Research Paper

Effect of a Structured Nurse-led Follow-up on Self-care and Metabolic Indices in Diabetes Patients

Elham Saberi Noghabi[1], Reza Noori[1], Azam Razizadeh[2], Fatemeh Mohammadzadeh[3*]

1. Nursing Research Center, Allameh Bohlool Gonabadi Hospital, Gonabad University of Medical Sciences, Gonabad, Iran.
2. Clinical Research Development Unit, Bohlool Hospital, Gonabad University of Medical Sciences, Gonabad, Iran.
3. Department of Epidemiology & Biostatistics, Social Development & Health Promotion Research Center, School of Health, Gonabad University of Medical Sciences, Gonabad, Iran.

Use your device to scan and read the article online

Citation Saberi Noghabi E, Noori R, Razizadeh A, Mohammadzadeh F. Effect of a Structured Nurse-led Follow-up on Self-care and Metabolic Indices in Diabetes Patients. Journal of Research & Health. 2026; 16(1):39-50. http://dx.doi.org/10.32598/JRH.16.1.2102.4

http://dx.doi.org/10.32598/JRH.16.1.2102.4

ABSTRACT

Background: Diabetes is a metabolic disorder that is associated with several complications. This study aimed to assess the effect of a structured nurse-led post-discharge follow-up plan on self-care behaviors, metabolic control indices, and adverse health outcomes in diabetics.

Methods: A total of 144 adults with diabetes were randomly assigned to intervention and control groups. The intervention group received self-care education and scheduled follow-up with a nurse educator. Data on self-care behaviors, glycosylated hemoglobin A1C (HbA1c), fast blood sugar (FBS), total cholesterol (TC), and adverse health outcomes were collected at the baseline and after a 3-month intervention. Outcome analyses were conducted based on the intention-to-treat principles.

Results: During the three-month project, the intervention group showed a significant increase in self-care behaviors (from 31.17±7.69 to 31.32±13.58, P<0.001), while the control group exhibited no significant change (from 31.17±7.69 to 31.32±13.58, P=0.907). After the intervention, the mean self-care behavior score was significantly higher in the intervention group (B=20.02; 95% confidence interval [CI], 14.49%, 25.56%; P<0.001). Additionally, the mean HbA1c level in the nurse-led follow-up group was 0.70 units lower than in the control group (95% CI, 0.15%, 1.26%; P<0.001). The odds of achieving a good FBS level were significantly higher in the intervention group compared to the control group (odds ratio [OR]=7.79; 95% CI, 1.21%, 50.40%; P<0.001). Furthermore, the mean TC level in the intervention group was 20.31 units lower than in the control group (95% CI, 11.56%, 29.04%; P<0.001).

Conclusion: A structured nurse-led post-discharge follow-up plan significantly improves self-care behaviors and metabolic control in patients with diabetes. Implementing such interventions in routine diabetes care could enhance disease management and reduce the risk of complications.

Keywords: Diabetes mellitus, Hemoglobin A1C (HbA1C), Fast blood sugar (FBS), Patient discharge, Follow-up studies

Article info:
Received: 22 Oct 2024
Accepted: 05 Mar 2025
Publish: 01 Jan 2026

*** Corresponding Author:**
Fatemeh Mohammadzadeh, Assistant Professor.
Address: *Department of Epidemiology & Biostatistics, Social Development & Health Promotion Research Center, School of Health, Gonabad University of Medical Sciences, Gonabad, Iran.*
Phone: *+98 (51) 57223028*
E-mail: *fmhz.uni@gmail.com*

Introduction

Diabetes is a metabolic disorder characterized by hyperglycemia caused by insulin resistance, insulin deficiency, or both [1]. Diabetes is one of the top ten causes of death worldwide and a serious public health concern that imposes a significant global burden on societies [2, 3]. Most developed and developing countries have experienced an increase in diabetes prevalence in recent decades [2]. Diabetes is estimated to impact 642 million people globally by 2040 [4]. According to studies, Iran had a 35% increase in the prevalence of diabetes over six years from 2005 to 2011. By 2030, 9.2 million Iranians are estimated to have diabetes [4, 5].

Diabetes is usually associated with complications, such as cardiovascular diseases, kidney diseases, and neuropathy, which are all significant causes of death [3]. For those with diabetes, the hospitalization rate is, on average, 2-3 times more frequent than for those without diabetes [6, 7]. Compared to non-diabetic patients, patients with diabetes have a greater likelihood of hospital readmission due to various factors, including poor glucose control, medication nonadherence, pharmaceutical side effects, inadequate disease management, and inability to care for themselves [6-8]. The risk of readmission could be heightened by poor patient evaluation at discharge, a flawed discharge program, incomplete communication and information transfer between doctors and patients, and inadequate follow-up after discharge [9]. Effective discharge planning for patients with diabetes can notably improve metabolic parameter control and reduce readmission rates by evaluating patients' requirements during hospitalization and establishing continuity of care after discharge. Patients with diabetes require a structured, well-planned, and comprehensive discharge program that includes ongoing education, monitoring of health behaviors, and reminders of follow-up appointments. Nurses play a key role in implementing a discharge program. They can improve diabetes management by frequently interacting with patients, following up and educating them about the disease, monitoring behavioral changes, and being involved in transition care [10]. A follow-up or continuous care program can establish effective and communication between the patient, their family, and the nurse. Nurses act as follow-up care agents and service providers to identify the needs and problems of patients, help maintain and improve their health, reduce the symptoms of the disease, and increase the level of satisfaction and quality of life of the patients [11].

