests that the intervention addressed not only technical caregiving skills but also psychosocial needs (Meyer et al., 2023; Edmunds et al., 2025).

Caregivers of patients with chronic illness may experience fatigue, stress, social restriction, and financial strain due to prolonged caregiving responsibilities. Recent evidence from Indonesian caregivers of older adults with T2DM shows that caregiver burden, depression symptoms, and social support are important determinants of caregiver quality of life (Siregar et al., 2025). Similar studies have also reported that caregiver burden is associated with poorer well-being and reduced caregiving capacity (Kristaningrum et al., 2021). Therefore, the improvement observed in this study may reflect the effect of empowerment strategies in reducing perceived caregiving difficulty and increasing caregivers' ability to manage their role. The sustained improvement at post-test 2 indicates that the benefits of the intervention were maintained beyond the structured educational sessions. This may be attributed to the home-based

reinforcement, caregiver checklists, and follow-up communication incorporated into the program (Bel et al., 2026). Family-supported and community-based diabetes interventions have been shown to improve self-management behavior, psychosocial outcomes, and continuity of care (Ka et al., 2018; Matrook et al., 2025). In this study, follow-up support may have helped caregivers apply the skills learned during the sessions into daily caregiving practice, thereby sustaining improvements in confidence and quality of life.

The findings are consistent with previous evidence showing that family empowerment and caregiver-oriented interventions improve diabetes care outcomes. Rondhianto et al. (2024) reported that family caregiver empowerment improved caregivers' capability to support T2DM self-management. Family-based interventions have also been shown to improve diabetes-related outcomes through enhanced family participation, behavioral support, and reinforcement of self-management (Baig et al., 2015; Eshtaya et al., 2025). These results support the idea that chronic diabetes management should involve both patients and family caregivers because much of diabetes care occurs at home rather than in clinical settings

([American Diabetes Association](#), 2025). The present study contributes to the literature by focusing specifically on caregiver outcomes, particularly caregiver self-efficacy and quality of life ([National Institute of Health](#), 2023). Many diabetes interventions primarily evaluate patient-centered outcomes such as glycemic control, self-care behaviors, or health status, whereas caregiver well-being is examined less frequently ([Alzawahreh & Ozturk](#), 2024; [Haeruddin et al.](#), 2026).

This study demonstrates that strengthening caregiver self-efficacy may be a meaningful pathway for improving caregiver quality of life. The findings also support a conceptual pathway in which family empowerment enhances caregiver self-efficacy, strengthens caregiving competence, reduces caregiving strain, and improves overall quality of life ([Setyoadi et al.](#), 2026). From a nursing and primary healthcare perspective, these findings suggest that caregiver empowerment should be integrated into routine diabetes management. Nurses can implement structured caregiver education, role clarification, guided practice, emotional support, and follow-up monitoring as part of family-centered chronic disease care ([Rojas-oca & Bego](#), 2021). Such interventions may

be especially relevant in Indonesia and other family-oriented settings where relatives play a central role in long-term illness management ([Teli et al.](#), 2024). Digital and nurse-led interventions may also be considered to support continued caregiver engagement, particularly when face-to-face follow-up is limited ([Araújo et al.](#), 2025).

Several limitations should be acknowledged. The quasi-experimental design may limit causal inference, and purposive sampling may reduce generalizability. The sample was drawn from a limited number of primary healthcare centers in a single geographic area, and the follow-up period was relatively short. In addition, all patients in both the intervention and control groups were older than 45 years, indicating a restricted age distribution within the study population. Although this age profile may reflect the characteristics of patients with T2DM attending the participating primary healthcare centers, the absence of younger adults further limits the generalizability of the findings to the broader T2DM population, as caregiving demands, family roles, and self-management needs may differ across life stages. Caregiver self-efficacy and quality of life were also measured using self-reported questionnaires, which may introduce

response bias. Nevertheless, the use of repeated measurements and standardized intervention procedures strengthens the internal consistency of the findings. Future studies should employ randomized controlled trials with larger and more age-diverse samples, include participants from multiple healthcare settings, extend follow-up periods, and incorporate objective indicators of caregiver outcomes, such as caregiver burden, stress biomarkers, service utilization, and patient-caregiver dyadic outcomes.

5. CONCLUSIONS

The self-efficacy-based family empowerment intervention significantly improved caregiver self-efficacy and quality of life among family caregivers of patients with type 2 diabetes mellitus. Caregivers who participated in the intervention demonstrated greater and more sustained improvement across repeated measurements compared with those receiving standard education alone. These findings suggest that structured empowerment programs integrating education, guided practice, emotional support, and self-efficacy enhancement may strengthen caregivers' confidence, coping capacity, and overall well-being in managing

long-term diabetes care. The sustained intervention effects observed at follow-up indicate that continued reinforcement and family-centered support contribute to maintaining positive caregiving adaptation beyond the formal intervention period. This study highlights the importance of integrating caregiver-focused empowerment strategies into community-based primary healthcare services to support sustainable diabetes management and improve caregiver outcomes.

