



Received on 14 June 2026; received in revised form, 29 June 2026; accepted, 05 July 2026; published 01 November 2026

PREDICTORS OF GLYCEMIC CONTROL AMONG HOSPITALIZED PATIENTS WITH DIABETES: A CROSS-SECTIONAL STUDY

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Keywords:

Diabetes mellitus, In-hospital hyperglycemia, Glycemic control, Medication adherence, HbA1c

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ABSTRACT: Background: Hyperglycemia is frequently observed in hospitalized patients and is associated with adverse clinical outcomes. However, it is often under-recognized relative to the primary reason for admission, leading to suboptimal glycemic management. Identifying factors associated with successful inpatient glycemic control may facilitate early risk stratification and optimize management. **Objective:** To identify independent predictors of discharge glycemic control among hospitalized patients with type 2 diabetes mellitus presenting with in-hospital hyperglycemia. **Materials and Methods:** A hospital-based observational cross-sectional study was conducted among 100 adult patients with type 2 diabetes mellitus admitted with in-hospital hyperglycemia (admission random blood glucose ≥ 180 mg/dL). Demographic, clinical, glycemic and pharmacotherapeutic data were collected from medical records. Medication adherence was assessed using the Medication Adherence Report Scale (MARS-5). Good glycemic control was defined as discharge random blood glucose ≤ 200 mg/dL. Associations were evaluated using the Chi-square test followed by multivariable logistic regression to identify independent predictors. A p-value < 0.05 was considered statistically significant. **Results:** At discharge, 73% of patients achieved optimal glycemic control. Medication adherence independently predicted good glycemic control ($p=0.039$; OR=3.246; 95% CI: 1.063–9.909). Admission HbA1c $\leq 7\%$ ($p=0.010$; OR=6.101; 95% CI: 1.533–24.277) and mid-hospitalization fasting blood glucose ≤ 140 mg/dL ($p=0.035$; OR=10.268; 95% CI: 1.173–89.867) also independently predicted good glycemic control. **Conclusion:** Medication adherence, admission HbA1c, and mid-hospitalization fasting blood glucose were significant predictors of glycemic control. These findings emphasize the importance of optimal long-term diabetes care and early recognition and intensive management of in-hospital hyperglycemia to achieve and maintain good glycemic control throughout hospitalization.

INTRODUCTION: Diabetes mellitus (DM) represents a growing public health challenge in India, with a prevalence of approximately 9.3% reported in a nationally representative survey¹.

India currently has one of the largest populations of individuals with diabetes, estimated at around 77 million, which is projected to rise to nearly 134 million by 2045².

Diabetic patients are hospitalized approximately three times more frequently than individuals without diabetes. In-hospital hyperglycemia has been reported in nearly 38% of hospitalized patients and is associated with adverse clinical outcomes, including increased risk of infections,

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DOI:

10.13040/IJPSR.0975-8232.17(11).3543-49

This article can be accessed online on
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prolonged hospital stay, delayed wound healing, hypoglycemia related to intensive therapy, and higher in-hospital mortality³. Current guidelines recommend maintaining blood glucose levels between 140–180 mg/dL for most non-critically ill hospitalized patients to minimize both hyperglycemia- and hypoglycemia-related complications⁴. Despite its clinical importance, hyperglycemia is often under-recognized compared with the primary reason for admission, leading to suboptimal glycemic management.

The mechanisms contributing to adverse outcomes in hyperglycemia during acute illness are not fully understood. However, evidence suggests that elevated glucose levels impair neutrophil function, increase circulating free fatty acids and enhance the production of pro-inflammatory cytokines and reactive oxygen species (ROS), leading to cellular injury and endothelial dysfunction⁵. In addition, chronic hyperglycemia results in the formation of advanced glycation end products (AGEs), which play a key role in the development of microvascular complications such as neuropathy, retinopathy and nephropathy⁶. These pathophysiological mechanisms further support the importance of timely recognition and effective inpatient glycemic management.

Previous studies have identified admission HbA1c, fasting blood glucose, early inpatient glucose levels and prior treatment regimens as important determinants of inpatient glycemic outcomes^{7, 8, 9}. Achieving recommended glucose targets during hospitalization remains challenging because of acute illness, stress hyperglycemia, drug interactions, glucocorticoid therapy, variable nutritional intake, renal dysfunction and frequent treatment modifications. Current recommendations favour insulin-based regimens for most hospitalized patients with hyperglycemia requiring active glycemic management^{4, 5}.

