Journal of Integrative Nursing and Palliative Care (JINPC)

Original Article

Volume 5 | Issue 1 | Page 100-112

Patient-Centered Nursing Interventions for Type 2 Diabetes: Exploring Coping Mechanisms and Self-Management Practices

Sanjay Vora[1], Manisha Pillai[2], Abhishek Basu[1,2*], Charu Bhatia[1], Rajiv Menon[2]

[1]*All India Institute of Medical Sciences, Sri Aurobindo Marg, Ansari Nagar East, New Delhi, Delhi, 110029, India.*

[2]*Madras Diabetes Research Foundation, No 4, Conran Smith Road, Gopalapuram, Chennai, 600 086, India*

Abstract

Diabetes is a chronic illness that can significantly disrupt everyday life. Proper self-care is essential to regulate blood sugar and reduce the risk of complications. This research investigated the impact of a structured education program on diabetes patients' self-management habits, empowerment, and level of engagement in their care. A quasi-experimental study included 100 adults aged 30–65. The 16-week program had three phases: an initial two-week period for recruitment and baseline assessment using the DSMQ, DES, and PAM; a 12-week intervention with weekly 90-minute sessions covering nutrition, physical activity, medication adherence, stress coping, and self-empowerment; and a two-week follow-up with repeated assessments. Statistical analyses included paired t-tests for DSMQ and DES, chi-square tests for PAM, and descriptive statistics, with significance set at $p < 0.05$. After completing the program, participants' self-management, empowerment, and activation improved significantly. DSMQ scores rose from 64.5 to 68.6 ($p < 0.001$), DES scores increased from 65.4 to 70.0 ($p = 0.001$), and those at the highest PAM level went from 30 to 50 ($p = 0.016$). Positive relationships among DSMQ, DES, and PAM indicate that gains in one area supported improvements in the others. The structured education program enhanced patients' diabetes self-care, sense of empowerment, and engagement. These results emphasize the importance of targeted educational interventions in fostering patient involvement in chronic disease management. Future programs should focus on the specific needs of diverse and socio-economically disadvantaged populations to improve access to diabetes self-management education and overall health outcomes.

Keywords: Diabetes, Self-care, Empowerment, Patient engagement, Education program, Chronic disease

Introduction

Chronic diseases, particularly diabetes, represent a major global health challenge. Type 2 diabetes (T2DM), characterized by insulin resistance and a relative deficiency of insulin, is increasing rapidly worldwide and placing significant pressure on healthcare systems [1, 2]. Currently, approximately 422 million people are living with diabetes, mostly in low- and middle-income countries. With the disease directly causing around 1.5 million deaths annually, understanding its impact is critical. In response, the World Health Organization has set a goal to curb the rise of diabetes and obesity by 2025 [3]. In Egypt, the prevalence of diabetes is higher than the average in the Middle East and North Africa (MENA) region. According to the International Diabetes Federation, an estimated 15.6% of Egyptians aged 20–79 years have T2DM, with rates expected to increase further due to changes in diet, reduced physical activity, and urbanization. These trends underscore the need for diabetes management strategies tailored to Egypt's socio-economic and cultural context [4-6].

Corresponding author: Abhishek Basu
Address: All India Institute of Medical Sciences, Sri Aurobindo Marg, Ansari Nagar East, New Delhi, Delhi, 110029, India; Madras Diabetes Research Foundation, No 4, Conran Smith Road, Gopalapuram, Chennai, 600 086, India
E-mail: ✉ a.basu_89@outlook.com
Received: 19 January 2024; **Accepted:** 17 April 2024; **Published:** 30 June 2024

How to Cite This Article: Vora S, Pillai M, Basu A, Bhatia C, Menon R. Patient-Centered Nursing Interventions for Type 2 Diabetes: Exploring Coping Mechanisms and Self-Management Practices. J Integr Nurs Palliat Care. 2024;5(1):100-12. doi:10.51847/JiIJYt9txC

Effective management of T2DM requires a comprehensive approach, including lifestyle modification, medication adherence, regular monitoring, and patient education. Nurses play a central role in this process, as they are well-positioned to provide education, guidance, and empowerment to patients. Research indicates that nursing interventions can enhance self-management behaviors and improve glycemic control by actively engaging patients and supporting their knowledge acquisition [7–11]. Globally recognized programs, such as the Diabetes Prevention Program in the United States and integrated care models in Europe and Australia, highlight the importance of combining education, behavioral support, and community engagement, which can be adapted to different cultural settings [12–14].