In response to precipitously rising healthcare costs, Iran's Ministry of Health and Medical Education (IMOHME) launched a nurse-led follow-up plan for three chronic diseases to make the most of limited medical resources, improve disease management and prevent complications. IMOHME began the nurse-led follow-up plan in 2019 as a pilot in selected hospitals. The follow-up nurse is stationed at the hospital and is responsible for the follow-up of patients with chronic diseases who were discharged from hospital wards or referred to the clinic and require training and follow-up. The follow-up process is designed, implemented, and evaluated with the participation of the specialized care team from referral through discharge. Therefore, the current study aimed to assess whether a structured nurse-led post-discharge follow-up plan, designed by IMOHME, could improve self-care behaviors and metabolic control indices and reduce adverse health outcomes in diabetics.

Methods

Design, setting, sampling, and patients

This randomized clinical trial was conducted between May and January 2022. The study participants consisted of 144 type 2 diabetic patients hospitalized at Bohlol Hospital in Gonabad, Iran. The inclusion criteria included a confirmed diagnosis of diabetes by a specialist, discharge from the hospital with referral to the hospital's self-care and follow-up unit, age >18 years, ability to provide informed consent, access to a phone or mobile device, no speech, hearing, or visual impairments, the ability to comprehend and respond to questions, residency in Gonabad, and no history of mental illness. The exclusion criteria included death and refusal to continue participation in the study.

According to the formula for comparing means between two independent groups, the effect size of 0.74 for the hemoglobin A1C (HbA1C) level was based on a similar study [12], with a confidence level of 99%, and a test power of 95%. The minimum required sample size was calculated to be 65 people in each group. The sample size was raised to 72 individuals per group after accounting for a drop rate of 10%.

Randomization

The randomization list was generated by the analyst prior to the intervention, using the web-based platform at [13]. The list was created using random-permutation blocks of sizes 2 and 4 to ensure balanced group allocation. To maintain blinding, the list was concealed in sealed envelopes. Once a patient's eligibility was con-

firmed, the corresponding envelope was opened, and the participant was assigned to either the intervention or the control group.

Interventions

For the intervention group, the nurse-led follow-up plan was implemented. The nurse-led follow-up plan included the assignment and follow-up of hospitalized patients with diabetes, a process designed, implemented, and evaluated with the specialized care team's participation from the time of discharge onward. The patients were referred to the follow-up unit after completing safe discharge procedures in the inpatient department and receiving specialized training from nurses and doctors. The follow-up nurse performed initial assessments to continue the required training after discharge, based on the patiens' history and the developed protocols for training the patient, his companions, and his family at all stages.

After the necessary training in the first session about home care that was provided at the time of discharge, according to the instructions, within 3 to 7 days after discharge in the first phase of follow-up, three phone calls were made to the patients, and based on the checklist, necessary follow-ups and trainings were provided. The subjects of training included the complications of diabetes, the benefits of self-care in preventing complications, the importance of proper physical activity, the importance of following a proper diet, the importance of foot care, and the effects of smoking in the occurrence of complications in patients with diabetes. Additionally, in cases of additional support needs, patients were referred to relevant centers, such as the diabetes clinic, the hospital self-care clinic, health centers, psychologists, addiction and smoking cessation centers, nutrition counselors, and home care facilities. The necessary follow-ups were conducted with the mentioned institutions. The patients were classified into three zones based on the doctor's prescription, the severity of the condition, and warning signals. The frequency of follow-up was determined by patient category. Patients in the green zone were followed-up every two weeks, while those in the yellow zone were followed up every two months. For patients in the red zone, while recommending an immediate visit to the hospital emergency room, a phone follow-up was done up to 6 hours later. Then, the follow-up of these patients was performed twice a week after they were discharged from the hospital until they were in the green zone. The control group underwent routine training and usual follow-up procedures, as well as one additional ordinary follow-up during the study to observe the ethical standards.

Outcomes

The primary outcome was to determine the differences in HbA1C levels between the two groups. The secondary outcomes were to compare the two groups based on self-care behaviors, fast blood sugar (FBS) level, total cholesterol (TC) level, percent of unplanned emergency department revisits, percentage of patients' physical complications after discharge, and percentage of rehospitalization. The outcome variables were measured at the baseline and following the three-month intervention. The last three secondary outcomes were measured as design evaluation indices. The percentage of diabetes patients who were satisfied with the services was also measured following the three-month intervention in the follow-up nursing plan group as another evaluation index of the plan.