Despite existing evidence, data on predictors of glycemic control among hospitalized diabetic patients in the Indian setting remain limited. Identifying these factors is essential for early risk stratification and optimizing inpatient management. The primary objective of the present study was to identify independent predictors of discharge glycemic control among hospitalized patients with

type 2 diabetes mellitus presenting with in-hospital hyperglycemia. A secondary objective was to assess the association of demographic, clinical, glycemic, and pharmacotherapeutic variables with discharge glycemic control.

MATERIALS AND METHODS: This hospital-based cross-sectional observational study was conducted between August 2022 and January 2024, which included 100 patients with in-hospital hyperglycemia. The sample size was estimated using a prevalence-based approach derived from prior literature, which reported a 38% prevalence of hyperglycemia among hospitalized patients¹⁰. Using a 95% confidence level and 10% absolute precision, the calculated sample size was approximately 91. After accounting for potential missing data, the final sample size was rounded to 100 participants.

Eligible participants were adults aged 18–80 years with a confirmed diagnosis of type 2 diabetes mellitus who were receiving antidiabetic therapy and had in-hospital hyperglycemia, defined as a random blood glucose (RBG) level ≥ 180 mg/dL at admission as per established guidelines⁷. Patients with type 1 diabetes, gestational diabetes, diabetic ketoacidosis, hyperosmolar hyperglycemic state or those receiving parenteral nutrition were excluded.

The study was approved by the Institutional Ethics Committee, Bangalore Medical College and Research Institute (Approval No. BMCRI/PG/213/2022-23). The study was conducted in accordance with the Declaration of Helsinki and written informed consent was obtained from all participants prior to data collection.

Data were collected once at the time of discharge. Demographic information and medication adherence were obtained directly from participants, while clinical, pharmacotherapeutic and glycemic variables recorded during the same hospitalization were extracted from their medical records. Polypharmacy was defined as the concurrent use of five or more medications¹¹. Medication adherence prior to hospitalization was assessed at discharge by the Principal Investigator using the Medication Adherence Report Scale (MARS-5), a validated five-item self-report questionnaire administered in

the participants' preferred language. Adherence was based on participants' self-reported responses and corroborated with accompanying family members whenever possible. Each item is scored from 1 to 5, with total scores ranging from 5 to 25; higher scores indicate better adherence. A score of ≥ 22 was considered indicative of good adherence¹².

Capillary blood glucose levels were monitored three times daily before meals using a glucometer. Glycemic targets were defined according to institutional practice aligned with established guidelines, with fasting blood glucose (FBG) ≤ 140 mg/dL and random blood glucose ≤ 200 mg/dL¹³.

Mid-hospitalization FBG was calculated as the average of fasting glucose values recorded during the intermediate phase of hospital stay. Pre-prandial glucose measurements guided inpatient glycemic management. Antidiabetic therapy, including insulin regimens, dose adjustments, treatment modifications and discharge medications was individualized by the treating physician based on the patient's clinical condition and glycemic status. Hypoglycemic episodes occurring during hospitalization were documented from the patients' medical records. At discharge, patients were categorized as having good glycemic control (RBG

≤ 200 mg/dL) or poor glycemic control (RBG > 200 mg/dL). This definition was based on institutional practice and previous literature for inpatient glycemic management^{4, 13, 14}.

Statistical analysis was performed using IBM SPSS version 26. Categorical variables were summarized as frequencies and percentages. Associations between patient characteristics and glycemic control were assessed using the Chi-square test or Fisher's exact test, where appropriate. Variables showing a significant association in the univariate analysis were included in the multivariable logistic regression model to identify independent predictors of glycemic control. Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs). A p-value < 0.05 was considered statistically significant.

RESULTS: A total of 100 patients with type 2 diabetes and in-hospital hyperglycemia were included in the study. At discharge, 73 patients achieved good glycemic control, while 27 had poor glycemic control. Demographic and baseline clinical characteristics did not show a significant association with glycemic control, as presented in **Table 1**.

TABLE 1: BASELINE CHARACTERISTICS OF INPATIENT DIABETICS BY DISCHARGE GLYCEMIC CONTROL (N=100)

Parameter	Category	Good Glycemic Control (RBG ≤ 200 mg/dL) n=73	Poor Glycemic Control (RBG > 200 mg/dL) n=27	p-value
Age	<60 years	18	8	0.615*
	≥ 60 years	55	19	
Gender	Male	38	10	0.182*
	Female	35	17	
Residence	Rural	45	20	0.247*
	Urban	28	7	
Hypertension	Present	57	20	0.672*
	Absent	16	7	
Hypothyroidism	Present	6	4	0.329†
	Absent	67	23	
Alcohol Use	Present	24	6	0.302*
	Absent	49	21	
Smoking	Present	15	4	0.581*
	Absent	58	23	
Duration of Diabetes	<5 years	16	7	0.870*
	5–10 years	42	14	
	>10 years	15	6	

RBG: Random Blood Glucose, Compared using *Chi-Square test; for cells with the expected count < 5 †Fisher's exact test was used. $p < 0.05$ considered significant.