Patient empowerment is a critical component of diabetes care. Empowered individuals gain the knowledge, skills, and confidence needed to manage their condition effectively. Such patients are more likely to adhere to treatment plans, adopt healthy behaviors, and achieve better health outcomes [15–20]. However, socio-economic factors—including income, education, and healthcare access—significantly influence diabetes management. Patients with lower socio-economic status often face barriers to education and necessary medical resources, which can hinder self-management and worsen outcomes [21–23].

Health promotion and wellness interventions also play an essential role in reducing diabetes complications. Nurses, due to their frequent interactions with patients, can deliver guidance on nutrition, physical activity, and stress management [24, 25]. Integrating coping strategies is particularly important, as diabetes is frequently associated with psychological challenges like anxiety and depression. Effective coping skills can strengthen patients' mental well-being and enhance their self-management capabilities [26, 27].

Despite strong evidence supporting nursing interventions, challenges remain in implementing effective strategies for diabetes management. Limited access to care and education, insufficient self-management support, and additional socio-economic, cultural, and infrastructural barriers continue to impede progress [28–30]. This review focuses on a comprehensive nursing intervention program designed to empower T2DM patients through educational sessions, individualized support, and coping strategies aimed at improving self-management skills and patient-centered outcomes.

Aim of the study

This study aims to examine the effectiveness of a structured diabetes self-management education program in improving patients' self-management behaviors, empowerment, and activation levels.

Materials and Methods

Study design

A quasi-experimental, single-group pre-test/post-test design was employed to evaluate the impact of nursing interventions on diabetes management. This approach enabled the comparison of outcomes before and after the intervention, providing insights into its effectiveness. A randomized controlled trial was not feasible due to ethical considerations, as withholding potentially beneficial interventions from some participants would be inappropriate. Additionally, practical limitations such as time, resources, and participant availability necessitated a flexible approach. The quasi-experimental design allowed for real-world evaluation of the nursing program while maintaining participant welfare, thereby offering valuable evidence on the intervention's effectiveness.

Study setting and sample size

This research was carried out in several healthcare centers across Zagazig City, Egypt, which serve patients with diverse backgrounds and access to medical services. To determine the required number of participants, G*Power software was used with a power of 0.80, an alpha of 0.05, and a medium effect size (Cohen's d = 0.5), resulting in an estimated sample of 80. To account for possible dropouts, the study enrolled 100 participants, ensuring the results would be statistically robust.

Addressing confounding factors

Various factors, such as age, gender, socio-economic status, co-existing health conditions, psychological state, and medication adherence, could influence diabetes outcomes. To manage these, the study employed stratified random sampling to achieve a balanced representation across different demographics. Baseline information—including education, income, and lifestyle behaviors—was collected, and multivariable regression analyses were applied to control for these variables during data analysis. This approach strengthens confidence that observed improvements resulted from the nursing interventions rather than external factors.

Sampling method

A stratified random sampling strategy was used to ensure the study included a representative mix of Type 2 diabetes patients from all districts of Zagazig City, including Al-Qenayat, Al-Kawmeya, Al-Sharq, Al-Ahrar, and

Al-Munira. The population was divided into subgroups based on key characteristics: district, age categories (30–45, 46–55, 56–65), and gender.

A comprehensive list of eligible patients was compiled from healthcare records. Within each stratum, participants were randomly selected using a lottery or random number generator. If a selected individual declined participation, another from the same subgroup was randomly chosen to maintain balanced representation. This careful process enhances transparency, reproducibility, and ensures the findings reflect the city's diverse population, making them applicable to similar urban settings in Egypt.

Recruitment process

Participants were recruited through multiple channels to ensure inclusivity. Informational sessions explained the study's purpose, procedures, and benefits, while printed materials were displayed in clinic waiting areas. Physicians also referred patients who met the inclusion criteria. All participants provided informed consent, confirming they understood the study objectives, potential risks, and their rights. This approach ensured ethical recruitment while maximizing participation and representativeness.

