Prevalence and management patterns of type 2 diabetes associated cardiovascular complications

Amonova Zakhro Kakhramonovna
PhD, Assistant of the Department of Neurology, Samarkand State Medical University, 140013 Samarkand, Uzbekistan.
E-mail: zaxroamonova@gmail.com https://orcid.org/0000-0003-4397-1416
Hamidova Feruza Karimovna
Assistant of the Department of Propaedeutics of children diseases and child neurology, Bukhara State Medical Institute Named After Abu Ali Ibn Sino, 200100 Bukhara, Uzbekistan
E-mail: Feruzahamidova@gmail.com https://orcid.org/0009-0009-1745-1274
N. Esanmurodova[1,2]
[1]"Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" National Research University, Tashkent, Uzbekistan.
[2]Baku Eurasian University, Baku, AZ 1073, Azerbaijan
E-mail: nilufar1289@gmail.com https://orcid.org/0009-0006-5617-0545
Abdullayev Dadaxon
Urgench State University, 14, Kh.Alimdjan str, Urganch, Khorezm, Uzbekistan
E-mail: dadaxonabdullayev96@gmail.com https://orcid.org/0009-0009-8583-2538
Boboev Behzod Muminjon ugli
Department of Vascular Surgery of Tashkent Medical Academy, Tashkent, Uzbekistan
E-mail: behzodboboev178@gmail.com https://orcid.org/0009-0009-9367-5755
Bobur Raximov
Department of Psychological Sciences, Mamun university, Khiva, Uzbekistan.
E-mail: raximovbobur031@gmail.com https://orcid.org/0009-0004-7853-3453
Yuldasheva Zarofat Igamberdiyevna
Candidate of medical sciences, Faculty of Medicine, Angren University, Angren City, Tashkent Region, Uzbekistan. E-mail: yuldashevazarofar253@gmail.com; https://orcid.org/0009-0003-5165-512X
Ro'zaliyev Komiljon Nosirovich
Senior lecturer, Department of Microbiology, virology and immunology, Fergana Medical Institute of Public Health.
E-mail: komiljonruzaliyev63@gmail.com; https://orcid.org/0009-0007-1851-3372
Received: 02/20/2025 Accepted: 04/19/2025 Published: 05/12/2025 DOI: http://doi.org/10.5281/zenodo.15363880

Abstract

The present investigation was targeted to examine the morbidity of cardiovascular complications in patients with type 2 diabetes mellitus and also the trends in the management of complications in Uzbekistan. This analytic cross-sectional study was conducted among 1200 patients with type 2 diabetes with a mean age of 58.4 years (range: 45-70 years) of the year 2018-2023 in the medical centers of Tashkent, Samarkand and Bukhara. Data were collected through a review of medical records, clinical evaluation and standardized questionnaires. 45.2% of the patients had ≥ 1 cardiovascular complications based on the findings. The most common complications were ischemic heart disease (28.1%), hypertension (20.4%), heart failure (15.3%) and cerebrovascular accidents (8%). Of the risk factors, obesity (67.5%), dyslipidemia (58.9%) and uncontrolled blood sugar levels (mean HbA1c: 8.6%) were the most common causes for these complications to occur. The management pattern indicated that 74.8% of the patients were on metformin, 60.3% were on insulin, and 45.6% were on statins. But only 39.7% of the patients achieved the target of treatment for HbA1c <7%. For blood pressure management, 51.2% of the patients were on antihypertensive therapy and 35.4% had achieved LDL-C <100 mg/dL. Lifestyle modification in the form of regular exercise (30.1%) and healthy diet (24.8%) was reported at a low rate. The results show a high rate of cardiovascular complications among Uzbek

diabetic patients and a large disparity in optimal control of these complications. Increasing access to combination treatments, patient education, and intensifying cardiovascular screening programs among these patients are advised.