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AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study. SS collected the data, drafted and revised the manuscript. DDSLI supervised the study, performed the statistical analysis and critically revised the manuscript. AWK and SA contributed to the methodology,

performed the statistical analysis and critically revised the manuscript. All authors read and approved the final version.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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DATA AVAILABILITY

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

DECLARATION OF USE OF AI

During the preparation of this work, the authors used Grammarly to assist with language and grammar editing. The authors take full responsibility for reviewing, verifying, and revising all AI-assisted output, and for ensuring the accuracy, validity, originality, and integrity of the manuscript's content.

REFERENCES

- Ahmad, F., & Joshi, S. H. (2023). Self-Care Practices and Their Role in the Control of Diabetes: A Narrative Review. *Cureus*, 15(7). <https://doi.org/10.7759/cureus.41409>
- Aljuaid, M., Ilyas, N., Altuwaijri, E., Albedawi, H., Alanazi, O., Shahid, D., & Alonazi, W. (2022). Quality of Life among Caregivers of Patients Diagnosed with Major Chronic Disease during COVID-19 in Saudi Arabia. *Healthcare*, 10(3), 1–15. <https://doi.org/10.3390/healthcare10030523>
- Alzawahreh, S., & Ozturk, C. (2024). 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 Corresponding Author : JMIR Form Res, 8(e64463), 1–12. <https://doi.org/10.2196/64463>
- American Diabetes Association. (2025). Diagnosis and Classification of Diabetes: Standards of Care in Diabetes-2025. *Diabetes Care*, 48 (January), 27–49. <https://doi.org/10.2337/dc25-S002>

- Araújo, F., Cardoso, C., Sá, M., & Lopes, M. (2025). Efficacy of digital technology-based interventions for reducing caregiver burden and stress: a systematic review and meta-analysis. *Front. Digit. Health*, 7(2), 1–12. <https://doi.org/10.3389/fdgth.2025.1636084>
- Baig, A. A., Benitez, A., Quinn, M. T., & Burnet, D. L. (2015). Family interventions to improve diabetes outcomes for adults. *Annals of the New York Academy of Sciences*, 1353(1), 89–112. <https://doi.org/10.1111/nyas.12844>
- Bandura, A. (1993). Perceived Self-Efficacy in Cognitive Development and Functioning. *Educational Psychologist*, 28(2), 117–148. [https://www.itma.vt.edu/courses/tel/resources/bandura\(1993\)_self-efficacy.pdf](https://www.itma.vt.edu/courses/tel/resources/bandura(1993)_self-efficacy.pdf)
- Bel, M., Jim, S., & Bel, A. (2026). Acta Psychologica Psychoeducational intervention against support groups for caregivers: A randomised controlled trial of its effectiveness. *Acta Psychologica*, 265(1), 1–12. <https://doi.org/10.1016/j.actpsy.2026.106676>
- Dailah, H. G. (2024). The Influence of Nurse-Led Interventions on Diseases Management in Patients with Diabetes Mellitus: A Narrative Review. *Healthcare (Switzerland)*, 12(3). <https://doi.org/10.3390/healthcare12030352>
- Edmunds, S. R., Renaud, M., Goodrum, N. M., Bradshaw, J., Cooper, D. K., & Ingersoll, B. (2025). Caregiver Self-Regulation as a Key Factor in the Implementation Potential of Caregiver-Mediated Interventions. *Behavioral sciences (Basel, Switzerland)*, 15(10), 1336. <https://doi.org/10.3390/bs15101336>
- Eshtaya, R., Ayed, A., Malak, M. Z., & Shehadeh, A. (2025). The association between diabetes management self-efficacy and quality of life among Palestinian patients with type 2 diabetes. *BMC Primary Care*, 26(1), 1–9. <https://doi.org/10.1186/s12875-025-02980-1>
- Guo, F., Li, L., Jiang, H., Yu, J., & Wang, Y. (2024). Effectiveness of a family empowerment program on caregiving capacity and adverse mood in caregivers of children with acute leukemia : a quasi-experimental study.