Inclusion and exclusion criteria

This study recruited adults between 30 and 65 years old who had a confirmed diagnosis of Type 2 diabetes and were actively managing their condition through medications, diet, or other prescribed strategies. Participants were required to live within the study area, consent to participate, and be able to attend all intervention sessions.

Certain individuals were excluded to ensure safety and consistency. This included patients with serious medical conditions, such as advanced heart failure, cancer, or end-stage kidney disease, as well as those with significant psychiatric disorders like severe depression, schizophrenia, or anxiety that might interfere with participation. Patients with other chronic illnesses requiring priority care, such as COPD or autoimmune diseases, were also excluded. Individuals already taking part in other diabetes programs or studies, those with cognitive impairments, unstable housing, frequent relocations, or dependence on alcohol or tobacco were not eligible. Additionally, patients who lacked consistent access to healthcare resources, such as insurance or reliable transportation, were excluded to ensure full participation in the program.

Data collection instruments

Demographic information

A structured form was used to collect participants' personal and socio-economic information. Key variables included age, gender, education, marital status, employment, and income. Clinical data, including duration of diabetes, current treatment regimen, and family history of diabetes, were also recorded. Collecting these details allowed the research team to understand factors that might influence how participants manage their diabetes and respond to interventions. Socio-economic factors, in particular, were considered critical because they can affect access to care, adherence to treatment, and overall health literacy.

Diabetes self-management questionnaire (DSMQ)

The DSMQ, created by Schmitt *et al.* [31], evaluates how well patients manage their diabetes, particularly behaviors affecting blood glucose control. It contains 16 items covering four areas: glucose monitoring, diet, physical activity, and healthcare use. Responses are rated on a four-point scale, from 0 (not applicable) to 3 (fully applies). Total scores range from 0 to 100, with higher scores reflecting better self-management. Subscale scores are also calculated to identify areas needing improvement. The tool has proven reliable and valid, and higher DSMQ scores are associated with improved HbA1c levels.

Diabetes empowerment scale (DES)

The DES, developed by Anderson *et al.* [32], measures patients' sense of empowerment in managing their diabetes, with a focus on psychological and behavioral aspects of self-care. The 28-item questionnaire addresses areas like managing the emotional aspects of diabetes, satisfaction with self-care, and ability to set and reach health goals. Each item is rated on a 5-point scale, giving total scores from 28 to 140. Higher scores indicate stronger empowerment and confidence in managing diabetes. The DES is widely validated and applicable across different populations and clinical settings.

Patient activation measure (PAM)

The Patient Activation Measure (PAM), developed by Hibbard and Gilburt [33], is a widely used tool for assessing a patient's knowledge, skills, and confidence in managing their own health. It evaluates multiple dimensions of engagement, including understanding one's condition, making informed decisions, and taking proactive steps in health management. The PAM includes statements rated on a four-point Likert scale, with total scores ranging from 0 to 100; higher scores reflect greater activation and readiness to participate in healthcare decisions. Research

indicates that higher PAM scores are linked to improved health outcomes, making this tool valuable for both clinical assessments and intervention planning aimed at enhancing patient engagement.

Validity and reliability

The study ensured the accuracy and credibility of its instruments through rigorous validation procedures. A pilot study involving 10% of the total sample (10 participants) was conducted before the main study to test the DSMQ, DES, and PAM. Participants were selected to represent diverse ages, genders, and socio-economic backgrounds. They completed all three tools and provided feedback regarding clarity, cultural relevance, and appropriateness. Minor adjustments were made based on their responses to improve comprehension and ensure the instruments accurately measured the intended constructs. Factor analysis confirmed the construct validity of the DSMQ, DES, and PAM, verifying that they effectively assessed diabetes self-management and empowerment.

Internal consistency was evaluated using Cronbach's alpha, yielding high reliability: DSMQ = 0.86, DES = 0.91, and PAM = 0.84, all exceeding the acceptable threshold of 0.70. These findings confirm that the tools are both valid and reliable for assessing diabetes self-management and empowerment in this population. Pilot participants were not included in the main data analysis.

Program Structure: 16-week nursing intervention for diabetes self-management (April–August 2024)

The 16-week nursing intervention, conducted from April to August 2024, was designed to equip patients with the skills needed for effective Type 2 diabetes self-management. The program followed a structured four-stage framework: assessment, planning, implementation, and review.

