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Glycemic Control and Its Complications Among Type 2 Diabetes Mellitus Patients in Tertiary Hospitals

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Abstract: ***Background:*** Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by persistent hyperglycemia which if inadequately controlled leads to serious microvascular and macrovascular complications. ***Methods:*** A hospital-based cross-sectional observational study was conducted at the Department of Medicine, Al Haramain Hospital, Sylhet and Ideal Clinic, Sylhet from March 2022 to February 2023. A total of 296 T2DM patients aged 30 years and above diagnosed for at least one year were considered as candidate for the study. Data on demographic variables, clinical history, laboratory parameters including HbA1c and diabetes-related complications were collected using structured questionnaires and patient records. Glycemic control was categorized as good (HbA1c <7%) or poor (HbA1c ≥7%). Statistical analyses were performed using SPSS to identify associations between glycemic control, demographic factors, and complications. ***Results:*** Among the 296 participants, 98 (33.1%) had good glycemic control, while 198 (66.9%) had poor control. Microvascular complications were highly prevalent, affecting 62.8% of patients, with diabetic neuropathy (35.1%) being the most frequent, followed by retinopathy (29.4%) and nephropathy (24.3%). Macrovascular complications were also common, with ischemic heart disease observed in 27.8%, stroke in 10.1%, and peripheral arterial disease in 8.8%. Older age (≥60 years) and longer duration of diabetes (>10 years) were significantly associated with poor glycemic control and higher complication rates ($p<0.05$). No significant gender differences were found in glycemic control or complication prevalence. ***Conclusion:*** The study highlights a substantial burden of poor glycemic control and related complications among T2DM patients in this tertiary care setting.

Keywords: Type 2 Diabetes Mellitus, Glycemic Control, HbA1c, Diabetic Complications, Microvascular Complications, Macrovascular Complications.

Original Research Article

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Article at a glance:

Study Purpose: *To assess the level of glycemic control and its association with diabetes-related complications in patients attending Al Haramain Hospital and Ideal Clinic, Sylhet.*

Key findings: *Many patients had poor glycemic control (high HbA1c). Common complications included neuropathy, retinopathy, and hypertension. Poor control was linked with increased risks.*

Newer findings: *This study highlights hospital-specific trends in Sylhet and emphasizes the urgent need for better diabetes education and consistent monitoring to reduce complications in the region.*

Abbreviations: *T2DM – Type 2 Diabetes Mellitus, HbA1c – Hemoglobin A1c, DKA – Diabetic Ketoacidosis.*

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and relative insulin deficiency, leading to persistent hyperglycemia. It accounts for more than 90% of all diabetes cases globally and poses a

significant public health challenge due to its rising prevalence and associated complications.[1] According to the International Diabetes Federation (IDF), 537 million adults were living with diabetes in 2021, and this number is projected to rise to 783 million by 2045 if current trends continue.[2] The prevalence of diabetes is particularly alarming in low- and middle-income countries, including Bangladesh where rapid urbanization, sedentary lifestyles, unhealthy diets, and increased life expectancy have contributed to a surge in cases.[3] A nationwide survey in Bangladesh reported a diabetes prevalence of approximately 9.7%, with a significant proportion of individuals remaining undiagnosed or poorly controlled.[4] Effective glycemic control is essential to prevent acute and chronic complications of T2DM. Poor glycemic control is associated with a higher risk of microvascular complications such as retinopathy, nephropathy, and neuropathy, as well as macrovascular events including myocardial infarction and stroke.[5] Studies such as the UK Prospective Diabetes Study (UKPDS) and Diabetes Control and Complications Trial (DCCT) have clearly demonstrated the link between chronic hyperglycemia and vascular complications.[6] Despite advancements in therapeutic strategies and the availability of national and international guidelines, achieving optimal glycemic control remains a significant challenge in developing countries. Factors such as poor patient adherence, inadequate access to healthcare, low awareness, and economic constraints contribute to suboptimal diabetes management.[7] Additionally, many patients in Bangladesh present with complications at the time of diagnosis, indicating delayed detection and intervention.[8] Recent hospital-based studies in South Asia have shown that a large proportion of T2DM patients do not meet target glycemic levels, with complications already present in early disease stages.[9] The situation calls for enhanced surveillance, education, and treatment strategies tailored to the local population and healthcare system. The northeastern region of Bangladesh, particularly Sylhet, lacks sufficient clinical data regarding glycemic control and diabetes-related complications. Al Haramain Hospital, Sylhet and Ideal Clinic, Sylhet both as tertiary care facility in Sylhet provides a unique opportunity to evaluate the glycemic status and associated complications of patients with T2DM. This study aims to assess the extent of glycemic control and the frequency and nature of complications in these patients. Such data are essential for the development of region-specific guidelines and resource allocation, ultimately improving outcomes for patients with T2DM.

