

Impact of Pharmacist-Led Diabetes Education Programs on Patient Outcomes: A Quantitative Analysis of Glycemic Control, Patient Knowledge, and Self-Management Behaviors

Saad M. Aldhafyan¹, Mazen S. Alotaibi², Waseem N. Alshahrani³,
Abdullah A. Alahmari⁴

Pharmacist

Health affairs at the Ministry of National Guard

Abstract

Background: Effective diabetes education is crucial for improving patient outcomes in diabetes management. This study evaluates the impact of pharmacist-led diabetes education programs on glycemic control, patient knowledge, and self-management behaviors.

Methods: A randomized controlled trial was conducted involving 150 patients with type 2 diabetes. Participants were randomly assigned to either a pharmacist-led diabetes education program or standard care. Outcomes were assessed using HbA1c levels, Diabetes Knowledge Test (DKT) scores, and Diabetes Self-Management Questionnaire (DSMQ) scores, measured at baseline and 6 months.

Results: The intervention group showed a significant reduction in HbA1c levels (mean decrease of 0.7% vs. 0.1% in the control group, $p < 0.001$). Diabetes knowledge improved significantly (mean increase of 12.2 points vs. 1.4 points, $p < 0.001$), and self-management behaviors also enhanced (mean increase of 14.4 points vs. 1.4 points, $p < 0.001$).

Conclusions: Pharmacist-led diabetes education programs significantly improve glycemic control, diabetes knowledge, and self-management behaviors in patients with type 2 diabetes. These findings support the integration of such programs into routine diabetes care to enhance patient outcomes.

Keywords: Pharmacist-led education, diabetes management, glycemic control, patient knowledge, self-management, randomized controlled trial.

Introduction

Diabetes mellitus, a chronic condition characterized by elevated blood glucose levels, presents significant challenges for management and patient outcomes. Effective diabetes care involves not only pharmacological treatment but also comprehensive patient education to facilitate self-management and lifestyle modifications (Chamberlain, 2016). As the prevalence of diabetes continues to rise globally, there is an increasing need for effective and scalable strategies to improve patient outcomes (Cho et al., 2018).

Pharmacists have become integral in diabetes management due to their expertise in medication management and patient education. Pharmacist-led diabetes education programs are designed to enhance patient understanding of diabetes, improve medication adherence, and support behavioral changes necessary for effective self-management (Ko et al., 2016). These programs often include structured sessions on glycemic control, dietary advice, exercise recommendations, and techniques for monitoring blood glucose levels.

Evidence suggests that pharmacist-led interventions can significantly improve glycemic control, increase patient knowledge about diabetes, and promote better self-management behaviors. Studies have reported that patients receiving pharmacist-led education achieve lower HbA1c levels and exhibit higher levels of diabetes-related knowledge and self-care practices compared to those receiving standard care (Pousinho et al., 2016; Bukhsh et al., 2018). However, there is a need for more rigorous quantitative analyses to fully understand the impact of these programs and to identify specific areas where they contribute to improved patient outcomes.

This study aims to analyze the effectiveness of pharmacist-led diabetes education programs by evaluating their impact on glycemic control, patient knowledge, and self-management behaviors. By providing a comprehensive quantitative analysis, this research seeks to contribute to the growing body of evidence supporting the role of pharmacists in enhancing diabetes care.

Literature Review

Diabetes Education and Self-Management: Diabetes education is crucial for effective diabetes management, as it empowers patients to make informed decisions about their health, adhere to treatment regimens, and implement lifestyle changes (Chamberlain, 2016). Numerous studies have demonstrated that comprehensive diabetes education programs significantly improve glycemic control and overall patient outcomes. For instance, a meta-analysis by Norris et al. (2002) found that diabetes self-management education was associated with a modest but significant reduction in HbA1c levels, highlighting the importance of patient education in managing diabetes effectively.

Role of Pharmacists in Diabetes Management: Pharmacists play a pivotal role in diabetes management due to their expertise in medication therapy and patient education. Pharmacist-led diabetes education programs have gained prominence as an effective strategy to enhance patient outcomes. Research by Pousinho et al. (2016) shows that pharmacist-led interventions are effective in improving glycemic control, with a significant reduction in HbA1c levels compared to standard care. This is supported by a study by Ko et al. (2016), which reported that patients who received pharmacist-led education experienced better glycemic control and higher satisfaction with their diabetes care.

Comparative Effectiveness of Pharmacy-Led Programs: Pharmacy-led diabetes education programs often involve structured sessions that cover various aspects of diabetes management, including medication adherence, lifestyle modifications, and self-monitoring techniques. These programs are typically compared to standard care or other interventions to assess their effectiveness. A study by Bukhsh et al. (2018) conducted a meta-analysis of pharmacist-led diabetes education programs and found that these programs were associated with significant improvements in HbA1c levels, diabetes knowledge, and self-management behaviors compared to control groups.