The initial two-week pre-test phase involved participant recruitment and baseline assessment. Recruitment was conducted via informational brochures posted at healthcare centers and physician referrals within Zagazig City. Baseline measurements included the DSMQ, DES, and PAM, alongside the distribution of a culturally adapted Arabic-language booklet on diabetes management.

The core of the program was a 12-week intervention phase (May–July 2024), featuring weekly 90-minute educational sessions. Week three focused on the fundamentals of Type 2 diabetes, its complications, and the importance of glycemic control, using interactive methods such as lectures, multimedia presentations, and group discussions. In week four, emphasis shifted to nutrition and physical activity, with practical cooking demonstrations and personalized exercise plans. Week five introduced coping strategies and stress management techniques, including mindfulness practices, relaxation exercises, and structured workshops to strengthen participants' psychological resilience and self-management skills.

Weeks 6–8: Medication, self-empowerment, and review

During the sixth week, participants focused on understanding their medications and improving adherence. They learned how to follow their prescriptions correctly, prevent low blood sugar, and recognize potential side effects. The seventh week centered on building self-empowerment. Patients were guided to set realistic health goals, manage their diabetes independently, and navigate the healthcare system confidently. Group discussions and peer mentoring provided a practical, hands-on component to strengthen these skills. Week eight served as a consolidation period. Participants summarized their knowledge, shared personalized self-management plans, and addressed any unresolved questions, ensuring that learning was fully reinforced.

Weeks 9–12: Reinforcement and support

The final four weeks focused on sustaining the habits and skills developed earlier. Nurses conducted weekly check-ins through phone calls or clinic visits, helping participants stay on track, solve challenges, and maintain motivation. Peer support was also encouraged via WhatsApp groups, allowing participants to share experiences, exchange tips, and motivate each other. This combination of professional guidance and peer interaction helped maintain engagement and adherence to self-management behaviors.

Post-Test and clinical assessment

The program concluded with a two-week post-test in August 2024. Participants completed the DSMQ, DES, and PAM again to measure improvements in self-management, empowerment, and activation. Clinical outcomes, including HbA1c, blood pressure, and body mass index, were also recorded to evaluate the physiological impact of the intervention.

Educational approach and materials

Throughout the program, participants used culturally appropriate educational resources, including an Arabic-language booklet and multimedia presentations. The program blended interactive sessions, practical demonstrations, peer support, and ongoing follow-ups to create lasting behavior changes. By providing continuous reinforcement and culturally tailored guidance, the intervention aimed to empower patients with Type 2 diabetes to take control of their health, improve their self-management skills, and enhance their quality of life **(Table 1)**.

Table 1. Final summary table of the 16-week program

Phase	Week	Activity	Key Focus
Pre-test phase	Week 1–2	Recruitment and baseline assessments	DSMQ, DES, PAM, clinical measures (HbA1c, BMI, BP)
Intervention phase	Week 3	Introduction and diabetes basics	Understanding diabetes and complications
	Week 4	Dietary management	Nutrition education and meal planning
	Week 5	Physical activity	Exercise routines and the importance of physical activity
	Week 6	Medication adherence	Medication management, understanding regimens
	Week 7	Stress management	Mindfulness, relaxation, coping strategies
	Week 8	Empowerment through self-management	Goal setting and healthcare system navigation
	Week 9	Review and reinforcement	Recap, group discussions, self-management plans
	Week 10–12	Follow-up and continuous support	Ongoing peer and nurse support
Post-test phase	Week 13–14	Post-intervention assessments and clinical evaluations	DSMQ, DES, PAM, clinical measures (HbA1c, BMI, BP)
Evaluation	Final Phase	Statistical analysis and thematic analysis of feedback	Comparison of pre-and post-test results, feedback evaluation

Ethical considerations

This study was conducted with strict attention to ethical standards to protect participants' rights and well-being. Approval was granted by the Research Ethics Committee at the Faculty of Nursing, Zagazig University, Egypt (ID/Zu. Nur. REC#: 00212). Before joining the study, each participant signed an informed consent form confirming their understanding of the study's aims, procedures, potential risks, and expected benefits. Confidentiality was rigorously maintained, and participants had the right to leave the study at any stage. The research adhered to both national and international ethical guidelines, ensuring respect for every participant's dignity and autonomy.