Questionnaires

Baseline characteristics questionnaire

It included several items, including age, sex, duration of diabetes, body mass index (BMI) (Kg/m^2), marital status, occupation, educational level, residence, income level, drug type, underlying diseases, history of hospitalization, and diabetes complications.

Farsi self-care of diabetes inventory (FSCODI)

This questionnaire was created in 2017 by an Italian group based on the theory of self-care in chronic diseases [14] and has been translated into ten other languages. The tool comprises 40 items across four dimensions. Each dimension also has several subscales. The dimensions are as follows: Self-care maintenance (12 items; four subscales: Activity-nutritional behavior, smoking avoidance behavior, illness-related behaviors, health-promoting behaviors), self-care monitoring (eight items; three subscales: Symptom monitoring, symptom assessment, and symptom recognition), self-care management (eight items; two subscales: Autonomous self-care and consultative self-care), and self-care confidence (eight items; two subscales: Task-specific self-care confidence and persistence self-care). The items scores are based on a 5-point Likert scale. The scores for each dimension, as well as the overall scale, are standardized to a range of 0-100, with higher scores indicating better self-care. The validity and reliability of the Farsi version of the self-care of diabetes inventory (SCODI) were assessed and confirmed by Ebadi et al. [15]. The F-SCODI demonstrated acceptable validity and reliability. Construct validity was supported through exploratory factor anal-

ysis, which identified distinct factors within each self-care dimension. The tool also exhibited strong internal consistency, with Cronbach's α values ranging from 0.59 to 0.89 across the dimensions, and McDonald's omega coefficients ranging from 0.75 to 0.95, reinforcing the reliability of the factors. Furthermore, test-re-test stability was confirmed with high intra-class correlation coefficients, ranging from 0.62 to 0.92, indicating the tool's reliability over time [15].

Statistical analysis

SPSS software, version 16.0 was used to analyze the data. The normality of the quantitative variables was assessed using the Kolmogorov-Smirnov test. Mean±SD were used to describe quantitative variables, while numbers and percentages were used to describe qualitative variables. Independent sample t-tests and chi-square test were applied to compare the baseline characteristics between the intervention and control groups. Outcome analyses were performed based on the initial group assignment (intention to treat), and all P were two-sided. Despite randomization, the intervention and control groups were significantly different in some baseline characteristics.

Unadjusted effects were assessed using simple linear and logistic regression analyses. Adjusted analysis was performed using multiple regression models, including linear regression for continuous outcomes (HbA1C and TC) and logistic regression for binary outcomes (FBS, unplanned emergency department referral, physical complications after discharge, and re-hospitalization). For each group, we compared the baseline and the final measurement following 3-months intervention using a paired t-test for continuous outcomes (HbA1C and TC) and McNemar's test for FBS as a binary outcome.

Results

Characteristics of the patients

Nine (6%) patients, three (4%) in the control group, and six (8%) in the nurse-led follow-up group, discontinued the trial, all for personal reasons (Figure 1). A total of 135 patients were included in the analysis (dropout rate=6.25%).

Table 1 presents the patients' characteristics in the follow-up and control groups. Age, sex, BMI, marital status, occupation, educational level, residence, income level, drug type, underlying disease, and history of hospitalization did not significantly differ between the two patient groups. However, three baseline characteristics were significantly different between the two groups: Diabetic complications, hospitalization history, and diabetes duration (Table 1).

Intervention effects

Self-care behavior changes

Following 3-month intervention, a significant increase was observed in self-care behaviors and their dimensions in both the unadjusted and the adjusted analysis (Table 2). Based on the results of adjusted analyses the mean of self-care behaviors (20.02; 95% confidence interval [CI], 14.49%, 25.56%; P<0.001) and its dimensions, including self-care maintenance (14.20; 95% CI, 6.71%, 21.67%; P<0.001), self-care monitoring (19.58; 95% CI, 11.19%, 27.97%; P<0.001), self-care management (23.11; 95% CI, 14.01%, 32.21%; P<0.001), and self-care confidence (17.92; 95% CI, 8.17%, 27.68%; P<0.001) was significantly higher in the intervention group.

HbA1C level changes

No significant differences were observed in HbA1C levels between the two groups in unadjusted analysis (P=0.208). However, the adjusted analysis showed that the mean HbA1C level in the nurse-led follow-up group was 0.70 (95% CI, 0.15%, 1.26%) units lower than in the control group (Table 2).

FBS changes

No significant difference was observed between the two groups in the percentage of patients with good FBS levels (P=0.059). However, the adjusted analysis showed that the odds ratio for a good FBS level was significantly higher in the intervention group than in the control group (odds ratio [OR]=7.79; 95% CI, 1.21%, 50.40%) (Table 2).

TC changes

A significant difference was observed in TC levels between the two groups in unadjusted analysis (P<0.001). The adjusted analysis results also showed that the mean TC level in the intervention group was 20.31 (95% CI, 11.56%, 29.04%) units lower than that of the control group (Table 2).