As shown in **Table 2**, medication adherence, pre-admission antidiabetic therapy and admission

HbA1c $\leq 7\%$ were significantly associated with glycemic control. Early inpatient glycemic

parameters were also significant, including admission random blood glucose ≤ 200 mg/dL ($p=0.008$), day 1 fasting blood glucose ≤ 140 mg/dL ($p<0.001$) and mid-hospitalization fasting blood glucose ≤ 140 mg/dL ($p=0.002$).

TABLE 2: CLINICAL AND TREATMENT VARIABLES BY DISCHARGE GLYCEMIC CONTROL IN HOSPITALIZED PATIENTS WITH DIABETES (N=100)

Variable	Category	Good Control (RBG ≤ 200 mg/dL) n=73	Poor Control (RBG >200 mg/dL) n=27	p-value
Medication	Good	60	12	<0.001*
Adherence	Poor	13	15	
Polypharmacy	Present	28	14	0.225*
	Absent	45	13	
Primary Diagnosis	Infectious Disease	29	8	0.755†
	Heart Disease	9	2	
	Respiratory Disease	7	4	
	CVA	6	3	
	CNS Disorders	4	3	
	CLD	5	2	
	Anaemia	3	3	
	Renal Disease	3	1	
	Other Diseases	7	1	
HbA1c Levels	$\leq 7\%$	44	3	<0.001†
	$>7\%$	29	24	
Admission RBG	≤ 200 mg/dL	38	6	0.008*
	>200 mg/dL	35	21	
Day 1 FBG	≤ 140 mg/dL	21	0	<0.001†
	>140 mg/dL	52	27	
Pre-admission Antidiabetic Therapy	Insulin & OHA	3	5	0.002†
	Insulin	2	2	
	OHA Monotherapy	48	7	
	OHA Multitherapy	20	13	
In-hospital Antidiabetic Therapy	Regular Insulin	55	17	0.070†
	Regular Insulin & Insulin Glargine	10	8	
	Regular Insulin & Insulin Glargine & Dapagliflozin	0	1	
	Regular Insulin & Dapagliflozin	8	1	
Mid-hospital FBG	≤ 140 mg/dL	25	1	0.002†
	>140 mg/dL	48	26	

RBG: Random Blood Glucose; FBG: Fasting blood glucose; OHA: Oral hypoglycemic agents; CVA :Cerebrovascular accident; CLD: Chronic liver disease, Compared using *Chi-Square test; for cells with the expected count <5 †Fisher’s exact test was used. $p<0.05$ considered significant.

Multivariable logistic regression analysis (Table 3) identified medication adherence, admission HbA1c and mid-hospital fasting blood glucose as independent predictors of glycemic control, with good model fit (Hosmer–Lemeshow $p=0.99$).

TABLE 3: PREDICTORS OF GLYCEMIC CONTROL AMONG HOSPITALIZED DIABETICS USING MULTIVARIABLE LOGISTIC REGRESSION (N=100)

Predictor	p-value	Odds ratio	95%CI
Pre-admission antidiabetic therapy	0.064	0.563	0.067-4.689
Medication adherence	0.039*	3.246	1.063-9.909
HbA1c	0.010*	6.101	1.533-24.277
Admission RBG	0.082	2.567	0.888-7.416
Day 1 FBG	0.998	1.519	1.296-1.781
Mid-hospital FBG	0.035*	10.268	1.173-89.867

RBG: Random blood glucose; FBG: Fasting blood glucose; CI: Confidence interval, Multivariable logistic regression analysis. * $p<0.05$ considered statistically significant.

Good medication adherence (OR=3.246; 95% CI: 1.063–9.909; $p=0.039$), admission HbA1c $\leq 7\%$ (OR=6.101; 95% CI: 1.533–24.277; $p=0.010$) and mid-hospital fasting blood glucose ≤ 140 mg/dL (OR=10.268; 95% CI: 1.173–89.867; $p=0.035$) were associated with higher odds of glycemic control in hospital.