Patient Knowledge and Self-Management: Increasing patient knowledge about diabetes and enhancing self-management behaviors are key goals of diabetes education programs. Research has shown that pharmacist-led programs can significantly improve patients' understanding of their condition and empower them to take control of their health. A study by Bukhsh et al. (2018) highlighted that pharmacist interventions improved patients' diabetes knowledge and self-management practices, leading to better clinical outcomes. This aligns with findings from a more recent study by Van Eikenhorst et al. (2017), which emphasized that patient education by pharmacists results in improved self-management and adherence to treatment regimens.

Gaps in Current Research: Despite the evidence supporting the effectiveness of pharmacist-led diabetes education programs, there are still gaps in the literature regarding the specific components of these programs that contribute to improved outcomes. Further research is needed to identify the most effective strategies for implementing these programs and to evaluate their long-term impact on patient outcomes. Additionally, more rigorous quantitative studies are required to assess the comparative effectiveness of pharmacy-led programs against other diabetes management strategies.

Methodology

Study Design: This research employed a quantitative, randomized controlled trial (RCT) design to assess the impact of pharmacist-led diabetes education programs on glycemic control, patient knowledge, and self-management behaviors among individuals with type 2 diabetes. The study aimed to compare the effectiveness of these programs against standard care in a primary care setting.

Participants: The study was conducted at a tertiary hospital over a 12-month period. A total of 200 participants with a diagnosis of type 2 diabetes, aged 18–75 years, were recruited. Participants were randomly assigned to either the intervention group or the control group using a computer-generated randomization process.

Intervention : The intervention group received a comprehensive pharmacist-led diabetes education program consisting of six sessions over a 3-month period. Each session lasted approximately 45 minutes and covered the following topics: diabetes pathophysiology, medication management, lifestyle modifications, glucose monitoring, and self-management strategies. The sessions were conducted by trained clinical pharmacists with expertise in diabetes care. Participants in the intervention group also received personalized action plans and follow-up support via phone and email.

The control group continued with standard care, which included routine diabetes management provided by their primary care providers without additional structured education sessions.

Outcome Measures: The primary outcomes were:

- 1. Glycemic Control:** Measured by changes in HbA1c levels from baseline to 6 months. HbA1c was assessed using standard laboratory methods.
- 2. Patient Knowledge:** Evaluated using the Diabetes Knowledge Test (DKT), a validated instrument to measure participants' understanding of diabetes management, administered at baseline and 6 months.
- 3. Self-Management Behaviors:** Assessed through the Diabetes Self-Management Questionnaire (DSMQ), which evaluates various aspects of self-management such as medication adherence, dietary habits, and physical activity, administered at baseline and 6 months.

Data Collection: Data were collected at three time points: baseline (prior to intervention), 3 months (after completing the education program for the intervention group), and 6 months (to assess long-term outcomes). Blood samples for HbA1c testing were collected at baseline and 6 months. The DKT and DSMQ were administered at baseline and 6 months through self-report questionnaires.

Statistical Analysis: Descriptive statistics were used to summarize demographic and baseline characteristics of participants. Between-group differences in HbA1c levels, DKT scores, and DSMQ scores were analyzed using independent t-tests or Mann-Whitney U tests, depending on the distribution of the data. Paired t-tests or Wilcoxon signed-rank tests were used to compare pre- and post-intervention scores within groups. Additionally, multivariate analysis of covariance (ANCOVA) was employed to adjust for potential confounding variables such as age, gender, and baseline HbA1c levels. Statistical significance was set at $p < 0.05$.

Ethical Considerations: The study was approved by the ethics committee. Informed consent was obtained from all participants prior to enrollment. Confidentiality of participant data was maintained throughout the study, and all procedures adhered to ethical guidelines for research involving human subjects.

Findings

Participant Characteristics: A total of 200 participants were recruited and randomized into either the intervention group (n=100) or the control group (n=100). Baseline characteristics were similar between the two groups, as shown in Table 1.

Table 1. Baseline Characteristics of Participants

Characteristic	Intervention Group (n=100)	Control Group (n=100)	p-value
Age (years)	58.2 ±8.4	57.8 ±8.1	0.675
Gender (Male)	45 (45%)	44 (44%)	0.878
Duration of Diabetes (years)	9.3 ±5.2	9.0 ±5.0	0.625
Baseline HbA1c (%)	8.2 ±1.1	8.3 ±1.2	0.532
Education Level (%)			
High School or Less	30 (30%)	32 (32%)	0.742
Some College	40 (40%)	38 (38%)	0.654
College Degree	30 (30%)	30 (30%)	1.000

Effectiveness of Intervention

Glycemic Control: Table 2 shows the changes in HbA1c levels from baseline to 6 months. The intervention group experienced a statistically significant reduction in HbA1c compared to the control group.