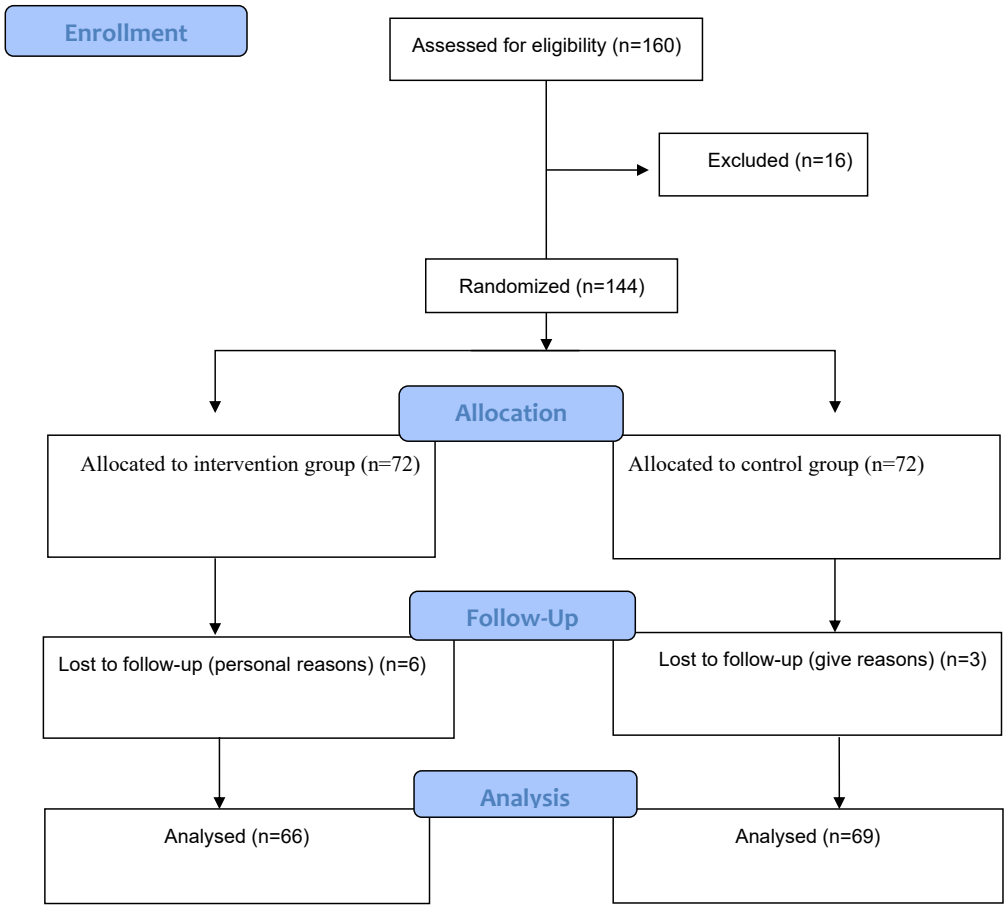

Figure 1. The CONSORT flowchart of the study

Adverse health outcome

No significant relationship was observed between the two groups in the unplanned referral to the emergency department, physical complications after discharge, and re-hospitalization during the trial, in the unadjusted analysis. The adjusted analysis results also showed no statistically significant difference between the intervention and control groups for unplanned emergency department referrals (P=0.714), physical complications after discharge (P=0.166), and re-hospitalization during the trial (P=0.320) (Table 3).

Satisfaction with the intervention

In the intervention group, 66 patients (96.7%) expressed satisfaction with the services.

Discussion

This study examined whether a structured nurse-led post-discharge follow-up could improve self-care behaviors and metabolic control indices, and reduce adverse health outcomes in diabetics.

The results of the present study supported the positive effects of the nurse-led post-discharge follow-up plan on self-care behaviors in patients with diabetes. Effective disease management can be achieved by increasing awareness about the disease, proper use of medication, good adaptation to their diet and physical activities, adopting behaviors, such as self-monitoring and regular medical follow-up. Increasing the individual's self-care behaviors plays a significant role in effective disease management, reducing caregiver load, making diabetes mellitus (DM) treatment easier for patients and caregivers, and enhancing clinical outcomes in patients with type 2 diabetes mellitus (T2DM) [16]. According to studies, patients with diabetes who participate in their own care have a significant impact on the progression and development of their disease [17-19].