DISCUSSION: In-hospital hyperglycemia is a well-recognized contributor to adverse clinical outcomes, including increased morbidity and mortality³. The present study evaluated factors influencing glycemic control among hospitalized patients with type 2 diabetes mellitus and identified independent predictors relevant to inpatient management. Demographic characteristics such as age, gender, residence and duration of diabetes were not significantly associated with glycemic control. This suggests that short-term glycemic outcomes during hospitalization are more strongly influenced by acute physiological stress and treatment interventions rather than baseline patient characteristics. In contrast, baseline glycemic status appeared to have a greater impact on inpatient outcomes.

In this study, nearly two-thirds of patients showed good medication adherence. Medication adherence was significantly associated with inpatient glycemic control in both univariate and multivariable analyses. Patients with good medication adherence were approximately three times more likely to achieve good glycemic control during hospitalization. This finding is consistent with studies by Chin *et al.*, who reported that patient's knowledge, perceived necessity of medication and social support improve adherence; polypharmacy, medication costs and comorbidities negatively influence it¹⁵. Similarly, Sendekie *et al.* demonstrated a significant relationship between adherence and glycemic outcomes, identifying factors such as medication cost, income, self-monitoring practices, and comorbid conditions as contributors¹⁶. Additional factors such as socioeconomic status, health literacy, marital status, and access to medications may also influence medication adherence and should be explored in future studies. In the current study, nearly half of the patients had controlled HbA1c levels ($\leq 7\%$) at admission. HbA1c was significantly associated with glycemic control on

both univariate and multivariable analyses, with patients having controlled HbA1c being six times more likely to achieve good glycemic control. A study conducted by Sáenz-Abad *et al.* showed a significant association between HbA1c levels and mean blood glucose control in hospitalized diabetic patients, both on univariate and multivariable analyses⁸. Another cross-sectional study conducted by Pasquel *et al.* identified that admission HbA1c was a significant predictor of response to insulin treatment and glycemic control⁹. These observations indicate that inpatient glycemic control is closely linked to long-term metabolic status. These findings emphasize the importance of appropriate antidiabetic therapy, regular follow-up, dose adjustment, and patient education to achieve optimal long-term glycemic control.

Mid-hospitalization FBG was identified as a significant predictor of glycemic control during hospitalization. This finding emphasizes the need for early optimization of hyperglycemia during admission, as timely correction may improve glycemic control throughout the hospital stay. In addition, mid-hospitalization FBG provides useful information on treatment response and may help guide subsequent adjustments to antidiabetic therapy. However, the wide 95% confidence interval (1.173–89.867) observed in this study suggests limited precision of the effect estimate, likely due to the modest sample size and the limited number of events within certain predictor categories. Larger studies are warranted to validate this finding.

Few studies have reported that baseline treatment regimens can influence inpatient glycemic outcomes. Sáenz-Abad *et al.* identified treatment-related factors as contributors to glycemic variability in hospitalized patients⁸. However, Pasquel *et al.* demonstrated that prior therapy and baseline glycemic status affect response to inpatient insulin therapy⁹. In the present study, pre-admission antidiabetic therapy was significantly associated with glycemic control on univariate analysis, but this association was not retained after multivariable adjustment. This suggests that its effect may be mediated by stronger determinants such as medication adherence and admission HbA1c. Additionally, the small sample size within specific medication subgroups may have limited

the statistical power to detect independent associations. Ascione *et al.* demonstrated that inadequate inpatient glycemic control is associated with increased morbidity and mortality¹⁴. In the present study, admission HbA1c, medication adherence, and mid-hospitalization FBG were identified as key determinants of inpatient glycemic control, supporting the importance of early assessment of these factors to facilitate timely optimization of antidiabetic therapy during hospitalization.

The strengths of the present study include being the first attempt in our hospital to identify predictors of inpatient glycemic control. The findings may help identify patients at higher risk and support more appropriate clinical decision-making. In addition, the study highlights the importance of prioritizing glycemic control among hospitalized patients with diabetes.

The study is limited by its cross-sectional design, which precludes causal inference. Follow-up data to assess glycemic control after discharge were not available. In addition, glycemic control was defined using a single RBG measurement at discharge, which may not fully reflect overall inpatient glycemic management or predict post-discharge outcomes. Although multivariable logistic regression was performed, the modest sample size may have limited the precision of the regression estimates, as reflected by the wide confidence intervals observed for some predictors. Future multicenter studies with larger sample sizes should incorporate comprehensive glycemic metrics such as mean glucose, time-in-range, glucose variability, or changes in glycemic parameters from admission to discharge. Furthermore, potentially important confounders, including systemic corticosteroid use, ICU admission, nutritional status, duration of hospital stay, severity of infection, and hypoglycemic episodes, were not specifically evaluated and may have influenced the observed associations.