MATERIALS AND METHODS

Study Design

This study was a hospital-based cross-sectional observational study conducted at the Department of Medicine of Al Haramain Hospital, Sylhet and Ideal Clinic, Sylhet, Bangladesh. The study period spanned from March 2022 to February 2023 and all T2DM patients who fulfilled the inclusion and exclusion criteria, aged 30 years and above, diagnosed for at least one year were enrolled for the study

Data Collection Procedure

Data were collected from 296 patients diagnosed with type 2 diabetes mellitus (T2DM) attending both inpatient and outpatient departments. A structured and pretested questionnaire was used to obtain relevant information through direct interviews and review of medical records. Data included sociodemographic characteristics, duration of diabetes, comorbid conditions, medication history, and lifestyle factors. Clinical evaluations and laboratory results were documented, including fasting blood glucose (FBG), glycated hemoglobin (HbA1c), lipid profile, serum creatinine, and urine albumin levels. Glycemic control was assessed using HbA1c values, and diabetes-related complications were identified through clinical assessments, laboratory findings, and patient records. Microvascular complications included retinopathy, nephropathy, and peripheral neuropathy. Macrovascular complications included ischemic heart disease, stroke, and peripheral arterial disease.

Inclusion Criteria

Patients were eligible for inclusion in the study if they were aged 30 years or older, had a confirmed diagnosis of type 2 diabetes mellitus for at least one year, and attended the Department of Medicine at Al Haramain Hospital, Sylhet and Ideal Clinic, Sylhet during the study period. Only those individuals who provided written informed

consent to participate in the study were included. These criteria ensured the inclusion of patients with a stable diagnosis and sufficient duration of disease to assess glycemic control and related complications effectively.

Exclusion Criteria

Patients were excluded from the study when they had type 1 diabetes mellitus or gestational diabetes, as the focus was solely on type 2 diabetes mellitus. Critically ill patients who were unable to respond to interviews or complete necessary clinical evaluations were also excluded to maintain data reliability. Additionally, patients with incomplete clinical or laboratory records were not considered, as comprehensive data were essential for assessing glycemic control and associated complications. Individuals who declined to provide written informed consent were likewise excluded from participation.

Statistical Analysis

Data were entered and analyzed using SPSS version 26.0. Descriptive statistics were applied to summarize demographic and clinical characteristics. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as means and standard deviations. The Chi-square test was used to determine the association between glycemic control and diabetes-related complications. A p-value of less than 0.05 was considered statistically significant.

Ethical Consideration

Prior approval for the study was obtained from the Institutional Review Board (IRB) of Al Haramain Hospital, Sylhet and Ideal Clinic, Sylhet. All participants were informed about the objectives, benefits, and potential risks of the study, and written informed consent was taken before data collection. The confidentiality of participants was strictly maintained throughout the study and all procedures were conducted in accordance with the Declaration of Helsinki.

RESULTS

A total of 296 patients with type 2 diabetes mellitus were enrolled in this study. The demographic characteristics, glycemic control status, prevalence of complications, and associated factors are summarized in the following tables.

Table 1: Sociodemographic Characteristics of the Study Population (n = 296)

Variable	Frequency (n)	Percentage (%)
Age (years)		
30–39	48	16.2
40–49	76	25.7
50–59	89	30.1
≥60	83	28.0
Gender		
Male	162	54.7
Female	134	45.3
Residence		
Urban	179	60.5
Rural	117	39.5

Table 1 presents the mean age of the participants was 53.8 ± 10.4 years, with most patients aged between 50 and 59 years (30.1%). Male patients constituted 54.7%, and 60.5% resided in urban areas.