Table 1. Characteristics of the participants

Variables		Mean±SD/No. (%)		P
		Nurse-led Follow-up Group (n=69)	Control Group (n=66)	
Age (y)		62.20±9.79	63.62±8.63	0.37*
Duration of diabetes (y)		8.65±6.31	12.90±7.87	0.001*
BMI (Kg/m²)		27.34±2.26	27.27±2.29	0.86*
Sex	Female	40(58.0)	39(59.1)	0.90†
	Male	29(42.0)	27(40.9)	
Marital status	Married	60(87.0)	54(81.8)	0.41†
	Single/widowed	9(13.0)	12(18.2)	
Occupation	Self-employed	9(13.6)	14(20.3)	0.64†
	Retired	16(24.2)	16(23.2)	
	Employee	4(6.1)	2(2.9)	
	Housewife	37(56.1)	37(53.6)	
Educational level	High school or less	64(92.8)	61(92.4)	0.94†
	University	5(7.2)	5(7.6)	
Residence place	Urban	52(75.4)	55(83.3)	0.25†
	Rural	17(24.6)	11(16.7)	
Income level	Sufficient	69(100.0)	64(97.0)	0.24†
	Insufficient	0	2(3.0)	
Drug type	Insulin	10(14.5)	12(18.2)	0.75†
	Oral	45(65.2)	39(59.1)	
	Both	14(20.3)	15(22.7)	
Underlying diseases	Yes	53(76.8)	50(75.8)	0.89†
	No	16(23.2)	16(24.2)	
History of hospitalization	Yes	63(91.3)	18(27.3)	<0.001†
	No	6(8.7)	48(72.7)	
Diabetes complications	Yes	20(29.0)	30(45.5)	0.048†
	No	49(71.0)	36(54.5)	

*Independent two samples t-test, †chi-square test.

Table 2. FBS level, hba1c level, TC level, and self-care behaviors at baseline and following three-month intervention in patients with diabetes

Variables	No. (%)/ Mean±SD			
	Control Group (n=66)		Follow-up Group (n=69)	
	Baseline	End of Trial,	Nurse-led Post-discharge Baseline	End of Trial
FBS	-	-	-	-
Poor control (<70 or >130)	48 (72.7)	45(68.2)	49(71.0)	36(52.2)
Good control (70-130)	18 (27.3)	21 (31.8)	20 (29.0)	33 (47.8)
P[e]	0.250		<0.001	
HbA1C	7.71±1.76	7.71±1.85	8.34±2.01	7.32±1.67
P[f] (MD; 95%CI)	0.971, (0.38; -0.24, 0.24)		<0.001, (-1.01; -1.37, -0.66)	
TC	173.35 (41.21)	174.92 (39.29)	156.23 (50.67)	142.29 (3.28)
P[f], (MD; 95%CI)	0.311, (-1.57; -1.50, 4.66)		<0.001, (-13.94; -21.06, -6.82)	
Self-care maintenance	38.42±7.74	39.90±13.08	39.67±8.67	59.33±18.79
P[f], (MD; 95%CI)	0.379 (1.25; 1.56, 4.06)		<0.001, (18.04; 14.21, 21.86)	
Self-care monitoring	28.93±9.81	31.25±16.22	28.71±9.52	54.94±19.14
P[f], (MD; 95%CI)	0.197 (2.19; -1.16, 5.54)		<0.001, (23.43; 19.13, 27.75)	
Self-care management	21.57±14.10	24.84±17.13	28.63±11.72	54.24±19.02
P[f], (MD; 95%CI)	0.132 (3.32; 1.02, 7.67)		<0.001, (23.94; 19.09, 28.79)	
Self-care confidence	37.12±10.04	32.08±15.97	38.66±12.25	53.08±18.93
P[f], (MD; 95%CI)	<0.001 (9.14; 5.25, 13.03)		< 0.001, (31.04; 26.29, 35.80)	
Self-care behaviors (total score)	31.17±7.69	31.32±13.58	33.22±8.56	53.63±17.42
P[f], (MD; 95%CI)	0.907 (0.18; -2.82, 3.18)		<0.001, (18.40; 14.62, 22.18)	

Variables	Difference in Outcome Variables Between Follow-up and Control Groups at the Baseline and Following Intervention			P[b]
	Unadjusted Analysis		Adjusted Analysis	
	OR (95% CI)/β (95% CI)	P[a]	OR (95% CI)/β (95% CI)	
FBS	Ref	-	Ref	-
Poor control (<70 or >130)	Ref	-	Ref	-
Good control (70-130)	1.96 (0.97, 3.96)	0.059	7.79 (1.21, 50.40)	<0.001
P[e]	-	-	-	-
HbA1C	-0.38 (-0.99, 0.22)	0.208	-0.70 (-1.26, -0.15)	0.013
P[f] (MD; 95%CI)	-	-	-	-

Variables	Difference in Outcome Variables Between Follow-up and Control Groups at the Baseline and Following Intervention			
	Unadjusted Analysis		Adjusted Analysis	P[b]
	OR (95% CI)/β (95% CI)	P[a]	OR (95% CI)/β (95% CI)	
TC	-32.63 (-44.93, -20.33)	<0.001	-20.31 (-29.04, -11.56)	<0.001
P[f], (MD; 95%CI)	-	-	-	-
Self-care maintenance	19.43 (13.90, 24.97)	<0.001	14.20 (6.71, 21.67)	<0.001
P[f], (MD; 95%CI)	-	-	-	-
Self-care monitoring	23.68 (17.63, 29.74)	<0.001	19.58 (11.19, 27.97)	<0.001
P[f], (MD; 95%CI)	-	-	-	-
Self-care management	29.40 (23.23, 35.57)	<0.001	23.11 (14.01, 32.21)	<0.001
P[f], (MD; 95%CI)				
Self-care confidence	26.25 (18.78, 33.72)	<0.001	17.92 (8.17, 27.68)	<0.001
P[f], (MD; 95%CI)				
Self-care behaviors (total score)	22.31 (16.98, 27.65)	<0.001	16.28 (8.70, 23.86)	<0.001
P[f], (MD; 95%CI)				

