Medical Journal of Public Health
ISSN:
DOI:

RESEARCH ARTICLE OPEN ACCESS

Predictors of Poor Glycaemic Control Among Patients with Type 2 Diabetes

Shraddha[1], Yogita shinde[2]

[1]*The Assam Royal Global University, Assam, Email: Basubasu.shraddha88@gmail.com*
[2]*MGM Medical College, Kamothe, Navi Mumbai, Maharashtra, Email: Mumbaiyogis8stars@rediffmail.com*

Received:- 13/06/2026, Revised:- 14/07/2026, Accepted:- 21/07/2026, Published:- 28/07/2026

Abstract:

Poor glycaemic control is a serious public health problem among adults with diabetes as it is associated with long-term complications, decreased quality of life and excess health-care utilisation. The aim of this study was to identify and estimate the prevalence of poor glycaemic control and its demographic and clinical predictors in adult patients with diabetes by using secondary cross-sectional data. In total, 500 adult participants who had diabetes were analysed. Patients were classified as having poor glycaemic control if their glycated haemoglobin (HbA1c) levels ≥7%. Age, gender, body mass index (BMI), smoking status, hypertension, heart disease and blood glucose level were assessed by descriptive statistics, chi-square tests, independent t-tests and binary logistic regression. Of the study participants, 191 (38.2%) were poorly controlled and 309 (61.8%) were adequately controlled. Poor glycaemic control was more frequent in individuals with hypertension, heart disease and current smoking status, with minimal differences between gender. Results suggest that the clinical comorbidities and the behavioural aspects must be taken into account when treating diabetes because they also influence the glycaemic control. The study emphasises the value of periodic HbA1c testing, early screening of high-risk groups, lifestyle modification, smoking cessation and good management of cardiovascular comorbidities for better glycaemic management outcomes. Despite its cross-sectional design and reliance on secondary data, the study's results offer a valuable body of evidence for supporting targeted clinical interventions and public health strategies for improving diabetes care and decreasing diabetes-related complications.

Keywords: Type 2 diabetes mellitus; Glycaemic control; HbA1c; Risk factors; Public health.

Introduction

Type 2 diabetes mellitus (T2DM) is among the world's most common non-communicable diseases and is a significant public health problem because of its rising prevalence, long-term complications and rising costs. The rapid urbanisation, ageing, sedentary lifestyle and unhealthy dietary habits along with the increased rates of obesity have significantly contributed to the increasing prevalence of diabetes in both developed and developing countries. Although there have been improvements in the management of diabetes, it is difficult for many patients to achieve and maintain optimal glycaemic control. Chronic hyperglycaemia leads to micro and macrovascular complications, diminished quality of life and a significant strain on healthcare resources. Long-term, international evidence has shown that poor glycaemic control is still very common, especially in low and middle-income countries and that there is a need for persistent monitoring and good management strategies (Aschner et al., 2020).

Glycaemic control is one of the main targets of diabetes care as it relates directly to disease progression and the development of diabetes related complications. Glycated haemoglobin (HbA1c) is acknowledged as an excellent measure of glycaemic control – the average glucose level over the previous 2-3 months. Tight glycemic control indicated by normal levels of HbA1c have been linked to lower rates of cardiovascular disease, nephropathy, neuropathy, retinopathy and early death. However, systematic evidence from sub-Saharan Africa shows that a significant proportion of people living with type 2 diabetes do not meet recommended glycaemic targets, which is poised to represent ongoing problems in delivering diabetes care and managing patients (Fina Lubaki et al., 2022). In addition, poor glycaemic control has consistently been associated with more diabetes-related complications, further emphasizing the need for regular assessment and timely intervention (Dimore et al., 2023).

Many studies have tried to determine what factors are linked to poorer glycaemic control, acknowledging that multiple factors including demographic, clinical, behavioural and health system factors are involved in successful diabetes management. Factors like increasing age, obesity, smoking, hypertension, longer duration of the disease, medication-related problems, and comorbid conditions have been identified as important factors to contribute to the inadequate glycaemic control among patients with type 2 diabetes in systematic reviews and meta-analyses studies (Al-ma'aitah et al., 2022; Bitew et al., 2023). Likewise, in Ethiopia, a study conducted among diabetic population revealed that suboptimal glycaemic control is still prevalent and highlighted several patient- and healthcare-related factors that are associated with suboptimal treatment outcomes (Gebreyohannes et al., 2019). These findings indicate that diabetes management is multifaceted, and that modifiable risk factors, which could be targeted for intervention, exist.