Statistical analysis

Data were analyzed using SPSS version 26. Descriptive statistics summarized participants' demographic characteristics, with categorical variables expressed as frequencies and percentages. To evaluate the impact of the intervention, paired t-tests compared pre- and post-intervention scores for the DSMQ and DES, both showing significant improvements ($p < 0.05$). Changes in PAM levels, which are categorical, were analyzed using Chi-square tests, revealing significant shifts in activation. Correlation analyses explored the relationships between DSMQ, DES, and PAM scores, highlighting interconnected improvements in self-management, empowerment, and activation. Multiple regression analyses were also performed to identify which baseline factors, such as age and gender, predicted post-intervention outcomes.

Results and Discussion

Participant characteristics

The study enrolled 100 participants with a broad age distribution. The 41–50 age group represented the largest segment (21.3%), followed by those aged 51–60 (18.7%) and 30–40 (12.0%). Women made up 44.0% of the sample, while men represented 22.7%. Education levels were varied, with 27.0% holding a college degree or higher. Nearly half of the participants (48.0%) were unemployed, reflecting socioeconomic challenges. Most participants were married (32.0%) and classified as middle class (32.0%). A family history of diabetes was reported by 29.3%, suggesting possible genetic influence.

Diabetes self-management questionnaire (DSMQ)

The DSMQ scores showed clear improvements across all areas. The overall mean score increased from 64.5 (SD = 10.4) before the program to 68.6 (SD = 9.8) afterward ($t = 3.98$, $p < 0.001$). The Glucose Management subscale showed the largest improvement, rising from 70.2 (SD = 11.0) to 75.4 (SD = 10.5) ($t = 3.45$, $p < 0.001$). **Figure 1** illustrates these changes across the DSMQ domains.

Diabetes empowerment scale (DES)

DES scores reflected increased empowerment. The mean score improved from 65.4 (SD = 11.9) pre-intervention to 70.0 (SD = 11.2) post-intervention ($t = 3.27$, $p = 0.001$). All subdomains, including psychosocial management and goal-setting, showed positive changes. For instance, goal-setting improved from 70.0 (SD = 11.5) to 75.1 (SD = 10.9) ($t = 3.63$, $p < 0.001$), demonstrating increased confidence in managing diabetes.

Patient activation measure (PAM)

Patient activation improved substantially. Those in Level 1 (0–49) decreased from 55 to 40 participants ($\chi^2 = 7.45$, $p = 0.024$), while participants reaching Level 4 (80–100) increased from 30 to 50 ($\chi^2 = 8.25$, $p = 0.016$). **Figure 2** visualizes the pre- and post-intervention PAM levels.

Correlations among measures

Positive correlations were observed between DSMQ, DES, and PAM scores, both before and after the intervention. The DSMQ total score correlated with DES at 0.58 pre-intervention and 0.65 post-intervention ($p \leq 0.001$), indicating that improvements in self-management were associated with increased empowerment and activation. These findings suggest that the intervention strengthened participants' behavioral and psychological engagement in diabetes management.

Table 7 summarizes the results of the multiple regression analysis examining predictors of post-intervention outcomes. The analysis revealed that baseline scores on the DSMQ, DES, and PAM were significant predictors of improvements following the intervention. Specifically, the pre-intervention DSMQ score showed a strong positive association with post-intervention DSMQ outcomes ($B = 0.45$, $p \leq 0.001$). Additionally, certain demographic factors contributed to variations in post-intervention scores. Age had a modest but significant positive effect ($B = 0.20$, $p = 0.047$), whereas gender was also influential, with male participants showing slightly lower post-intervention scores ($B = -1.00$, $p = 0.048$). These results suggest that both initial self-management abilities and demographic characteristics play a role in determining the extent to which participants benefit from the diabetes self-management program.