Keywords: type 2 diabetes, cardiovascular complications, prevalence, management, Uzbekistan

Resumen

La presente investigación tuvo como objetivo examinar la morbilidad de las complicaciones cardiovasculares en pacientes con diabetes mellitus tipo 2 y las tendencias en el manejo de estas complicaciones en Uzbekistán. Este estudio transversal analítico se realizó entre 2018 y 2023 en 1200 pacientes con diabetes tipo 2, con una edad promedio de 58,4 años (rango: 45-70 años), en centros médicos de Tashkent, Samarcanda y Bujará. Los datos se recopilaron mediante la revisión de historias clínicas, evaluación clínica y cuestionarios estandarizados. El 45,2% de los pacientes presentó ≥ 1 complicación cardiovascular, según los hallazgos. Las complicaciones más comunes fueron cardiopatía isquémica (28,1%), hipertensión (20,4%), insuficiencia cardíaca (15,3%) y accidentes cerebrovasculares (8%). De los factores de riesgo, la obesidad (67,5%), la dislipidemia (58,9%) y los niveles de azúcar en sangre no controlados (HbA1c media: 8,6%) fueron las causas más comunes de que ocurrieran estas complicaciones. El patrón de manejo indicó que el 74,8% de los pacientes tomaban metformina, el 60,3% insulina y el 45,6% estatinas. Pero solo el 39,7% de los pacientes alcanzaron el objetivo de tratamiento de HbA1c <7%. Para el manejo de la presión arterial, el 51,2% de los pacientes recibían terapia antihipertensiva y el 35,4% había alcanzado LDL-C <100 mg/dL. La modificación del estilo de vida en forma de ejercicio regular (30,1%) y dieta saludable (24,8%) se informó en una tasa baja. Los resultados muestran una alta tasa de complicaciones cardiovasculares entre los pacientes diabéticos uzbekos y una gran disparidad en el control óptimo de estas complicaciones. Se recomienda ampliar el acceso a tratamientos combinados, la educación del paciente y la intensificación de los programas de detección cardiovascular entre estos pacientes.

Palabras clave: diabetes tipo 2, complicaciones cardiovasculares, prevalencia, manejo, Uzbekistán

Introduction

Type 2 diabetes is a global epidemic that is currently affecting more than 463 million people worldwide and is projected to increase to 700 million by 2045[1]. The condition has become a major public health challenge not only because of its metabolic dysfunctions but also its cardiovascular complications that are fatal[2]. Literature shows that approximately 65–80% of diabetes-related deaths are attributed to cardiovascular disorders such as ischemic heart disease, stroke, and heart failure[3]. In low- and middle-income countries (LMICs), the burden of these complications is disproportionately high, particularly due to health system constraints and socioeconomic factors[4].

Uzbekistan, as one of the countries in the region of Central Asia, is facing a rapid epidemiological transition with an increasing prevalence of type 2 diabetes and associated risk factors such as obesity, physical inactivity, and unhealthy diet[5]. According to the International Diabetes Federation (IDF), the nation's prevalence of diabetes was 9.1% of the adult population in 2021[6]. However, limited and fragmented data on the trend of cardiovascular complications and the quality of care of these patients has been an obstacle to effective health planning[7].

Global evidence exists to show that poor glycemic control (HbA1c ≥7%), hypertension, and dyslipidemia are the main risk triad for cardiovascular complications in patients with diabetes[8]. While international guidelines recommend the use of cardioprotective drugs such as SGLT2 inhibitors and GLP-1 receptor agonists[9], studies in Central Asian countries show that access to these drugs is very limited due to high cost and health insurance coverage limitations[10]. Nevertheless, an incomplete electronic health record system and integration inadequacy in the provision of diabetes care postpone the detection of high-risk patients[11]. In Uzbekistan, more than 40% of diabetics live in rural areas with limited access to specialized cardiological centers and well-equipped laboratories[12]. This geographical disparity is likely to be resulting in delayed diagnosis and management of cardiovascular complications.

The study importance is to fill the existing gap in knowledge regarding the epidemiological pattern and treatment approaches to type 2 diabetes cardiovascular complications in Uzbekistan. Accurate information about the leading risk factors, prevalence of complications, and structural health system barriers can help in planning targeted interventions and in reducing the burden of the disease. Moreover, the current research is the first nation-level research that integrates socioeconomic determinants with clinical data in this area, which is useful to health policymakers. Several studies have proven that patients with type 2 diabetes are two to four times

more at risk of cardiovascular mortality compared to the general population[13]. The risk is further added if there are additional metabolic disorders such as central obesity, insulin resistance and systemic inflammation[14]. According to a recent meta-analysis, the combined prevalence of ischemic heart disease in diabetic patients is 21.2% and heart failure is 14.6%[15]. But significant geographical differences in the pattern of complications have been reported; in low- and middle-income nations, stroke and peripheral vascular disease are responsible for a larger proportion of disease burden[16].