Table 2. Changes in HbA1c Levels

Group	Baseline HbA1c (%)	6-Month HbA1c (%)	Change in HbA1c (%)	p-value
Intervention Group	8.2 ±1.1	7.5 ±1.0	-0.7 ±0.9	<0.001
Control Group	8.3 ±1.2	8.2 ±1.1	-0.1 ±0.8	0.078

Patient Knowledge: Table 3 presents the changes in Diabetes Knowledge Test (DKT) scores. Participants in the intervention group demonstrated significant improvements in diabetes knowledge compared to those in the control group.

Table 3. Changes in Diabetes Knowledge Test (DKT) Scores

Group	Baseline DKT Score	6-Month DKT Score	Change in DKT Score	p-value
Intervention Group	68.3 ±12.4	80.5 ±10.1	12.2 ±7.5	<0.001
Control Group	67.8 ±12.7	69.2 ±12.5	1.4 ±5.1	0.002

Self-Management Behaviors: Table 4 summarizes the changes in Diabetes Self-Management Questionnaire (DSMQ) scores. The intervention group showed significant improvements in self-management behaviors compared to the control group.

Table 4. Changes in Diabetes Self-Management Questionnaire (DSMQ) Scores

Group	Baseline DSMQ Score	6-Month DSMQ Score	Change in DSMQ Score	p-value
Intervention Group	60.2 ±15.3	74.6 ±12.8	14.4 ±8.3	<0.001
Control Group	61.0 ±14.9	62.4 ±15.0	1.4 ±4.2	0.120

Discussion

Summary of Findings: This study investigated the impact of pharmacist-led diabetes education programs on patient outcomes, including glycemic control, diabetes knowledge, and self-management behaviors. The findings demonstrate that the intervention significantly improved these outcomes compared to standard care.

Glycemic Control: The results revealed a substantial reduction in HbA1c levels among participants in the intervention group, with a mean decrease of 0.7% compared to 0.1% in the control group ($p < 0.001$). This is consistent with previous research showing that structured diabetes education programs can effectively lower HbA1c levels (Sokol et al., 2005; Machado et al., 2007). The pharmacist-led approach may offer personalized and more intensive education, which could explain the more significant improvements in glycemic control observed in this study.

Patient Knowledge: The intervention group also demonstrated a notable improvement in diabetes knowledge, with an increase in DKT scores of 12.2 points compared to only 1.4 points in the control group ($p < 0.001$). This aligns with findings from studies indicating that diabetes education programs enhance patient knowledge and understanding of diabetes management (Norris et al., 2002; Delamater et al., 2001). The comprehensive education provided by pharmacists likely contributed to this significant increase in knowledge.

Self-Management Behaviors: Self-management behaviors improved significantly in the intervention group, as evidenced by a 14.4-point increase in DSMQ scores compared to a 1.4-point increase in the control group ($p < 0.001$). This suggests that pharmacist-led programs not only improve knowledge but also positively influence patient behaviors related to diabetes management. Previous research supports the notion that effective diabetes education can lead to better self-management practices and overall disease management (Funnell et al., 2007; Chodosh et al., 2005).

Implications for Practice: The findings of this study underscore the value of integrating pharmacist-led education programs into diabetes care. Pharmacists are well-positioned to provide comprehensive education and support, which can lead to improved clinical outcomes and enhanced patient self-management. Implementing such programs in primary care settings could be a strategic approach to addressing the challenges of diabetes management and improving patient outcomes on a broader scale.

Limitations : Several limitations should be considered. First, the study was conducted in a single geographic region, which may limit the generalizability of the findings. Additionally, the reliance on self-reported measures for diabetes knowledge and self-management behaviors may introduce bias. Future research should consider multi-site studies and incorporate objective measures of behavior change.

Future Research: Further studies are needed to explore the long-term effects of pharmacist-led diabetes education programs and their impact on other patient outcomes, such as quality of life and healthcare utilization. Additionally, research should investigate the cost-effectiveness of these programs to better understand their economic impact.

Conclusion

In conclusion, pharmacist-led diabetes education programs have proven to be effective in improving glycemic control, increasing patient knowledge, and enhancing self-management behaviors. These programs represent a valuable addition to diabetes care, offering a potential strategy for improving outcomes in patients with type 2 diabetes.

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