Abbreviations: OR: Odds ratio; CI: Confidence interval; SD: Standard deviation; HbA1C: Hemoglobin A1C; FBS: Fasting blood sugar; MD: mean difference.

[a]P based on the simple logistic regression,[b]P based on the multiple logistic regression (adjusted for outcome measures at the baseline, diabetes complications, hospitalization history, and duration of diabetes), [c]P based on the simple linear regression; [d]P based on the multiple linear regression (adjusted for outcome measures at the baseline, diabetes complications, hospitalization history, and duration of diabetes), [e]P based on the McNemar's test; [f]P based on the paired t-test.

In the current study, the effect of the nurse-led post-discharge follow-up plan on the metabolic profile was assessed using HbA1C, FBS, and TC indices. Diabetes has been associated with poor glycemic control, resulting in consistently high blood glucose levels measured by HbA1c [20]. A one percent decrease in the HbA1c level is associated with a 25%, 7%, and 18% decrease in death from diabetes, mortality from all causes, and fatal and nonfatal myocardial infarction, respectively [21]. According to the current study, the nurse-led post-discharge follow-up plan improved HbA1c levels. In the nurse-led post-discharge follow-up group, a 1.01% (95% CI, 0.66%, 1.37%) reduction was observed at 12 weeks, and the percentage of patients with good HbA1c levels was increased from 30.4% to 44.9%. In the control group, no significant change in HbA1c levels was observed, and the percentage of patients with a good level of HbA1c decreased inversely from 30.3% to 25.8%. According to ADA standards, FBS levels ranging from 70 to 130 mg/dL were defined as adequate glycemic control [22]. The odds ratio of having FBS between 70 and 130 mg/dL in the nurse-led post-discharge follow-up group was significantly higher than in the control group (OR=7.79; 95% CI, 1.21%, 50.40%). The increase in the percentage of patients with good FBS levels in the nurse-led post-discharge follow-up group (18.8%; 29.0% to 47.8%) was higher than in the control group (4.1%; 27.3% to 31.4%). We also found that the nurse-led post-discharge follow-up group had considerably lower TC levels than the control group. The patients with good cholesterol levels (<200 mg/dL) increased by 11.6% (95% CI, 87%, 98.6%) in the nurse-led post-discharge follow-up plan, whereas the control group increased by 1.5% (95% CI, 77.3%, 78.8%). These achievements may be associated with greater adherence to self-care behaviors in the nurse-led post-discharge follow-up group than in the control group. In line with the above findings, similar studies have shown that a nurse follow-up intervention can improve patients' self-care and glycemic control [23-26].

Table 3. Indices of evaluation of the follow up nursing plan

Variables	No. (%)		Unadjusted Analysis		Adjusted Analysis	
	Nurse-led Post-discharge Follow-up Group	Control Group	OR (95% CI)	P[a]	OR (95% CI)	P[b]
Unplanned referrals to the emergency department	-	-				
Yes	60(87.0)	58(87.9)	1.09 (0.39, 3.01)	0.872	1.32(0.30, 5.85)	0.714
No	9(13.0)	8(12.1)				
Physical complications after discharge	-	-				
Yes	65(94.2)	56(84.8)	0.35 (0.10, 1.16)	0.085	0.33 (0.07, 1.59)	0.166
No	4(5.8)	10(15.2)				
Re-hospitalization during the trial						
Yes	68(98.6)	62(93.9)	0.23 (0.03, 2.10)	0.191	7.85 (0.14, 454.37)	0.320
No	1(1.4)	4(6.1)				

OR: Odds ratio; CI: Confidence interval.

[a]P based on the simple logistic regression, [b]P based on the multiple logistic regression (adjusted for outcome measures at the baseline, diabetes complications, hospitalization history, and duration of diabetes).

In the current study, no significant differences were observed in unplanned emergency department referrals, physical complications after discharge, or re-hospitalization during the trial between the nurse-led post-discharge follow-up and control groups. It might be related to the short duration of follow-up. A similar study in China found a significant reduction in re-hospitalization after a 24-month follow-up [27].

A total of 6.25% dropout rate during the 3-month intervention was a statistically admissible proportion, indicating good consistency of patients with the nurse-led follow-up plan. Moreover, patients' compliance and satisfaction with the nurse-led follow-up plan were generally high. As a result, the possibility of applying this plan on a larger scale in the future appears promising.