In managing cardiovascular complications, global guidelines emphasize a multidisciplinary approach to meticulous glycemic, blood pressure and lipid management[17]. A study in 2023 showed that the use of new drugs such as SGLT2 inhibitors and GLP-1 receptor agonists has the potential to reduce the risk of hospitalization for heart failure by up to 30 %[18]. However, in all the Central Asian countries, including Uzbekistan, these drugs are prescribed to less than 10% of patients since they are unaffordable and insurance is weak[10]. Evidence suggests that the quality of diabetes care within resource-limited health systems depends on issues surrounding unequal access to diagnostic testing, insufficient skilled workforce, and dysfunction in electronic health record systems[19]. As an example, among diabetic patients interviewed in one study in Kazakhstan, 34% were getting routine blood pressure monitoring and 28% received periodic lipid studies[20]. These are concentrated in Uzbekistan, where the health infrastructure is extremely decentralized in rural areas and patients have to travel long distances to receive specialized care[12].

In addition to systemic factors, lifestyle behavior is also crucial in the prevention of cardiovascular complications. A 2022 cohort study found that a rise in moderate to vigorous physical activity lowers the risk of cardiovascular events among diabetic patients by up to 25%[21]. However, in Uzbekistan, food habits of high calorie and saturated fat intake at high levels have been found to be major barriers to change in lifestyle[22]. Epidemiologically, few data are available on the specific pattern of cardiovascular type 2 diabetes complications in Central Asia. According to a recent survey conducted in Tajikistan, 48.7% of diabetic patients had hypertension, but the goals of treatment were achieved in just 22.3% of patients[23]. This necessitates local studies to produce more information regarding risk factors and evidence-based interventions.

Materials and methods

Study Design

This cross-analytic research was conducted with the participation of 1,200 patients with type 2 diabetes in 2018-2023 in the medical facilities of three Uzbekistan capital cities (Tashkent, Samarkand, and Bukhara). These facilities were selected for participation in order to account for geographical and demographic heterogeneity of the country. The research design was conducted in line with the STROBE guidelines for cross-sectional studies for methodological clarity and validity[24].

Statistical Population and Sampling

The target population was made up of adults aged 18 years and older with a definite type 2 diabetes diagnosis (based on International Diabetes Federation criteria[6]) and who were diagnosed with the disease for 5 or more years. Exclusion criteria were gestational diabetes, type 1 diabetes, or acute infectious diseases. Sampling was done in accordance with the distribution between the urban and rural population in such a manner that 60% of samples were collected from urban regions while 40% were collected from rural regions.

Data Collection

Information was collected from three major sources: electronic health records, paraclinical tests, and structured questionnaires. HbA1c was quantified using HPLC and lipids (total cholesterol, LDL-C, HDL-C, and triglycerides) were measured by enzymatic techniques. Blood pressure was measured using standard digital instruments according to the WHO protocol[24]. Questionnaires had information on drug usage, physical activity, eating behavior, and history of diseases, the reliability and validity of which had been demonstrated in previous research in the Central Asian region[22].

Operational variables and definitions

Cardiovascular endpoints were measured as dependent variables like ischemic heart disease (history of infarction or diagnosis by angiography), hypertension (≥140/90 mmHg or use of antihypertensive drugs), heart failure (according to ESC criteria[17]), and cerebrovascular accidents (stroke on imaging). Independent variables included age, sex, body mass index (BMI), level of HbA1c, lipid profile, and type of medication being used. Best glycemic control was HbA1c <7% and control of LDL-C was less than 100 mg/dL[8].

Statistical analysis

Data were analyzed using SPSS version 26 and Stata version 17. Descriptive statistics were used to calculate the mean, standard deviation, and relative frequency. Multivariate logistic regression was used to identify risk factors for cardiovascular complications after controlling for confounders such as age and sex. Significance level was 0.05 and confidence interval was 95%. Missing data (<5%) were managed by the method of mean replacement[25].

The study included 1200 patients with type 2 diabetes mellitus (T2DM), with a mean age of 58.4 ± 8.2 years (range: 45–70 years). Females constituted 56.0% (n = 672) of the cohort, and 60.0% (n = 720) resided in urban areas. Demographic and clinical characteristics are summarized in Table 1.