Table 2: Duration of Diabetes and Treatment Modalities (n = 296)

Variable	Frequency (n)	Percentage (%)
Duration of Diabetes		
1–5 years	132	44.6
6–10 years	97	32.8
>10 years	67	22.6
Treatment Modalities		
Oral Hypoglycemic Agents (OHA)	184	62.2
Insulin	53	17.9
Combination (OHA + Insulin)	59	19.9

Table 2 presents the majority of patients had diabetes for 1 to 5 years (44.6%). Most were managed with oral hypoglycemic agents alone (62.2%), while 19.9% received combination therapy.

Table 3: Glycemic Control Status Based on HbA1c (n = 296)

Glycemic Control Status	Frequency (n)	Percentage (%)
Good Control (HbA1c <7%)	98	33.1
Poor Control (HbA1c ≥7%)	198	66.9

Table 3 presents the only one-third of the study population achieved good glycemic control (HbA1c <7%), while 66.9% had poor glycemic control.

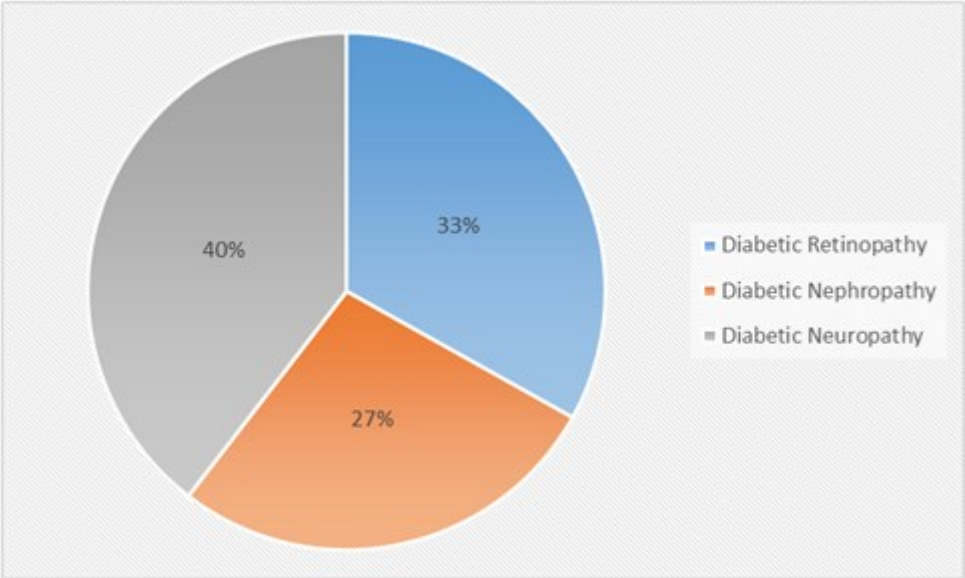

Figure 1: Prevalence of Microvascular Complications (n = 296)

Figure 1 presents the peripheral neuropathy was the most common microvascular complication (35.1%), followed by retinopathy (29.4%) and nephropathy (24.3%).