- BMC Nurs, 23(1), 1–9. <https://doi.org/10.1186/s12912-024-01973-2>
- Haeruddin, H., Amiruddin, R., Yusuf, S., Naiem, M. F., Sidin, A. I., Wahiduddin, W., Wahyu, A., Kurnyata, M., Kada, R., Ma, A., & Harbaeni, H. (2026). Exploring Self-Care Interventions to Improve Glycemic Control in Type 2 Diabetes Mellitus : A Scoping Review. *F1000Research*, 15(371), 1–18. <https://doi.org/10.12688/f1000research.177355.1>
- Huang, H., Liao, Y., Kung, P., Shyu, Y. L., Hsu, W., & Hsu, J. (2024). Caregiving management needs and predictors for family caregivers of persons with dementia : a cross-sectional study. *BMC Geriatr*, 24(724), 1–12. <https://doi.org/10.1186/s12877-024-05316-3>
- IDF. (2021). International Diabetes Federation (Vol. 102, Issue 2). <https://diabetesatlas.org/atlas/tenth-edition/>
- Jiang, Y., & Wang, L. (2025). Caregiver Empowerment Interventions for Post-Stroke Incontinence : A Narrative Review of Chinese and International Practices. *Journal of Multidisciplinary Healthcare*, 19(1), 6965–6974. <https://doi.org/10.2147/JMDH.S552868>
- Ka, M., Cowman, S., Sm, D., Sm, S., McGilloway, S., & DI, W. (2018). Family-based interventions for adults with type 2 diabetes mellitus (Protocol). *Cochrane Database Syst Rev*, 1(7), 1–19. <https://doi.org/10.1002/14651858.CD013064>
- Kristaningrum, N. D., Ramadhani, D. A., Hayati, Y. S., & Setyoadi. (2021). Correlation between the burden of family caregivers and health statuof people with diabetes mellitus. *Journal of Public Health Research*, 10(2), 326–331. <https://doi.org/10.4081/jphr.2021.2227>
- Martínez-Melero, I., Ruiz-García, M. J., Ruiz-Merino, G., & García-Rubio, A. (2025). Impact of a community-based educational intervention on the burden and health-related quality of life of informal caregivers. *Geriatric Nursing*, 65, 103513. <https://doi.org/10.1016/j.gerinurse.2025.103513>
- Matrook, K. A., Whitford, D. L., Smith, S. M., McGilloway, S., Piyasena, M. P., & Cowman, S. (2025). Family-based

interventions for adults with type 2 diabetes mellitus: A systematic review and meta-analysis. *Primary care diabetes*, 19(2), 111–119. <https://doi.org/10.1016/j.pcd.2025.01.006>

in Katingan Districts, Central Kalimantan, Indonesia. *International Journal of Nursing and Health Services (IJNHS)*, Volume 5, Issue 3. pg. 234-241. <https://doi.org/10.35654/ijnhs.v5i3.575>

Meyer, K., Glassner, A., Norman, R., James, D., Sculley, R., Lealvasquez, L., Hepburn, K., Lui, J., & White, C. (2023). Caregiver Self-Efficacy Improves Following Complex Care Training: Results from the Learning Skills Together Pilot Study. *Geriatr Nurs*, 45(1), 147–152. <https://doi.org/10.1016/j.gerinurse.2022.03.013>

National Institute of Health. (2023). The Caregiver's Handbook. NIH Publication. https://order.nia.nih.gov/sites/default/files/2023-03/caregivers-handbook-nia_o.pdf

Mphasha, M. H., Skaal, L., Mothiba, T. M., Ngoatle, C., Hlahla, L. S., & Group, F. (2023). Primary health care – family partnership for better diabetes outcomes of patients : a systematic review Primary health care – family partnership for better diabetes outcomes of patients : a systematic review. *Global Health Action*, 16(1), 1–12. <https://doi.org/10.1080/16089677.2022.2140517>

Niño-de-Guzman Quispe, E., Bracchiglione, J., Ballester, M., Groene, O., Heijmans, M., Martínez García, L., Noordman, J., Orrego, C., Rocha, C., Suñol, R., & Alonso-Coello, P. (2023). Patients' and informal caregivers' perspectives on self-management interventions for type 2 diabetes mellitus outcomes: a mixed-methods overview of 14 years of reviews. *Archives of Public Health*, 81(1), 1–21. <https://doi.org/10.1186/s13690-023-01153-9>

Natawirarindry, Catherine, and Guino-o, Theresa A. (2022). Quality of Caregiver Services and Quality of Life among Chronic Illness Undergoing Home Care

Pahn, J., Yang, Y., & Kim, S. H. (2025). Factors influencing self-management and health-related quality of life in low-income patients with diabetes: a predictive model. *International journal of nursing studies advances*, 8, 100349.