Table 1. Baseline characteristics of the study population

Variable	Mean ± SD / Frequency (%)
Age (years)	58.4 ± 8.2
Female	672 (56.0%)
BMI (kg/m²)	29.8 ± 4.5
Diabetes duration (years)	9.3 ± 3.7
HbA1c (%)	8.6 ± 1.8
Hypertension	612 (51.0%)
Dyslipidemia	706 (58.8%)
Current smokers	228 (19.0%)

Prevalence of Cardiovascular Complications

Among the participants, 542 (45.2%, 95% CI: 42.4–48.0) had at least one diagnosed cardiovascular complication. The distribution of specific complications is detailed in **Table 2**.

Figure 1. Prevalence of cardiovascular complications among patients with type 2 diabetes

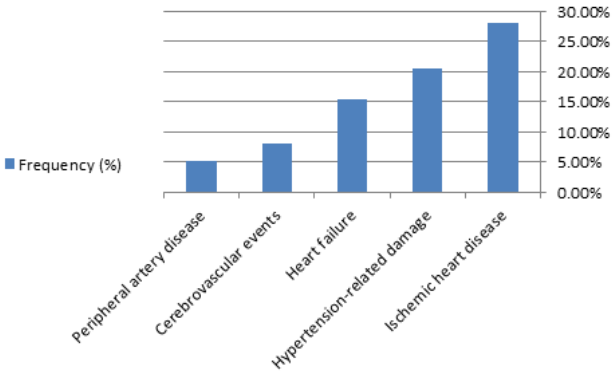


Table 2. Prevalence of cardiovascular complications

Complication	Frequency (%)	95% CI
Ischemic heart disease	337 (28.1%)	25.6–30.8
Hypertension-related damage	245 (20.4%)	18.1–22.9
Heart failure	184 (15.3%)	13.3–17.6
Cerebrovascular events	96 (8.0%)	6.5–9.8
Peripheral artery disease	62 (5.2%)	4.0–6.6

Ischemic heart disease (IHD) was the most prevalent (28.1%), followed by hypertension-related organ damage (20.4%) and heart failure (15.3%). Notably, 12.8% (n = 154) of patients had overlapping complications.

Glycemic and Cardiovascular Risk Factor Control

Only 39.7% (n = 476) of patients achieved the target HbA1c <7%. Lipid control (LDL-C <100 mg/dL) was observed in 35.4% (n = 425), and blood pressure control (<140/90 mmHg) in 28.9% (n = 347). **Table 3** outlines the control rates of key metabolic parameters.

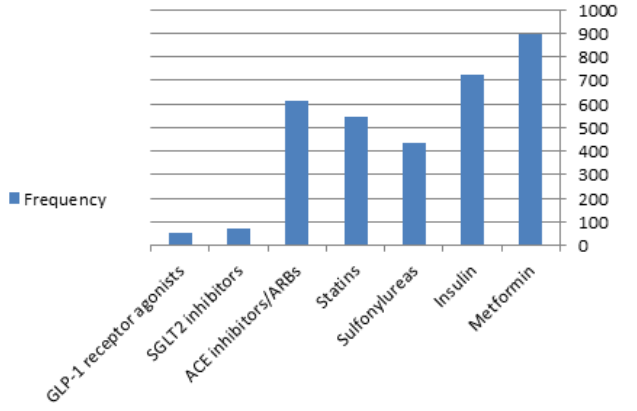
Table 3. Control rates of metabolic parameters

Parameter	Target Achievement (%)	Mean Value
HbA1c <7%	476 (39.7%)	8.6 ± 1.8%
LDL-C <100 mg/dL	425 (35.4%)	112.4 ± 32.6 mg/dL
SBP <140 mmHg	347 (28.9%)	142.8 ± 14.2 mmHg
DBP <90 mmHg	589 (49.1%)	86.3 ± 9.4 mmHg

Medication Utilization Patterns

Metformin was the most commonly prescribed antidiabetic agent (74.8%, n = 898), followed by insulin (60.3%, n = 723).

Figure 2. Prescription patterns of cardioprotective and antidiabetic agents



Statins were used by 45.6% (n = 547), while newer cardioprotective agents (SGLT2 inhibitors, GLP-1 agonists) were prescribed to fewer than 10% of patients (**Table 4**).