Table 2. Demographic characteristics of participants

Demographic Variable	Frequency (*n*)	Percentage (%)
Age		
- 30–40 years	18	12.0
- 41–50 years	32	21.3
- 51–60 years	28	18.7
- 61–65 years	22	14.7
Gender		
- Male	34	22.7
- Female	66	44.0
Educational Level		
- Less than High School	24	16.0
- High School	36	24.0
- College or Higher	40	27.0
Employment Status		
- Employed	28	18.7
- Unemployed	72	48.0
Marital Status		
- Married	48	32.0
- Single	24	16.0
- Divorced/Widowed	28	18.7
Socio-economic Status		
- Low	36	24.0
- Middle	48	32.0
- High	16	10.7
Family History of Diabetes		
- Yes	44	29.3
- No	56	37.3

Table 3. Diabetes self-management questionnaire (DSMQ) scores

Component	Pre-Intervention Mean Score (SD)	Post-Intervention Mean Score (SD)	Test Value (t)	*p*-value
Glucose management	70.2 (11.0)	75.4 (10.5)	3.45	< 0.001
Dietary control	65.0 (12.5)	68.2 (12.0)	2.87	0.005
Physical activity	55.4 (13.8)	58.7 (14.3)	2.54	0.015
Health care use	68.0 (11.2)	72.1 (11.8)	3.12	0.002
Total DSMQ Score	64.5 (10.4)	68.6 (9.8)	3.98	< 0.001

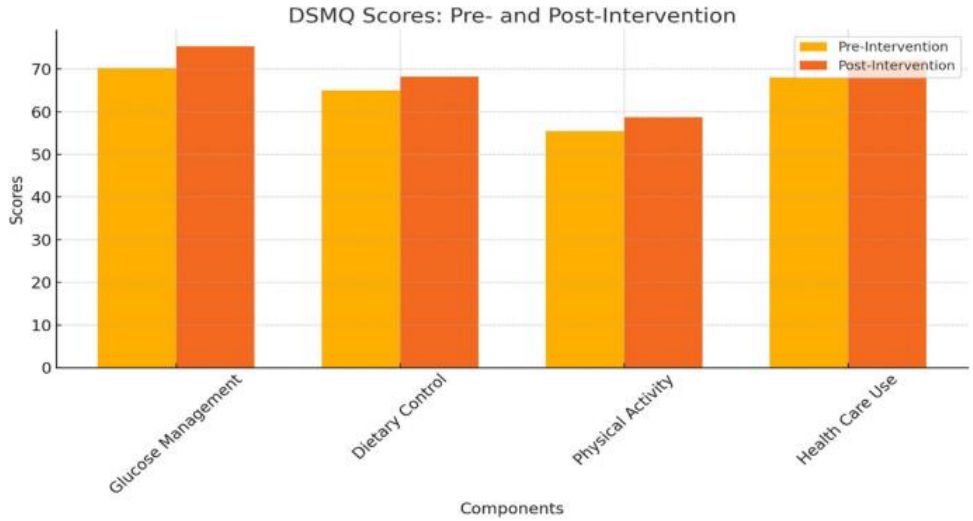

Figure 1. Pre- and post-intervention DSMQ scores by component

Table 4. Diabetes empowerment scale (DES) scores

DES Dimension	Pre-Intervention Mean Score (SD)	Post-Intervention Mean Score (SD)	Test Value (t)	*p*-value
Psychosocial aspects	65.2 (14.3)	70.3 (15.2)	2.98	0.003
Personal satisfaction	61.0 (12.2)	64.7 (12.6)	2.57	0.012
Goal setting	70.0 (11.5)	75.1 (10.9)	3.63	< 0.001
Total DES Score	65.4 (11.9)	70.0 (11.2)	3.27	0.001

Table 5. Patient activation measure (PAM) scores

PAM Level	Pre-Intervention Frequency (*n*)	Post-Intervention Frequency (*n*)	Chi-Square (χ^2)	*p*-value
Level 1 (0–49)	55	40	7.45	0.024
Level 2 (50–64)	75	60	3.45	0.063
Level 3 (65–79)	85	100	4.12	0.042
Level 4 (80–100)	30	50	8.25	0.016