Public health-wise, poor glycaemic control is a significant issue, as it leads to higher hospitalisation rates, healthcare costs, disability, mortality etc. Identifying people who are at higher risk of poor glycaemic control early gives time for healthcare providers to consider more individualised treatment options, reinforce education and optimize clinical outcomes. The increasing burden of diabetes and its negative impact on the health of the population have also been underscored by recent systematic evidence, which highlights the essential need for public health policies aimed at early risk assessment and screening, as well as integrated diabetes management programmes, to combat diabetes and improve the health of the population (Tegegne et al., 2024). Furthermore, observational research has shown that key drivers of poor glycaemic control need to be identified to design evidence-based interventions to improve diabetes outcomes and optimise allocation of health care resources (Dedefo et al., 2020). National studies also showed that glycaemic control is suboptimal among patients who are on routine diabetes care and the need for strengthening preventive strategies and continuous quality improvement in health care systems (Nigussie et al., 2021; Feleke et al., 2021).

While many studies have looked at glycaemic control among people with diabetes, there is a lot of variation between populations and healthcare settings in the prevalence and relative contribution of different predictors. In addition, recent studies indicate that the methods for ongoing assessment of demographic and clinical predictors could be used to supplement ongoing clinical studies and offer insights for public health monitoring and planning (Tarekegn et al., 2025). So, it is important to recognize the factors that are associated with poor glycaemic control, to support evidence-based clinical decision making and enhance public health strategies for reducing diabetes-related complications.

Objectives

- To describe the demographic and clinical characteristics of adult patients with diabetes included in the study.
- To determine the prevalence of poor glycaemic control among the study participants based on HbA1c levels.
- To identify demographic and clinical predictors associated with poor glycaemic control among adult patients with diabetes through multivariable statistical analysis.

2. Materials and Methods

2.1 Study Design

The type of this study was quantitative with a cross section and analytical design with secondary data analysis. The study sought to determine demographic and clinical factors that are associated with poor glycaemic control in adult diabetes patients by analysing an existing publicly available dataset. Since all variables were measured at the same time a cross-sectional approach was deemed appropriate in order to assess bivariate relationships between the selected predictor variables and the glycaemic control status.

2.2 Data Source

A publicly available diabetes data was used for this study, which they found on another platform called Kaggle (Mustafa, 2022). Clinical and demographic data were gathered for the purpose of diabetes prediction research and used in the original data set. The data collected were screened and cleaned before analysis to ensure that the data were of high quality and consistency. The records were cleaned up for duplicate observations, variable names were standardised and records were examined for completeness. As the data did not include personal identifiers, the confidentiality of participants was maintained throughout the study and anonymity was respected.

2.3 Study Population and Sample

Adults diagnosed with diabetes and present on the publicly available study population were the subjects of the study. Only participants over 18 years who had complete clinical and demographic information were included in the analysis to make the information more relevant. After the data cleaning and eligibility screening, a final analytical sample of 500 adult patients was selected. These are the participants that had all information needed for statistical analysis and had information regarding glycaemic status.

2.4 Eligibility Criteria

Selection of the participants was done based on the following criteria: age 18 years or older, positive diabetes status in the data set, and complete data on HbA1c level, blood glucose level, age, gender, body mass index (BMI), smoking status, hypertension status, and heart disease status. Records that lacked information on any of the study variables, were duplicated and/or had participants under 18 years old were not included in the final analyses.

2.5 Study Variables

The main outcome variable was poor glycaemic control, defined as glycated haemoglobin (HbA1c) levels. Glycaemic control was defined as follows: if the HbA1c level was below 7.0% it was termed as good glycaemic control, and if the HbA1c level was 7.0% or more it was termed as poor glycaemic control based on American Diabetes Association recommendation. For statistical analysis a binary outcome variable was then created with "0" representing adequate glycaemic control and "1" representing poor glycaemic control. Independent variables considered were all the demographic and clinical variables found in the data. Demographic variables were age and gender, and clinical variables were body mass index (BMI), hypertension status, heart disease status, smoking history, blood glucose level and HbA1c level. These variables were chosen due to their known association with glycaemic control, and their availability in the data.

2.6 Data Cleaning and Processing

Data was pre-processed prior to statistical analysis to assure the quality of the data. Duplicate records were found and deleted, and all variables were checked for completeness and consistency. There was no missing data in the selected variables of the data set. The age of the participants was excluded as less than 18 years so as to focus the analysis on adults. To ensure uniformity in records smoking history categories were set and an individual identification number for the participant was created for each observation. A binary variable was then created to denote poor glycaemic control defined by the pre-specified HbA1c cut-off.

2.7 Statistical Analysis

Data analysis was done using the appropriate statistical software. For the continuous variables, mean and standard deviation were used for summarisation while the categorical variables were summarised using frequencies and percentages. Poor glycaemic control was defined as an HBA1C level of 7.0% or above and the prevalence of poor glycaemic control was calculated as the proportion of participants with HBA1C level of 7.0% or above. The independent-samples t-test was used for continuous variables while the chi-square test was used for categorical variables to compare the results of the participants with satisfactory and poor glycaemic control. The variables that showed potential associations with glycaemic control were then analysed using binary logistic regression model to determine the independent predictors of poor glycaemic control. Results of the regression analysis were reported as odds ratios (ORs) and 95% confidence interval (CIs). For all analyses two-tailed p-values < 0.05 were deemed statistically significant.