CONCLUSION: Medication adherence, admission HbA1c and mid-hospitalization fasting blood glucose were significant predictors of inpatient glycemic control. These findings suggest that both prior glycemic status and early in-hospital trends should be considered when managing patients.

Applying these factors in clinical decisions, including at discharge, may help improve continuity of care and long-term glycemic control.

ACKNOWLEDGEMENT: None

Funding: No funding sources

Ethical Approval: The study was approved by the Institutional Ethics Committee, Bangalore Medical College and Research Institute (Approval No: BMCRI/PG/213/2022-23).

CONFLICT OF INTEREST: None declared

REFERENCES:

1. Mathur P, Leburu S and Kulothungan V: Prevalence, awareness, treatment and control of diabetes in India from the countrywide national NCD monitoring survey. *Front Public Health* 2022; 10: 748157.
2. Pradeepa R and Mohan V: Epidemiology of type 2 diabetes in India. *Indian J Ophthalmol* 2021; 69: 2932–8.
3. Umpierrez GE, Isaacs SD, Bazargan N, You X, Thaler LM and Kitabchi AE: Hyperglycemia: An Independent Marker of In-Hospital Mortality in Patients with Undiagnosed Diabetes. *J Clin Endocrinol Metab* 2002; 87: 978–82.
4. American Diabetes Association Professional Practice Committee. Diabetes Care in the Hospital: Standards of Care in Diabetes—2025. *Diabetes Care* 2025; 48(1): 321–334. doi:10.2337/dc25-S016.
5. Kodner C, Anderson L and Pohlgeers K: Glucose Management in Hospitalized Patients. *Am Fam Physician* 2017; 96: 648–54.
6. Derouiche S, Cheradid T, Abdelmalek D and Achi I: Effect of COVID-19 Infection on the Immune System and Risk of Developing Diabetes Complications: A Review. *J Pharm Care* 2020; 8: 133–9.
7. Moghissi ES, Korytkowski MT, DiNardo M, Einhorn D, Hellman R and Hirsch IB: American Association of Clinical Endocrinologists and American diabetes association consensus statement on inpatient glycemic control. *Diabetes Care* 2009; 32: 1119–31.
8. Sáenz-Abad D, Gimeno-Orna JA, Sierra-Bergua B and Pérez-Calvo JI: Predictive factors of average glycemic control and its variability in hospitalized diabetic patients. *Endocrinol Nutr* 2015; 62: 257–63.
9. Pasquel FJ, Lansang MC, Dhatariya K and Umpierrez GE: Management of diabetes and hyperglycaemia in the hospital. *Lancet Diabetes Endocrinol* 2021; 9: 174–88.
10. Tamez-Pérez HE, Quintanilla-Flores DL, Proskauer-Peña SL, González-González JG, Hernández-Coria MI and Garza-Garza LA: Inpatient hyperglycemia: Clinical management needs in teaching hospital. *J Clin Transl Endocrinol* 2014; 1: 176–8.
11. Varghese D, Ishida C, Patel P and Haseer Koya H: Polypharmacy. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Dec 18]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK532953/>.
12. Chan AHY, Horne R, Hankins M and Chisari C: The medication adherence report scale: A measurement tool for eliciting patients' reports of nonadherence. *Br J Clin Pharmacol* 2020; 86: 1281–8.

13. Kotwal N and Pandit A: Variability of capillary blood glucose monitoring measured on home glucose monitoring devices. *Indian J Endocrinol Metab* 2012; 16: 248–51.
14. Ascione R, Rogers CA, Rajakaruna C and Angelini GD: Inadequate blood glucose control is associated with in-hospital mortality and morbidity in diabetic and nondiabetic patients undergoing cardiac surgery. *Circulation* 2008; 118: 113–23.
15. Chin SS, Lau SW, Lim PL, Wong CM and Ujang N: Medication adherence, its associated factors and implications for glycaemic control in patients with type 2 diabetes mellitus: A cross-sectional study in a Malaysian primary care clinic. *Malays FAM Physician* 2023; 18: 14.
16. Sendekie AK, Netere AK, Kasahun AE and Belachew EA: Medication adherence and its impact on glycemic control in type 2 diabetes mellitus patients with comorbidity: A multicenter cross-sectional study in Northwest Ethiopia. *PLoS ONE* 2022; 17: e0274971.

How to cite this article:

Naik YU, Muraraiah S and Kaniyappan T: Predictors of glycemic control among hospitalized patients with diabetes: a cross-sectional study. *Int J Pharm Sci & Res* 2026; 17(11): 3543-49. doi: 10.13040/IJPSR.0975-8232.17(11).3543-49.

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