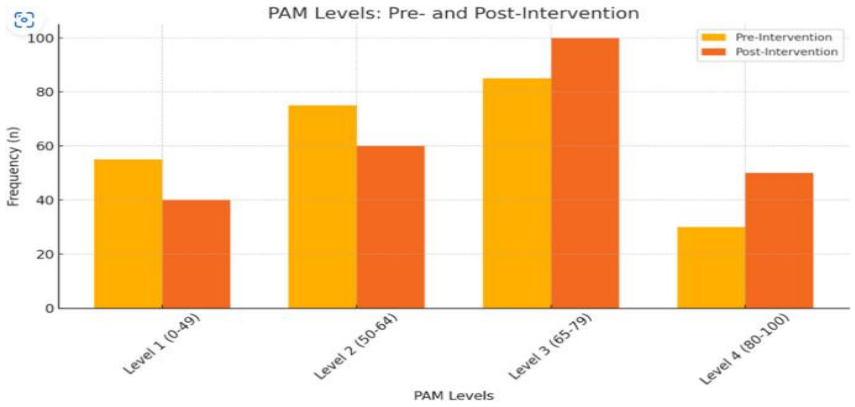

Figure 2. Pre- and post-intervention distribution of PAM levels

Table 6. Correlation between DSMQ, DES, and PAM scores

Variable Pair	Pre-Intervention Correlation Coefficient (*r*)	Post-Intervention Correlation Coefficient (*r*)	*p*-value
DSMQ Total Score & DES Total Score	0.58	0.65	< 0.001
DSMQ Total Score & PAM Score	0.55	0.58	< 0.001
DES Total Score & PAM Score	0.67	0.70	< 0.001

Table 7. Multiple regression analysis results

Outcome Variable	Independent Variables	Coefficient (B)	Standard Error	t-value	*p*-value
Post-DSMQ Score	Pre-DSMQ Score	0.45	0.05	9.00	< 0.001
	Age	0.20	0.10	2.00	0.047
	Gender (Male = 1, Female = 0)	-1.00	0.50	-2.00	0.048
Post-DES Score	Pre-DES Score	0.38	0.06	6.33	< 0.001
	Education Level (College or Higher = 1)	2.50	0.75	3.33	0.001
Post-PAM Score	Pre-PAM Score	0.32	0.07	4.57	< 0.001
	Socio-economic Status (Higher Status = 1)	1.80	0.85	2.12	0.034

The marked improvement in Diabetes Self-Management Questionnaire (DSMQ) scores following the intervention highlights the program's success in enhancing self-management behaviors. These findings align with prior research showing that structured diabetes education can improve glucose control, medication adherence, and overall self-care practices [34–40]. In particular, the significant gains in glucose management observed here reinforce the value of organized self-care education as a key strategy for reducing complications and improving metabolic outcomes in patients with Type 2 diabetes.

The increases in Diabetes Empowerment Scale (DES) scores suggest that the intervention effectively strengthened patients' confidence and goal-setting capabilities. Empowering patients is essential for promoting active participation in their care. Evidence indicates that empowerment-focused programs enhance psychosocial adaptation, self-efficacy, and goal-directed behaviors, supporting long-term adherence to healthy routines and more proactive self-management [41–46]. These improvements reflect the importance of interventions that build both knowledge and self-confidence in diabetes care.

Similarly, the Patient Activation Measure (PAM) outcomes demonstrated meaningful improvements in participants' willingness and ability to manage their health. The observed decrease in the number of participants at the lowest activation level, coupled with an increase at the highest level, supports prior findings that tailored educational and behavioral interventions can significantly raise patient activation [47–50]. Higher activation is consistently associated with healthier behaviors, better adherence, and improved disease management, underscoring the importance of incorporating strategies that foster engagement in self-care.

The positive correlations observed between DSMQ, DES, and PAM scores indicate that improvements in self-management, empowerment, and activation are closely linked. Participants who gained confidence in managing their diabetes were also more likely to feel empowered and take active responsibility for their care. This synergistic

relationship aligns with previous research showing that empowered and activated patients engage in proactive health behaviors, which can enhance overall disease management [21, 50–53].

Multiple regression analysis further revealed that baseline self-management and empowerment levels were strong predictors of post-intervention outcomes. This is consistent with literature suggesting that initial skill and confidence levels significantly influence the effectiveness of behavioral interventions [20, 54–59]. Demographic factors also played a role, with older participants and females showing greater improvements. This may reflect older adults' heightened responsiveness to health education due to cumulative health risks and the tendency of females to engage more actively in empowerment-based interventions [60–65].

Despite these positive short-term outcomes, the sustainability of these improvements over the long term remains uncertain. The study's follow-up period was relatively brief, limiting insights into whether gains in self-management, empowerment, and activation persist without continued support. Future studies should explore long-term effects and investigate factors that either facilitate or impede sustained improvements, including social support, healthcare access, and the integration of technology-based interventions.