2.8 Ethical Considerations

This study relied solely on secondary analysis of a publicly available and anonymised data set, retrieved from the Kaggle repository. There was no personally identifiable information in the dataset, thus ensuring the confidentiality and privacy of participants. This is

a secondary data analysis, no formal institutional ethical approval or informed consent was required as there was no direct contact with the human participants, and no identifiable data were accessed. The data set has been used solely for academic research in line with the terms of use of the repository and best practice in the use of data.

3. Results

A total of 500 adult patients with diabetes were included in the final analysis after data cleaning and eligibility screening. All participants had complete demographic and clinical information, with no missing observations for the variables analysed.

3.1 Demographic and Clinical Characteristics

Table 1 shows the demographic and clinical profile of the study participants. The mean age of participants was 62.92 ± 13.07 years, which is mainly comprised of older adults. Females accounted for 53.0% (n = 265) of the participants, while males represented 47.0% (n = 235). The average body mass index (BMI) was 31.86 ± 7.63 kg/m2 indicating that a significant number of participants were overweight or obese. The average HbA1c level was 6.92 ± 1.08%, while the mean blood glucose concentration was 193.86 ± 58.51 mg/dL. 21.2% (n = 106) of the participants had hypertension and 15.0% (n = 75) had documented heart disease. In terms of smoking behaviour, the majority of the sample was never smokers (41.2%), followed by those with unknown smoking history (19.0%) and former smokers (17.8%). As shown in fig.1, the study subjects were mainly older adults and females, and the majority of the smoking categories were "never smokers".

Table 1. Demographic and clinical characteristics of the study participants (N = 500)

Variable	**Category/Mean ± SD**	**n (%)**
Age (years)	62.92 ± 13.07	—
Gender	Male	235 (47.0)
	Female	265 (53.0)
BMI (kg/m^2)	31.86 ± 7.63	—
HbA1c (%)	6.92 ± 1.08	—
Blood glucose (mg/dL)	193.86 ± 58.51	—
Hypertension	Yes	106 (21.2)
	No	394 (78.8)
Heart disease	Yes	75 (15.0)
	No	425 (85.0)
Smoking status	Never	206 (41.2)
	Former	89 (17.8)
	Current	51 (10.2)
	Not current	37 (7.4)
	Ever	22 (4.4)
	Unknown	95 (19.0)