<https://doi.org/10.1016/j.ijnsa.2025.100>

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Pamungkas, R. A., Chamroonsawasdi, K., & Vatanasomboon, P. (2017). A systematic review: Family support integrated with diabetes self-management among uncontrolled type II diabetes mellitus patients. *Behavioral Sciences*, 7(3), 1–17. <https://doi.org/10.3390/bs7030062>

Rojas-oca, M. J., & Bego, E. (2021). Educational interventions by nurses in caregivers with their elderly patients at home. *Primary Health Care Research & Development*, 22(e26), 1–11. <https://doi.org/10.1017/S1463423621000086>

Rondhianto, R., Kushariyadi, K., & Rahmatullah, M. N. (2024). The Effect of Family Caregiver Empowerment Model Intervention on Fear of Hypoglycemia in People with Type 2 Diabetes Mellitus. *Nurse Media Journal of Nursing*, 14(2), 267–278. <https://doi.org/10.14710/nmjn.v14i2.56893>

Rondhianto, R., Nursalam, N., Kusnanto, K., & Melaniani, S. (2022). The effect of family caregiver empowerment interventions on family caregiver

capabilities in self-management of type 2 diabetes mellitus in Indonesia. *Enfermeria clinica (English Edition)*, 32(6), 385–395. <https://doi.org/10.1016/j.enfcle.2022.01.005>

Schwarzer, R. & J. (1995). Generalized Self-Efficacy Scale In Measures in health psychology: A users portfolio. Causal control beliefs, edited by Weinman, J., Wright, S., Johnston, M., pp. 35-37, Nfer-Nelson, 1995. <https://psycnet.apa.org/doi/10.1037/t00393-000>

Seng, J. J. B., Gwee, M. F. R., Yong, M. H. A., Kwan, Y. H., Thumboo, J., & Low, L. L. (2023). Role of Caregivers in Remote Management of Patients With Type 2 Diabetes Mellitus: Systematic Review of Literature. *Journal of Medical Internet Research*, 25(1), 1–11. <https://doi.org/10.2196/46988>

Setyoadi, Fransiskus, L., Seda, S., Lestari, P., & Irwando, E. (2023). Family Empowerment as Nursing Intervention for Families with Type 2 Diabetes Mellitus: A Literature Review. *Jurnal Kesehatan Komunitas Indonesia*, 3(3), 267–280. <https://doi.org/10.58545/jkki.v3i3.203>

- Setyoadi, S., Dewi, D., Lestari, S., Hayati, Y. S., Efendi, F., & Haryanto, J. (2026). Path Analysis of Family Communication , Decision-Making , and Caregiver Burden on Family Caregivers ' Quality of Life: The Mediating Role of Self-Efficacy. *Nurse Media Journal of Nursing*, 16(April), 17–29. <https://doi.org/10.14710/nmjn.v16i1.73159>
- Setyoadi, Yusuf, A., Kristianingrum, N. D., Hayati, Y. S., Noviyanti, L. W., & Syafiky, N. F. (2023). The correlation between family support and health status in patients om m er ci al us e on m er al. *Jurnal Kesehatan Komunitas Indonesia*, 11, 1–6. <https://doi.org/10.58545/jkki.v3i3.203>
- Siregar, R., Kritpracha, C., Chinnawong, T., & Latour, J. M. (2025). Quality of life among Indonesian family caregivers caring for dependent older persons with type 2 diabetes mellitus in the community: A cross-sectional, correlational study. *Belitung Nursing Journal*, 11(1), 48–58. <https://doi.org/10.33546/bnj.3683>
- Stepanian, N., Larsen, M. H., Mendelsohn, J. B., Mariussen, K. L., & Heggdal, K. (2023). Empowerment interventions designed for persons living with chronic disease - a systematic review and meta - analysis of the components and efficacy of format on patient - reported outcomes. In *BMC Health Services Research* (Vol. 6). BioMed Central. <https://doi.org/10.1186/s12913-023-09895-6>
- Teli, M., Thato, R., Hasan, F., & Rias, Y. A. (2024). Effectiveness of Family-Based Diabetes Management Intervention on Glycated Haemoglobin Among Adults With Type 2 Diabetes: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Biological Research for Nursing*, 26(2), 315–333. <https://doi.org/10.1177/10998004231218887>
- White, C. L., Barrera, A., Turner, S., Glassner, A., Brackett, J., Rivette, S., & Meyer, K. (2022). Family caregivers' perceptions and experiences of participating in the learning skills together intervention to build self-efficacy for providing complex care. *Geriatric Nursing*, 45, 198–204. https://doi.org/10.1016/j.geri_nurse.2022.04.012

World Health Organization. (2026). World

Diabetes Day 2026: Early action on diabetes. Geneva: World Health Organization; [cited 2026 Sep 21]. <https://www.who.int/campaigns/world-diabetes-day/2026>

Zhang, J., Zhang, Z., Zhang, K., Ge, X., Sun, R., & Zhai, X. (2023). Early detection of type 2 diabetes risk: limitations of current diagnostic criteria. *Frontiers in endocrinology*, 14, 1260623. <https://doi.org/10.3389/fendo.2023.1260623>