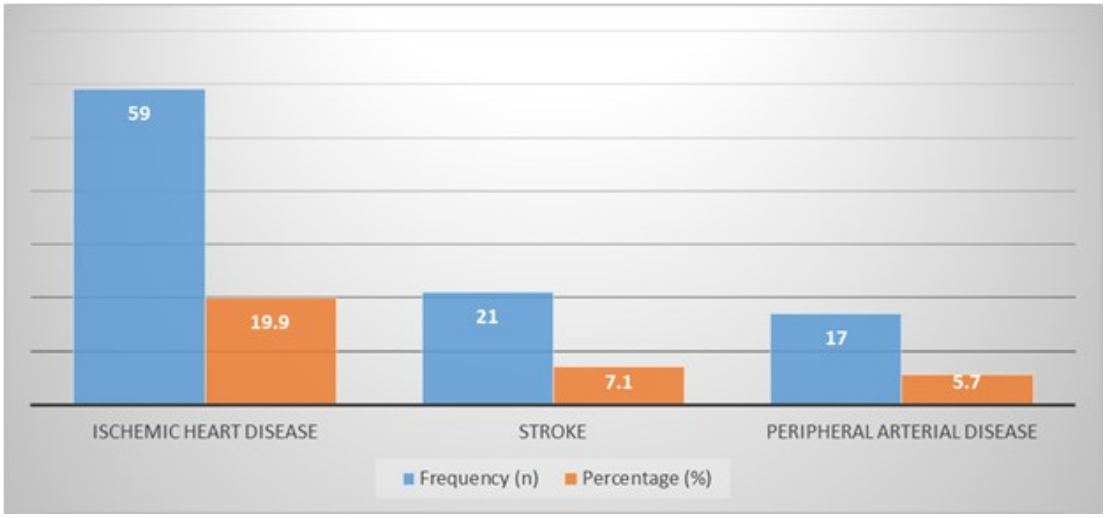

Figure 2: Prevalence of Macrovascular Complications (n = 296)

Figure 2 presents the complications were observed in chronic illness patients, with ischemic heart disease being the most common (19.9%), followed by stroke (7.1%) and peripheral arterial disease (5.7%).

Table 4: Association between Duration of Diabetes and Glycemic Control

Duration of Diabetes	Good Control (n, %)	Poor Control (n, %)	p-value
1–5 years	56 (42.4%)	76 (57.6%)	
6–10 years	28 (28.9%)	69 (71.1%)	0.002*
>10 years	14 (20.9%)	53 (79.1%)	

*Significant at $p < 0.05$

Table 4 presents Patients with diabetes for more than 10 years had the highest rate of poor glycemic control (79.1%), compared to 57.6% in those with 1–5 years duration ($p = 0.002$), showing a significant association between longer diabetes duration and poor control.

Table 5: Association between Glycemic Control and Microvascular Complications

Complication	Good Control (n, %)	Poor Control (n, %)	p-value
Retinopathy	15 (15.3%)	72 (36.4%)	<0.001*
Nephropathy	12 (12.2%)	60 (30.3%)	<0.001*
Neuropathy	22 (22.4%)	82 (41.4%)	0.001*

*Significant at $p < 0.05$

Table 5 shows the microvascular complications were more frequent in poorly controlled patients: retinopathy (36.4% vs. 15.3%), nephropathy (30.3% vs. 12.2%), and neuropathy (41.4% vs. 22.4%), all with p-values ≤ 0.001 indicating strong significance.

Table 6: Association between Glycemic Control and Macrovascular Complications

Complication	Good Control (n, %)	Poor Control (n, %)	p-value
Ischemic Heart Disease	8 (8.2%)	51 (25.8%)	0.001*
Stroke	3 (3.1%)	18 (9.1%)	0.04*
Peripheral Arterial Disease	2 (2.0%)	15 (7.6%)	0.05*

*Significant at $p < 0.05$

Table 6 presents the Macrovascular complications were significantly more common in the poor control group—ischemic heart disease (25.8% vs. 8.2%, p = 0.001), stroke (9.1% vs. 3.1%, p = 0.04), and peripheral arterial disease (7.6% vs. 2.0%, p = 0.05).

Table 7: Gender Distribution of Complications

Complication	Male (n, %)	Female (n, %)	p-value
Retinopathy	48 (29.6%)	39 (29.1%)	0.92
Nephropathy	38 (23.5%)	34 (25.4%)	0.68
Neuropathy	59 (36.4%)	45 (33.6%)	0.61

Table 7 shows no significant gender differences were found in microvascular complications, with similar prevalence in males and females (retinopathy: 29.6% vs. 29.1%, nephropathy: 23.5% vs. 25.4%, neuropathy: 36.4% vs. 33.6%; p > 0.05).