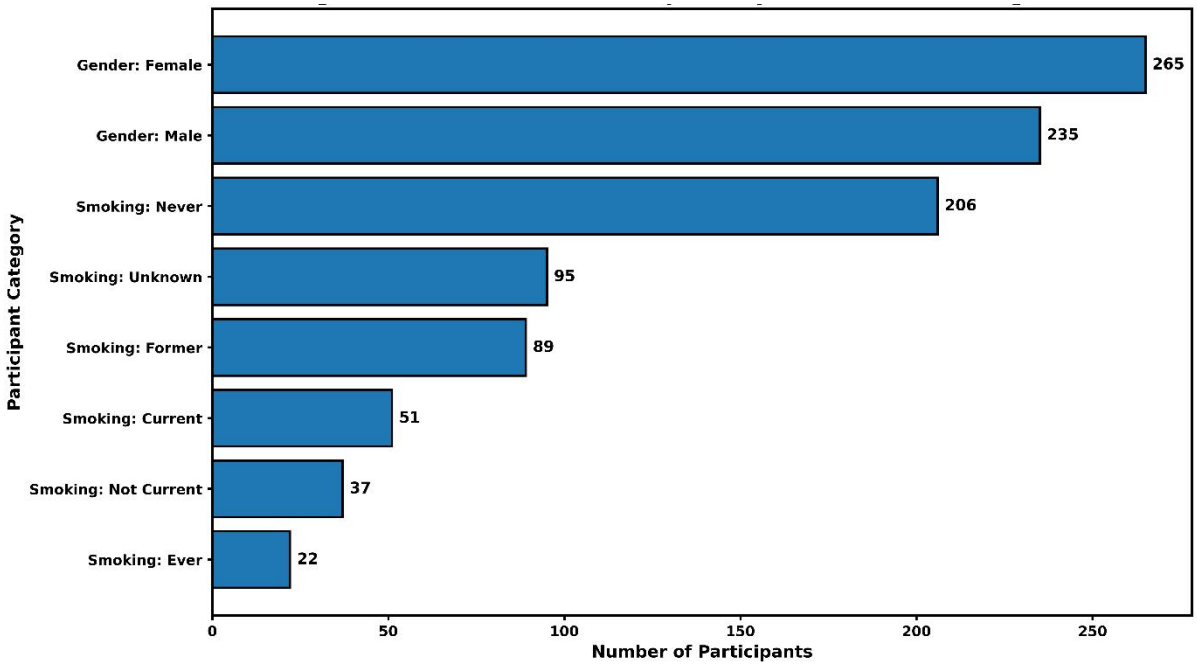

Figure 1. Distribution of participants according to gender and smoking status

3.2 Prevalence of Poor Glycaemic Control

A HbA1c level of 7.0% was used to define poor glycaemic control: 191 participants (38.2%) had poor glycaemic control, and 309 participants (61.8%) had adequate glycaemic control (Table 2). Over one-third of the participants had poor glycaemic control as shown in Table 2 and Figure 2, which implies that there was a huge burden of poor diabetes control among the study subjects.

Table 2. Distribution of glycaemic control among study participants

Glycaemic control	**n**	**%**
Adequate glycaemic control (HbA1c <7%)	309	61.8
Poor glycaemic control (HbA1c ≥7%)	191	38.2

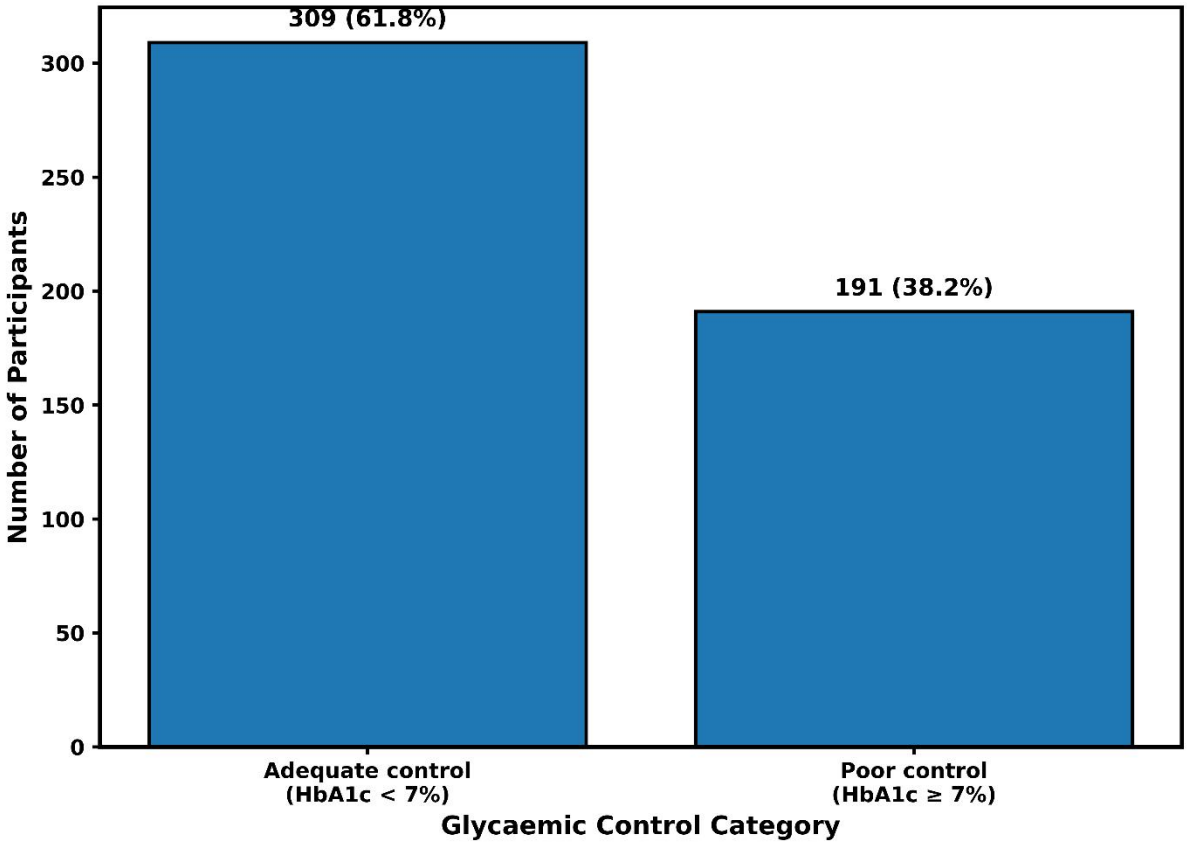

Figure 2. Prevalence of adequate and poor glycaemic control among adult patients with diabetes

3.3 Comparison of Participant Characteristics According to Glycaemic Control

The characteristics of the participants as function of glycaemic control status are summarised in Table 3. 103 (38.9%) female and 88 (37.4%) males had poor glycaemic control. Among participants with hypertension, 44.3% and those with heart disease, 44.0% had poor glycaemic control. There was a relatively higher prevalence of poor glycaemic control (49.0%) among current smokers than among those who never smoked (37.4). Figure 3 indicated that the female gender had a relatively small difference; hypertension, heart disease, and current smoking were significantly associated with a higher prevalence of poor glycaemic control.