Conclusion

A structured nurse-led post-discharge follow-up plan significantly improves self-care behaviors and metabolic control in patients with diabetes. Implementing such interventions in routine diabetes care could enhance disease management and reduce the risk of complications. Further research is recommended to assess the long-term benefits and sustainability of this approach.

Strengths and limitations

The strength of this study includes its randomized clinical trial design, which enhances the reliability of the findings by minimizing bias and ensuring comparability beween the intervention and control groups at baseline. However, the study also has several limitations. One key limitation is the short follow-up duration of only 3 months, which may not have been long enough to observe long-term outcomes such as re-hospitalization, complications, or sustained changes in disease management. While the study showed improvements in metabolic parameters, the short timeframe may have limited the detection of more significant changes in patients' health over the long term. The study was conducted at a single hospital in Gonabad, Iran, which may limit the generalizability of the findings to other regions or healthcare systems with different patient populations or healthcare structures.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Gonabad University of Medical Sciences, Gonabad, Iran (Code: IR.GMU.REC.1400.013). This study was con-

ducted following the guidelines of the Helsinki Declaration. The participants were assured that their identity would be kept private. All participants received information regarding the study's objectives and methodology and participated in the trial with informed consent. Participants had the option to leave the study at any time.

Funding

This research was financially supported by the Clinical Research Development Unit of Bohlool Hospital at Gonabad University of Medical Sciences, Vice Chancellor for Research and Technology.

Authors' contributions

Conceptualization and study design: Elham Saberi Noghabi, Fatemeh Mohammadzadeh; Data analysis: Fatemeh Mohammadzadeh; Data collection: Reza Noori, Elham Saberi Noghabi; Writing and final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

The authors acknowledge and thank the Clinical Research Development Unit of Bohlool Hospital in Gonabad University of Medical Sciences for their contribution to this research project, and also patients with diabetes.

References

[1] Suksomboon N, Poolsup N, Nge YL. Impact of phone call intervention on glycemic control in diabetes patients: A systematic review and meta-analysis of randomized, controlled trials. Plos One. 2014; 9(2):e89207. [DOI:10.1371/journal.pone.0089207] [PMID]

[2] Lin X, Xu Y, Pan X, Xu J, Ding Y, Sun X, et al. Global, regional, and national burden and trend of diabetes in 195 countries and territories: An analysis from 1990 to 2025. Scientific Reports. 2020; 10(1):14790. [DOI:10.1038/s41598-020-71908-9] [PMID]

[3] Deshpande AD, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. Physical Therapy. 2008; 88(11):1254-64. [DOI:10.2522/ptj.20080020] [PMID]

[4] Mirzaei M, Rahmaninan M, Mirzaei M, Nadjarzadeh A. Epidemiology of diabetes mellitus, pre-diabetes, undiagnosed and uncontrolled diabetes in Central Iran: Results from Yazd health study. BMC Public Health. 2020; 20(1):1-9. [DOI:10.1186/s12889-020-8267-y] [PMID]

[5] Esteghamati A, Larijani B, Aghajani MH, Ghaemi F, Kermanchi J, Shahrami A, et al. Diabetes in Iran: Prospective analysis from first nationwide diabetes report of national program for prevention and control of diabetes (NPPCD-2016). Scientific reports. 2017; 7(1):13461. [DOI:10.1038/s41598-017-13379-z] [PMID]

[6] Garg R, Hurwitz S, Rein R, Schuman B, Underwood P, Bhandari S. Effect of follow-up by a hospital diabetes care team on diabetes control at one year after discharge from the hospital. Diabetes Research and Clinical Practice. 2017; 133:78-84. [DOI:10.1016/j.diabres.2017.08.014] [PMID]

[7] Umpierrez GE, Pasquel FJ. Management of inpatient hyperglycemia and diabetes in older adults. Diabetes Care. 2017; 40(4):509-17. [DOI:10.2337/dc16-0989] [PMID]

[8] Magny-Normilus C, Nolido NV, Borges JC, Brady M, Labonville S, Williams D, et al. Effects of an intensive discharge intervention on medication adherence, glycemic control, and readmission rates in patients with type 2 diabetes. Journal of Patient Safety. 2021; 17(2):73. [DOI:10.1097/PTS.0000000000000601] [PMID]

[9] Phillips CO, Wright SM, Kern DE, Singa RM, Shepperd S, Rubin HR. Comprehensive discharge planning with post-discharge support for older patients with congestive heart failure: A meta-analysis. JAMA. 2004; 291(11):1358-67. [DOI:10.1001/jama.291.11.1358] [PMID]

[10] Karam M, Chouinard MC, Poitras ME, Couturier Y, Vedel I, Grgurevic N, et al. Nursing care coordination for patients with complex needs in primary healthcare: A scoping review. International Journal of Integrated Care. 2021; 21(1):16. [DOI:10.5334/ijic.5518] [PMID]

[11] Khorashadizadeh, F, Sefidi N, Taghdisi S, Saadati H, Abbaszadeh A, Bakhtiari M, et al. THE effect of follow-up nurse plan on the level of selfe-care and health anxiety of pregnant mothers with diabetes. Nursing And Midwifery Journal. 2024; 22(4):289-99. [DOI:10.61186/unmf.22.4.289]