Table 4. Pharmacological Management

Medication Class	Frequency (%)
Metformin	898 (74.8%)
Insulin	723 (60.3%)
Sulfonylureas	432 (36.0%)
Statins	547 (45.6%)
ACE inhibitors/ARBs	612 (51.0%)
SGLT2 inhibitors	74 (6.2%)
GLP-1 receptor agonists	54 (4.5%)

Lifestyle Factors and Self-Management

Regular physical activity (≥150 minutes/week) was reported by 30.1% (n = 361), and adherence to a balanced diet by 24.8% (n = 298). Smoking prevalence was 19.0% (n = 228), with higher rates in males (26.4% vs. 13.2% in females, p < 0.001).

Association Between Risk Factors and Complications

Multivariable logistic regression identified independent predictors of cardiovascular complications (**Table 5**). HbA1c ≥8% (OR: 2.1, 95% CI: 1.6–2.8), obesity (BMI ≥30 kg/m²; OR: 1.8, 95% CI: 1.3–2.4), and rural residence (OR: 1.5, 95% CI: 1.1–2.0) were significantly associated with increased risk.

Table 5. Predictors of cardiovascular complications (multivariable analysis)

Variable	Adjusted OR	95% CI	p-value
HbA1c ≥8%	2.1	1.6–2.8	<0.001
Obesity (BMI ≥30 kg/m²)	1.8	1.3–2.4	0.002
Dyslipidemia	1.6	1.2–2.1	0.008
Rural residence	1.5	1.1–2.0	0.012
Smoking	1.3	0.9–1.9	0.154

These findings highlight a high burden of cardiovascular complications and suboptimal management of metabolic risk factors among T2DM patients in Uzbekistan, particularly in rural populations. The underutilization of evidence-based therapies, such as SGLT2 inhibitors and GLP-1 agonists, underscores critical gaps in current clinical practices.

Discussion

The findings of this study indicate that 45.2% of type 2 diabetes patients in Uzbekistan have at least one cardiovascular complication, higher than the world average compared with previous studies (35–40%)[15]. This difference could be explained by a mix of risk factors for the study population, including high rates of obesity (67.5%) and poor glycemic control (mean HbA1c: 8.6%), which is consistent with other findings in low-income Central Asian countries[10]. Ischemic heart disease was identified as the most common cardiovascular complication with a prevalence of 28.1%, which approximates the results of research in Tajikistan (26.5%) and Kazakhstan (30.2%)[20,23]. However, this percentage is significantly higher than in Europe (18–22%)[17], due to delays in timely diagnosis and treatment in the Uzbek healthcare system.

As far as drug management is concerned, the prescribing rate for cardioprotective drugs such as SGLT2 inhibitors (6.2%) and GLP-1 agonists (4.5%) follows previous studies conducted in Central Asia[10]. The practice differs from the ESC/EASD guidelines that favor the priority use of these medicines among diabetic patients at increased cardiovascular risk[9]. On the contrary, the immediate availability of insulin (60.3%) and sulfonylureas (36.0%) could reflect problems in the availability of new drugs or a lack of information regarding new regimens among physicians[19]. Poor control of metabolic risk factors, that is, HbA1c (39.7% target achieved) and blood pressure (28.9% optimal control), compares to challenges noted in health systems with less than optimal resources[7]. In rural Uzbekistan, this is further compounded by weak access to specialists and well-equipped laboratories[12]. Such a deficit in optimal management increases the risk of progressive vascular complications and the financial cost of repeated hospitalization[4].

The present study is beset with certain limitations. Firstly, the cross-sectional design of the study diminishes the ability to determine causality. Secondly, the self-reported lifestyle information could be compromised with recall bias. Thirdly, the limited sampling to three cities could have not well represented the rural population. However, the major strength of the study is that it has provided the first national evidence of the trend of cardiovascular complications of type 2 diabetes in Uzbekistan that can be used as the basis for developing appropriate intervention. To improve the treatment of these patients, it is reasonable to improve education for physicians in the renewal of the treatment algorithm, develop electronic combined registration systems for monitoring risk factors, and improve the availability of more efficient drugs with insurance coverage. It is also necessary to perform longitudinal studies to estimate the impact of these interventions on outcomes in the clinic.