Table 3. Comparison of demographic and clinical characteristics according to glycaemic control

Variable	Adequate n (%)	Poor n (%)
Gender		
Male	147 (62.6)	88 (37.4)
Female	162 (61.1)	103 (38.9)
Hypertension		
No	250 (63.5)	144 (36.5)
Yes	59 (55.7)	47 (44.3)
Heart disease		
No	267 (62.8)	158 (37.2)

Yes	42 (56.0)	33 (44.0)
Smoking status		
Never	129 (62.6)	77 (37.4)
Former	57 (64.0)	32 (36.0)
Current	26 (51.0)	25 (49.0)
Not current	19 (51.4)	18 (48.6)
Ever	15 (68.2)	7 (31.8)
Unknown	63 (66.3)	32 (33.7)

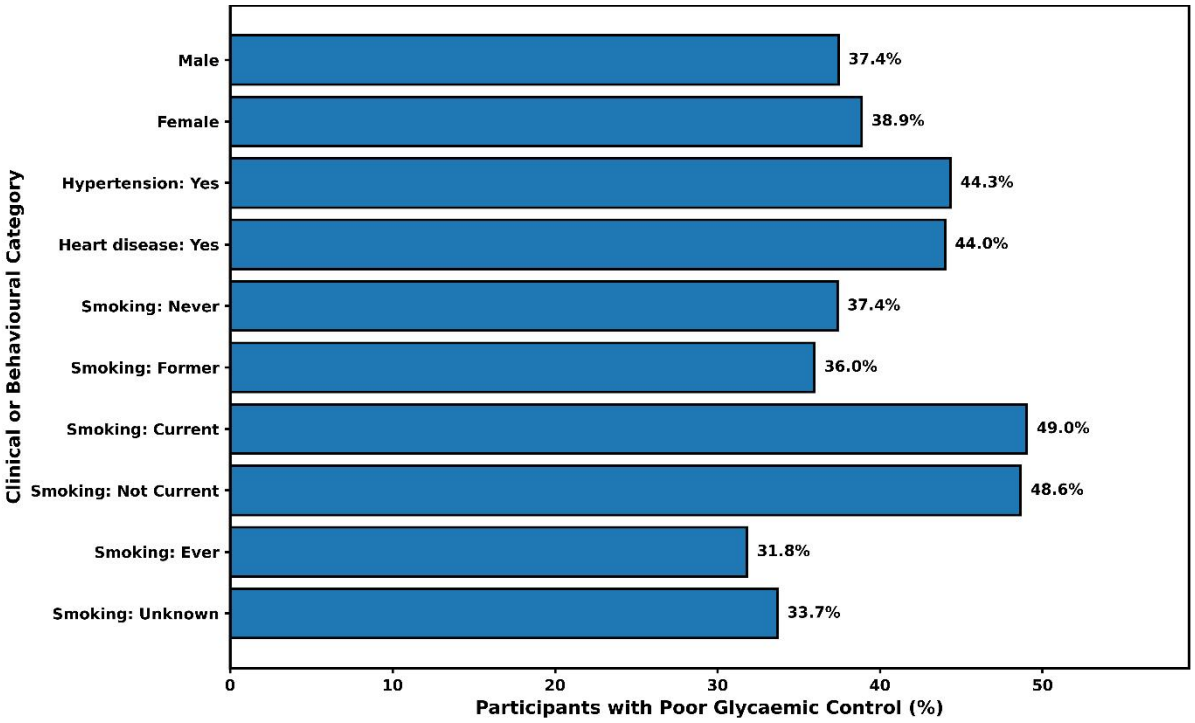

Figure 3. Comparison of poor glycaemic control across demographic and clinical categories

3.4 Summary of Potential Predictors of Poor Glycaemic Control

Table 4 provides a summary of the variables that were potential predictors of the poor glycaemic control. Clinically relevant variables that were considered for subsequent regression modelling to determine independent predictors of poor glycaemic control included age, BMI, hypertension, heart disease, smoking status, HbA1c level and blood glucose concentration.

Table 4. Variables included in the predictor analysis

Variable	Type	Role in analysis
Age	Continuous	Predictor
Gender	Categorical	Predictor
BMI	Continuous	Predictor

Hypertension	Binary	Predictor
Heart disease	Binary	Predictor
Smoking status	Categorical	Predictor
Blood glucose level	Continuous	Predictor
HbA1c level	Continuous*	Glycaemic assessment measure

*HbA1c was used to classify glycaemic control and was not entered as an independent predictor if the outcome was derived directly from HbA1c.