[12] Fakharzadeh L, Shahbazian H, Salehinia H, Yaghoobi M, Haghighizadeh M, Karandish M. Effect of telenursing on glycosylated hemoglobin (HbA1c) and anthropometric indexes in type 2 diabetic patients. Modern Care Journal. 2013; 10(2):101-7. [Link]

[13] Sealed Envelope. Randomisation and online databases for clinical trials [Internet]. 2025 [Updated 2025 December 20]. Available from: [Link]

[14] Riegel B, Jaarsma T, Strömberg A. A middle-range theory of self-care of chronic illness. Advances in Nursing Science. 2012; 35(3):194-204. [DOI:10.1097/ANS.0b013e318261b1ba] [PMID]

[15] Ebadi A, Ausili D, Albatineh AN, Salarvand S, Ghanei Ghashlagh R. Psychometric evaluation of the farsi version of the self-care of diabetes inventory in Iranian patients with diabetes. Diabetes, Metabolic Syndrome and Obesity. 2019; 12:2775-2784. [DOI:10.2147/DMSO.S235436] [PMID]

[16] Tiruneh SA, Ayele AA, Emiru YK, Tegegn HG, Ayele BA, Engidaw MT, et al. Factors influencing diabetes self-care practice among type 2 diabetes patients attending diabetic care follow up at an ethiopian general hospital, 2018. Journal of Diabetes and Metabolic Disorders. 2019; 18(1):199-206. [DOI:10.1007/s40200-019-00408-z] [PMID]

[17] Povey RC, Clark-Carter D. Diabetes and healthy eating: A systematic review of the literature. The Diabetes Educator. 2007; 33(6):931-59. [DOI:10.1177/0145721707308408] [PMID]

[18] Boule NG, Haddad E, Kenny GP, Wells GA, Sigal RJ. Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: A meta-analysis of controlled clinical trials. JAMA. 2001; 286(10):1218-27. [DOI:10.1001/jama.286.10.1218] [PMID]

[19] American Diabetes Association Standards of Medical Care in Diabetes - 2009. Diabetes Care. 2009; 32(Suppl 1):S13-S61. [DOI:10.2337/dc09-S013] [PMID]

[20] Nesari M, Zakerimoghadam M, Rajab A, Bassampour S, Faghihzadeh S. Effect of telephone follow-up on adherence to a diabetes therapeutic regimen. Japan Journal of Nursing Science. 2010: 7(2):121-28. [DOI:10.1111/j.1742-7924.2010.00146.x] [PMID]

[21] González-Ortiz M, Martínez-Abundis E, Robles-Cervantes JA, Ramos-Zavala MG, Barrera-Durán C, González-Canudas J. Effect of metformin glycinate on glycated hemoglobin A1C concentration and insulin sensitivity in drug-naive adult patients with type 2 diabetes mellitus. Diabetes Technology & Therapeutics. 2012; 14(12):1140-4. [DOI:10.1089/dia.2012.0097] [PMID]

[22] American Diabetes Association. Standards of medical care in diabetes. Journal of diabetes Care. 2022; 45(Supplement_1):S1–2. [DOI:10.2337/dc22-Sint]

[23] Piette JD, Weinberger M, McPhee SJ, Mah CA, Kraemer FB, Crapo LM. Do automated calls with nurse follow-up improve self-care and glycemic control among vulnerable patients with diabetes?.The American journal of medicine. 2000; 108(1):20-7. [DOI:10.1016/S0002-9343(99)00298-3] [PMID]

[24] Çınar Fİ, Akbayrak N, Çınar M, Karadurmuş N, Şahin M, Doğru T, et al. The effectiveness of nurse-led telephone follow-up in patients with type 2 diabetes mellitus. Turkish Journal of Endocrinology & Metabolism. 2010; 14(1):1. [Link]

[25] Wong FK, Mok MP, Chan T, Tsang MW. Nurse follow-up of patients with diabetes: randomized controlled trial. Journal of Advanced Nursing. 2005; 50(4):391-402. [DOI:10.1111/j.1365-2648.2005.03404.x] [PMID]

[26] Azami G, Soh KL, Sazlina SG, Salmiah M, Aazami S, Mozafari M, et al. Effect of a nurse-led diabetes self-management education program on glycosylated hemoglobin among adults with type 2 diabetes. Journal of Diabetes Research. 2018; 2018:4930157. [DOI:10.1155/2018/4930157] [PMID]

[27] Ni Y, Liu S, Li J, Dong T, Tao L, Yuan L, Yang M. The effects of nurse-led multidisciplinary team management on glycosylated hemoglobin, quality of life, hospitalization, and help-seeking behavior of people with diabetes mellitus. Journal of Diabetes Research. 2019; 2019:9325146. [DOI:10.1155/2019/9325146] [PMID]

This Page Intentionally Left Blank