Table 8: Glycemic Control by Age Group

Age Group (years)	Good Control (n, %)	Poor Control (n, %)	p-value
30–39	20 (41.7%)	28 (58.3%)	
40–49	30 (39.5%)	46 (60.5%)	0.03*
50–59	28 (31.5%)	61 (68.5%)	
≥60	20 (24.1%)	63 (75.9%)	

*Significant at p < 0.05

Table 8 illustrates the glycemic control varied significantly with age. Patients aged ≥60 years had the poorest control (75.9% with HbA1c ≥7%), while the best control was observed in the 30–39 age group (41.7% with HbA1c <7%). The association between age and glycemic control was statistically significant (p = 0.03).

DISCUSSION

This study assessed the glycemic control status and its complications among patients with type 2 diabetes mellitus (T2DM) attending the Department of Medicine, Al Haramain Hospital, Sylhet and Ideal Clinic, Sylhet. Among 296 participants, only 33.1% had good glycemic control (HbA1c <7%), while the remaining 66.9% had poor control. This high prevalence of inadequate glycemic control is comparable to several studies conducted in similar South Asian settings, where factors such as limited access to health education, economic constraints, and suboptimal adherence to treatment regimens contribute to poor diabetes management.[10,11] Microvascular complications were identified in 62.8% of the study population, with diabetic neuropathy (35.1%) being the most common, followed by retinopathy (29.4%) and nephropathy (24.3%). These findings align with global data emphasizing the burden of small-vessel damage due to chronic hyperglycemia in T2DM patients.[12,13] Macrovascular complications were also frequent, particularly among those with poor glycemic control. Ischemic heart disease was present in 27.8%, stroke in 10.1%, and peripheral arterial disease in 8.8% of patients. These findings reinforce the well-documented link between sustained hyperglycemia and atherosclerotic cardiovascular disease.[14,15] A significant association was observed between age and glycemic control. Patients aged 60 years and above had the highest rate of poor glycemic control (75.9%), which may be due to age-related decline in β-cell function, higher rates of comorbidities, and less stringent glycemic targets in the elderly.[16] On the contrary, better glycemic control was more common in younger age groups. This age-related trend in glycemic status is consistent with findings from prior studies.[17] Duration of diabetes also emerged as a significant factor. Patients with diabetes duration over 10 years had markedly higher rates of complications, suggesting the progressive nature of the disease and the cumulative effects of poor metabolic control over time. These results support the notion that long-term hyperglycemia is a critical driver of both microvascular and macrovascular complications.[18] Interestingly, the study did not find any significant gender differences in the

prevalence of glycemic control or diabetes-related complications, a finding consistent with some previous literature, although other studies have reported that women may experience worse glycemic outcomes or higher complication rates in specific contexts[19] This study underscores the urgent need for improved glycemic monitoring, patient education, and individualized diabetes care. Early diagnosis, consistent follow-up, and lifestyle modifications can substantially reduce the burden of complications. Integration of multidisciplinary diabetes care teams, improved patient adherence to medications, and wider access to HbA1c testing can enhance outcomes, particularly in resource-limited settings like Bangladesh. Overall, the findings highlight significant gaps in diabetes care and reinforce the importance of strategic interventions to enhance glycemic control and prevent complications in T2DM patients in tertiary care settings.

CONCLUSION

This study revealed that a substantial proportion of type 2 diabetes mellitus patients attending a tertiary care hospital in Sylhet had poor glycemic control, with over two-thirds exhibiting HbA1c levels above the recommended target. The high prevalence of both microvascular and macrovascular complications—particularly among older patients and those with longer disease duration—highlights the serious burden of uncontrolled diabetes in this population. These findings underscore the urgent need for strengthened diabetes management strategies, including regular monitoring, patient education, lifestyle modification, and early screening for complications. Enhancing awareness and implementing structured care plans can significantly reduce the long-term morbidity associated with type 2 diabetes in resource-limited settings like Bangladesh.

Limitations of the study

This study had several limitations. First, being a single-city, hospital-based study, the findings may not be generalizable to the broader population of type 2 diabetes mellitus patients in the community. Second, the cross-sectional design limits the ability to establish causal relationships between glycemic control and complications. Third, reliance on self-reported history and medical records may introduce recall or documentation bias.