Overall, the results in Tables 1–4 and Figures 1–3 showed that 38.2% of the respondents had poor glycaemic control. Poor glycaemic control was proportionately higher for hypertension, heart disease and smoking status and these conditions could be investigated further using inferential statistical analysis such as binary logistic regression analysis to determine their independent effects on poor glycaemic control.

4. Discussion

Present study was conducted to see the predictors of poor glycaemic control in adult diabetic patients by taking secondary cross-sectional data with 500 participants. In total, 38.2% of the study population had poor glycaemic control (HbA1c ≥7%), suggesting that a large proportion of people who had received diabetes care were not reaching the target glycaemic levels. While most of the participants had good glycaemic control, the level of poor control reported is clinically significant as hyperglycaemia is linked to the risk of cardiovascular disease, nephropathy, neuropathy, retinopathy and premature death. Results support the need to monitor patients at risk of poor glycaemic control in routine practice and identify them early (Abdissa & Hirpa, 2022; Abera et al., 2022).

The study revealed that participants with hypertension and heart disease and currently smoking group had relatively higher proportion of poor glycaemic control as compared to their respective counterparts. Results are like other studies showing that cardiovascular diseases and unhealthy lifestyle habits make diabetes management more difficult and lead to poor glycemic control. The same has been noted in the other LMICs like Ethiopia where hypertension, obesity, medication adherence and behavioural factors were found to be significant determinants of poor glycaemic control (Alemu et al., 2021; Alor et al., 2023). Similarly, Yahaya et al. (2023) pointed out that often, several co-existing risk factors interact to exacerbate metabolic control, and therefore, integrated management strategies need to be adopted rather than relying on glucose-lowering therapy (Adjei et al., 2025; Bereda & Bereda, 2021).

In the present study, while the difference in glycaemic control by gender was relatively small, the distribution of poor glycaemic control among the smoking groups indicated that current smokers had poorer metabolic outcomes than the non-smokers and former smokers. It is known that smoking induces insulin resistance, chronic inflammation, and impaired vascular function which have a negative effect on glucose metabolism. Similar results were reported in the observational studies that showed the behavioural risk factors were still significant in the occurrence of poor glycaemic control and diabetes related complications (Gebermariam et al., 2020; Sheleme et al., 2020). Moreover, the higher prevalence of poor glycaemic control in participants with hypertension and heart disease, is consistent with previous evidence that multimorbidity can interfere with diabetes self-management and that often, such people require comprehensive multidisciplinary care (Gebrie et al., 2020).

The results have implications for public health as well. Good diabetes control is not just about medicines – it involves ongoing patient education, lifestyle changes, regular checking of HbA1C level and early treatment of other cardiovascular risk factors. Prior research has highlighted the importance of structured diabetes education, regular clinical follow-up and better access to health care services to improve glycaemic outcomes in adults with diabetes (Oluma et al., 2021; Patrick et al., 2021). Furthermore, enhancing primary healthcare and implementing evidence-based screening programs could help detect patients with a higher risk of poor glycemic control and minimize the long-term burden of diabetes complications (Dawite et al., 2023; Legese et al., 2023).

There are several strengths that should be taken into consideration when determining the findings. A complete and cleaned data set, with no missing observations, was used to evaluate multiple demographic and clinical predictors. By adopting the same threshold for HbA1c, it made it easier to compare our results to the international diabetes guidelines and previous studies. However, there are also some drawbacks to consider. First, the cross-

sectional design does not allow for causal inferences to be drawn regarding predictor variables and glycaemic control. Second, the data was obtained from a secondary source that is available to the public and lacked some possibly important data like length of diabetes, compliance with medication, eating habits, exercise, social status, and treatment. Furthermore, the dataset was composed of adults with diabetes but did not specifically identify type 1 and type 2 diabetes, which could be limiting in interpretation of the findings in this study (Yosef et al., 2021; Djonor et al., 2021). To better understand causal pathways affecting glycaemic control, future studies should use prospective cohort designs with more detailed clinical and behavioural data. Variables regarding adherence to treatments, nutrition, exercise, health service use and psychosocial factors would enable a more complete evaluation of factors affecting glycaemic outcomes. In addition, larger multi centre data may help refine risk classification and help in the use of an individual-based approach to diabetes management in the clinical setting (Fekadu et al., 2019; YimamAhmed et al., 2020).

Further studies with specifically diagnosed type 2 diabetes patients and more diverse populations would add to the generalisability of the findings and evidence-based public health interventions to decrease the morbidity associated with diabetes.