In summary, the observed enhancements in empowerment and activation have important implications for diabetes management. As patients become more confident and engaged, they are likely to maintain improved self-management behaviors and achieve better health outcomes. Future research should prioritize longitudinal studies to assess the durability of these changes and their influence on long-term disease trajectories. Incorporating empowerment and activation strategies into diabetes care programs can provide healthcare professionals with effective tools to support patients in achieving optimal health outcomes.

Study Implications

The results of this study highlight the value of incorporating personalized, targeted interventions in diabetes management. The observed improvements in self-management behaviors, empowerment, and patient activation suggest that healthcare providers should adopt a dual-focused approach, balancing clinical treatment with patient education and support strategies that foster autonomy. The strong associations between self-management, empowerment, and activation indicate that progress in one area can positively influence the others. These findings emphasize the need for holistic, patient-centered diabetes care models that account for individual demographic factors, including age, education level, and socio-economic status. The study also draws attention to the social and economic barriers faced by many patients, as nearly half of the participants were unemployed. This underscores the importance of designing public health strategies that address both medical and social determinants of health. By enhancing self-management skills and empowerment, healthcare systems can better equip patients to take active roles in their care, potentially lowering long-term healthcare costs while improving quality of life.

Conclusion

In summary, structured, patient-centered interventions play a critical role in enhancing self-management behaviors, empowerment, and patient activation in individuals with diabetes. Statistically significant improvements were observed across all measured components (DSMQ, DES, and PAM), demonstrating the effectiveness of educational programs in equipping patients with the knowledge, skills, and confidence needed for effective diabetes management. However, several limitations, such as potential selection bias and reliance on self-reported measures, must be considered when interpreting the findings. The positive interconnections among the measured constructs suggest that enhanced self-management promotes greater empowerment and activation, thereby improving overall patient health and well-being. Larger-scale studies are needed to confirm these results and provide insights into the mechanisms underlying these improvements. The combination of education, behavioral support, and goal-setting likely contributed to durable behavioral changes, supporting the adoption of comprehensive, patient-centered care models that extend beyond clinical treatment to foster patient engagement and autonomy.

Recommendations

Based on the findings, several recommendations emerge for healthcare practice and policy. First, diabetes management programs should deliver tailored educational and behavioral interventions that consider the specific needs and demographics of patients. The study highlights significant socio-economic disparities among participants, with many unemployed and a notable proportion having a family history of diabetes. Therefore, future interventions should address both medical and social determinants, potentially incorporating economic support or community resources to assist patients facing financial challenges.

Second, given the strong link between empowerment and improved self-management, healthcare systems should prioritize strategies that build patient confidence and competence. Digital health tools, such as mobile applications and telemedicine, could expand the reach of educational interventions, particularly in underserved communities.

Additionally, future research should evaluate different intervention formats, such as group versus individual sessions, and explore the impact of peer support.
Policy-wise, integrating such programs into standard diabetes care pathways would help ensure equitable access to these critical resources. Extended follow-up periods, ideally six to twelve months post-intervention, are recommended to assess the durability of improvements in self-management, empowerment, and activation. Studies should also examine factors that sustain these benefits, including ongoing support and availability of resources, to optimize long-term outcomes.

Study Limitations

Despite offering valuable insights, this study has several limitations. First, all measures (DSMQ, DES, and PAM) relied on self-report, which may introduce response bias and not fully reflect actual patient behaviors. Future research should consider incorporating objective assessments, such as HbA1c levels or clinical examinations, to validate outcomes. Second, the relatively short follow-up period restricts understanding of the long-term sustainability of observed improvements, highlighting the need for longitudinal studies with extended monitoring. Third, the sample was not fully representative of the broader population, with a predominance of female participants and individuals from middle-class backgrounds. Finally, although empowerment interventions are effective, their implementation may face challenges in diverse socio-economic and cultural contexts. Variations in healthcare access, cultural norms, and individual circumstances can influence both the effectiveness and acceptability of these strategies. Future research should address these factors to enhance the relevance and applicability of empowerment-based interventions in real-world settings.

Acknowledgments: None.

Conflict of interest: None.

Financial support: None.

Ethics statement: None.

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