Recommendations

To improve outcomes for type 2 diabetes patients, regular HbA1c monitoring and early screening for complications are essential. Patient education on lifestyle changes and medication adherence should be prioritized. A multidisciplinary approach involving healthcare professionals can provide comprehensive care. Additionally, community-based programs are needed to extend diabetes management beyond hospital settings. Further research is encouraged to deepen understanding of glycemic control and its complications.

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REFERENCES

1. Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract. 2018;138:271-281. https://doi.org/10.1016/j.diabres.2018.02.023
2. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021. Diabetes Res Clin Pract. 2022;183:109119. https://doi.org/10.1016/j.diabres.2021.109119
3. Saquib N, Saquib J, Ahmed T, Khanam MA, Cullen MR. Cardiovascular diseases and type 2 diabetes in Bangladesh: A systematic review. Prev Chronic Dis. 2012;9:E120. https://doi.org/10.5888/pcd9.110317
4. Akter S, Rahman MM, Abe SK, Sultana P. Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults. Diabetes Res Clin Pract. 2014;103(3):431–437. https://doi.org/10.1016/j.diabres.2014.02.026
5. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA, et al. Association of glycaemia with complications of Type 2

diabetes (UKPDS 35). BMJ. 2000;321(7258):405–412. https://doi.org/10.1136/bmj.321.7258.405

6. DCCT Research Group. The effect of intensive treatment of diabetes on the development of long-term complications. N Engl J Med. 1993;329(14):977–986. https://doi.org/10.1056/NEJM199309303291401
7. Khattab M, Khader YS, Al-Khawaldeh A, Ajlouni K. Factors associated with poor glycemic control among patients with T2DM. Diabetes Res Clin Pract. 2010;89(3):e10-e13. https://doi.org/10.1016/j.diabres.2010.05.010
8. Chowdhury TA, Hitman GA. Type 2 diabetes in people of South Asian origin: Potential strategies for prevention. Br J Diabetes Vasc Dis. 2007;7(6):279–282. https://doi.org/10.1177/14746514070070060501
9. Mohan V, Shah SN, Joshi SR, Seshiah V, Sahay BK, Banerjee S. Current status of management, control, complications, and psychosocial aspects of patients with diabetes in India. J Assoc Physicians India. 2009;57:687–694. https://doi.org/10.1007/s00592-013-0528-2
10. Shera AS, Jawad F, Maqsood A. Prevalence of diabetes in Pakistan. Diabetes Res Clin Pract. 2007;76(2):219-222. https://doi.org/10.1016/j.diabres.2006.08.011
11. Ahmed MU et al. Glycemic control among T2DM patients in a tertiary care hospital in Dhaka. BIRDEM Med J. 2017;7(1):32–36. https://doi.org/10.3329/bmjb.v7i1.32051
12. Forbes JM, Cooper ME. Mechanisms of diabetic complications. Physiol Rev. 2013;93(1):137–188. https://doi.org/10.1152/physrev.00045.2011
13. Tesfaye S, Boulton AJ. Diabetic neuropathies: update on definitions, diagnostic criteria, estimation of severity, and treatments. Diabetes Care. 2010;33(10):2285–2293. https://doi.org/10.2337/dc10-1303
14. Stratton IM et al. Association of glycaemia with macrovascular and microvascular complications. BMJ. 2000;321(7258):405–412. https://doi.org/10.1136/bmj.321.7258.405
15. Haffner SM et al. Mortality from CHD in subjects with and without diabetes. N Engl J Med. 1998;339(4):229–234. https://doi.org/10.1056/NEJM199807233390404
16. Sinclair AJ et al. Managing diabetes in older people. BMJ. 2012;344:e529. https://doi.org/10.1136/bmj.e529
17. Huxley R, Barzi F, Woodward M. Excess risk of fatal CHD associated with diabetes in women vs men. Lancet. 2006;368(9547): 404–409. https://doi.org/10.1016/S0140-6736(06)69198-1
18. Adler AI et al. Association between duration of diabetes and risk of complications. Diabet Med. 2003;20(6):442–450. https://doi.org/10.1046/j.1464-5491.2003.00923.x
19. UKPDS Group. Intensive blood-glucose control with sulphonylureas or insulin. Lancet. 1998;352(9131):837–853. https://doi.org/10.1016/S0140-6736(98)07019-6.