5. Conclusion

Poor glycaemic control continues to be a significant public health problem, which contributes to the risk of diabetes associated morbidity and mortality and imposes a massive burden on health care systems. Of the adults with diabetes, 38.2% had poor glycaemic control, defined as an HbA1c ≥7%, suggesting that a significant proportion of these patients were not achieving recommended treatment targets. Both clinical and behavioural factors played a part in diabetes management, with the prevalence of poor glycaemic control being higher among participants with hypertension, heart disease, and smoking history. These results highlight the importance of a holistic strategy to diabetes treatment that goes beyond just lowering glucose levels. Important steps to improve glycaemic outcomes include routine monitoring of HbA1c, early identification of high-risk individuals, lifestyle modification, smoking cessation, and good management of cardiovascular comorbidities. Likewise, enhanced patient education, follow-up systems and primary healthcare can help minimize the burden associated with diabetes-related complications and ensure better long-term health outcomes. The study has the limitation of being cross sectional with secondary data but does provide much evidence on factors that can contribute to poor glycaemic control in adult diabetic. Future longitudinal evaluations with more variables related to behaviour, clinical status, and treatment are suggested to deepen the understanding of the factors affecting glycaemic control and to help design and implement targeted interventions, based on available evidence, to improve diabetes management and public health.

References

1. Abdissa, D., & Hirpa, D. (2022). Poor glycemic control and its associated factors among diabetes patients attending public hospitals in West Shewa Zone, Oromia, Ethiopia: an Institutional based cross-sectional study. Metabolism Open, 13, 100154.
2. Abera, R. G., Demesse, E. S., & Boko, W. D. (2022). Evaluation of glycemic control and related factors among outpatients with type 2 diabetes at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: a cross-sectional study. BMC endocrine disorders, 22(1), 54.
3. Adjei, S. K., Adjei, P., & Nkrumah, P. A. (2025). Poor Glycemic Control and Its Predictors Among Type 2 Diabetes Patients: Insights From a Single-Centre Retrospective Study in Ghana. Health Science Reports, 8(3), e70558.
4. Alemu, T., Tadesse, T., & Amogne, G. (2021). Glycemic control and its determinants among patients with type 2 diabetes mellitus at Menelik II Referral Hospital, Ethiopia. SAGE open medicine, 9, 20503121211023000.
5. Al-ma'aitah, O. H., Demant, D., Jakimowicz, S., & Perry, L. (2022). Glycaemic control and its associated factors in patients with type 2 diabetes in the Middle East and North Africa: An updated systematic review and meta-analysis. Journal of advanced nursing, 78(8), 2257-2276.
6. Alor, S. K., Kretchy, I. M. A., Glozah, F. N., & Adongo, P. B. (2023). Factors associated with glycaemic control among patients with type 2 diabetes mellitus in Ho, Ghana: A cross-sectional study. Metabolism Open, 20, 100265.
7. Aschner, P., Gagliardino, J. J., Ilkova, H., Lavalle, F., Ramachandran, A., Mbanya, J. C., ... & Chan, J. C. (2020). Persistent poor glycaemic control in individuals with type 2 diabetes in developing countries: 12 years of real-world evidence of the International Diabetes Management Practices Study (IDMPS). Diabetologia, 63(4), 711-721.
8. Bereda, G., & Bereda, G. (2021). The incidence and predictors of poor glycemic control among adults with type 2 diabetes mellitus in ambulatory clinic of Mettu Karl referral hospital, south western, Ethiopia: a prospective cross sectional study. Int Arch Endocrinol Clin Res, 7(1), 1-22.

9. Bitew, Z. W., Alemu, A., Jember, D. A., Tadesse, E., Getaneh, F. B., Seid, A., & Weldeyonnes, M. (2023). Prevalence of glycemic control and factors associated with poor glycemic control: a systematic review and meta-analysis. INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 60, 00469580231155716.
10. Dawite, F., Girma, M., Shibiru, T., Kefelew, E., Hailu, T., Temesgen, R., & Abebe, G. (2023). Factors associated with poor glycemic control among adult patients with type 2 diabetes mellitus in Gamo and Gofa zone public hospitals, Southern Ethiopia: A case-control study. PloS one, 18(3), e0276678.
11. Dedefo, M. G., Abate, S. K., Ejeta, B. M., & Korsa, A. T. (2020). Predictors of poor glycemic control and level of glycemic control among diabetic patients in west Ethiopia. Annals of Medicine and Surgery, 55, 238-243.
12. Dimore, A. L., Edosa, Z. K., & Mitiku, A. A. (2023). Glycemic control and diabetes complications among adult type 2 diabetic patients at public hospitals in Hadiya zone, Southern Ethiopia. PLoS One, 18(3), e0282962.
13. Djonor, S. K., Ako-Nnubeng, I. T., Owusu, E. A., Akuffo, K. O., Nortey, P., Agyei-Manu, E., & Danso-Appiah, A. (2021). Determinants of blood glucose control among people with Type 2 diabetes in a regional hospital in Ghana. PloS one, 16(12), e0261455.
14. Fekadu, G., Bula, K., Bayisa, G., Turi, E., Tolossa, T., & Kasaye, H. K. (2019). Challenges and factors associated with poor glycemic control among type 2 diabetes mellitus patients at Nekemte Referral Hospital, Western Ethiopia. Journal of multidisciplinary healthcare, 963-974.
15. Feleke, B. E., Feleke, T. E., Kassahun, M. B., Adane, W. G., Fentahun, N., Girma, A., ... & Seid, O. (2021). Glycemic Control of Diabetes Mellitus Patients in Referral Hospitals of Amhara Region, Ethiopia: A Cross-Sectional Study. BioMed research international, 2021(1), 6691819.
16. Fina Lubaki, J. P., Omole, O. B., & Francis, J. M. (2022). Glycaemic control among type 2 diabetes patients in sub-Saharan Africa from 2012 to 2022: a systematic review and meta-analysis. Diabetology & Metabolic Syndrome, 14(1), 134.
17. Gebermariam, A. D., Tiruneh, S. A., Ayele, A. A., Tegegn, H. G., Ayele, B. A., & Engidaw, M. (2020). Level of glycemic control and its associated factors among type II diabetic patients in debre tabor general hospital, northwest Ethiopia. Metabolism Open, 8, 100056.
18. Gebreyohannes, E. A., Netere, A. K., & Belachew, S. A. (2019). Glycemic control among diabetic patients in Ethiopia: a systematic review and meta-analysis. PLoS One, 14(8), e0221790.
19. Gebrie, A., Tesfaye, B., & Sisay, M. (2020). Evaluation of glycemic control status and its associated factors among diabetes patients on follow-up at referral hospitals of Northwest Ethiopia: a cross-sectional study, 2020. Heliyon, 6(12).
20. Legese, G. L., Asres, G., Alemu, S., Yesuf, T., Tesfaye, Y. A., & Amare, T. (2023). Determinants of poor glycemic control among type 2 diabetes mellitus patients at University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia: Unmatched case-control study. Frontiers in Endocrinology, 14, 1087437.
21. Mustafa, M. (2022). Diabetes prediction dataset [Data set]. Kaggle. https://www.kaggle.com/datasets/iammustafatz/diabetes-prediction-dataset
22. Nigussie, S., Birhan, N., Amare, F., Mengistu, G., Adem, F., & Abegaz, T. M. (2021). Rate of glycemic control and associated factors among type two diabetes mellitus patients in Ethiopia: a cross sectional study. PloS one, 16(5), e0251506.
23. Oluma, A., Abadiga, M., Mosisa, G., & Etafa, W. (2021). Magnitude and predictors of poor glycemic control among patients with diabetes attending public hospitals of Western Ethiopia. PloS one, 16(2), e0247634.
24. Patrick, N. B., Yadesa, T. M., Muhindo, R., & Lutoti, S. (2021). Poor glycemic control and the contributing factors among type 2 diabetes mellitus patients attending outpatient diabetes clinic at mbarara regional referral hospital, Uganda. Diabetes, Metabolic Syndrome and Obesity, 3123-3130.
25. Sheleme, T., Mamo, G., Melaku, T., & Sahilu, T. (2020). Glycemic control and its predictors among adult diabetic patients attending Mettu Karl Referral Hospital, Southwest Ethiopia: a prospective observational study. Diabetes Therapy, 11(8), 1775-1794.
26. Tarekegn, E. T., Gobezie, M. Y., Haile, M. B., & Zerga, A. A. (2025). Glycemic control and associated factors among type 2 diabetes patients attending at Dessie comprehensive specialized hospital outpatient department. Scientific Reports, 15(1), 9286.
27. Tegegne, K. D., Gebeyehu, N. A., Yirdaw, L. T., Yitayew, Y. A., & Kassaw, M. W. (2024). Determinants of poor glycemic control among type 2 diabetes in Ethiopia: a systematic review and meta-analysis. Frontiers in Public

Health, 12, 1256024.

28. Yahaya, J. J., Doya, I. F., Morgan, E. D., Ngaiza, A. I., & Bintabara, D. (2023). Poor glycemic control and associated factors among patients with type 2 diabetes mellitus: a cross-sectional study. Scientific Reports, 13(1), 9673.
29. YimamAhmed, M., Hambisa Ejigu, S., Zewudie Zeleke, A., & Yimam Hassen, M. (2020). Glycemic control, diabetes complications and their determinants among ambulatory diabetes mellitus patients in southwest ethiopia: A prospective cross-sectional study. Diabetes, Metabolic Syndrome and Obesity, 1089-1095.
30. Yosef, T., Nureye, D., & Tekalign, E. (2021). Poor glycemic control and its contributing factors among type 2 diabetes patients at Adama Hospital Medical College in East Ethiopia. Diabetes, metabolic syndrome and obesity, 3273-3280.