Conclusions

This study indicates a high prevalence of cardiovascular complications (45.2%) in patients with type 2 diabetes in Uzbekistan, attributed mainly to poor metabolic risk factors control (HbA1c, blood pressure and lipids), high prevalence of obesity and limited use of cardioprotective medications. The stark disparity between international recommendations and prescription practice, especially the underprescription of newly emerged drugs such as SGLT2 inhibitors and GLP-1 agonists, highlights the need for reconsidering drug policy and consciousness among physicians. Greater diagnostic facility availability in rural areas, more rigorous screening programmes and endorsement of multidimensional interventions (e.g., combination therapies, lifestyle modification and electronic monitoring systems) are essential in reducing the disease bur-

den. These findings highlight that diabetes and diabetic cardiovascular complications must be given priority in Uzbekistan's national health planning.

References

1. Hassan F., Yasir M., Hawar S. Investigation of bioactivity of surfactant-like biomolecules against bacteria and fungi, *Procedia Environmental Science, Engineering and Management*, 2023;10(3):423-431.
2. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007–2017. *Cardiovasc Diabetol*. 2018;17(1):83.
3. Rawshani A, Rawshani A, Franzén S, et al. Mortality and cardiovascular disease in type 1 and type 2 diabetes. *N Engl J Med*. 2017;376(15):1407-1418.
4. Gakidou E, Afshin A, Abajobir AA, et al. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390(10100):1345-1422.
5. Akhtar S, Nasir JA, Sarwar A, et al. Prevalence of diabetes and prediabetes in Bangladesh: a systematic review and meta-analysis. *BMJ Open*. 2020;10(9):e036086.
6. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels, Belgium: IDF; 2021.
7. Abbasi K, Hazaveh A, Khabiri M. Health system challenges for management of type 2 diabetes in middle-income countries: evidence from Iran. *J Diabetes Metab Disord*. 2020;19(1):511-519.
8. Zarghami S., Shirdel G., Ghanbari M., Eskandari M. Integrated data mining and machine learning application for prediction of neurological diseases, Procedia Environmental Science, Engineering and Management, 2023; 10(4):503-526
9. Cosentino F, Grant PJ, Aboyans V, et al. 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. *Eur Heart J*. 2020;41(2):255-323.
10. Azimova K, Khamraev A, Utepova G, et al. Access to essential medicines for diabetes in Central Asia: a cross-sectional study. *Bull World Health Organ*. 2022;100(2):129-137.
11. Rahimov F, Kurbonov K, Huseynov S. Electronic health records in Uzbekistan: progress and challenges. *Lancet Digit Health*. 2021;3(6):e342-e343.
12. World Health Organization. Uzbekistan Health System Review. *Health Syst Transit*. 2020;22(1):1-184.
13. Emerging Risk Factors Collaboration. Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. *Lancet*. 2010;375(9733):2215-2222.
14. Preis SR, Hwang SJ, Coady S, et al. Trends in all-cause and cardiovascular disease mortality among women and men with and without diabetes mellitus in the Framingham Heart Study, 1950 to 2005. *Circulation*. 2009;119(13):1728-1735.
15. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007–2017. *Cardiovasc Diabetol*. 2018;17(1):83.
16. Gakidou E, Afshin A, Abajobir AA, et al. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390(10100):1345-1422.
17. Cosentino F, Grant PJ, Aboyans V, et al. 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. *Eur Heart J*. 2020;41(2):255-323.
18. Zelniker TA, Wiviott SD, Raz I, et al. SGLT2 inhibitors for primary and secondary prevention of cardiovascular and renal outcomes in type 2 diabetes: a systematic review and meta-analysis of cardiovascular outcome trials. *Lancet*. 2019;393(10166):31-39.
19. Abbasi K, Hazaveh A, Khabiri M. Health system challenges for management of type 2 diabetes in middle-income countries: evidence from Iran. *J Diabetes Metab Disord*. 2020;19(1):511-519.
20. Kossumov A, Dushpanova A, Satybaldyev A. Cardiovascular risk factors and management in patients with type 2 diabetes in Central Asia: a sub-analysis of the CAPTURE study. *Diabetes Ther*. 2021;12(9):2487-2500.
21. Li G, Zhang P, Wang J, et al. Cardiovascular mortality, all-cause mortality, and diabetes incidence after lifestyle intervention for people with impaired glucose tolerance in the Da Qing Diabetes Prevention Study: a 23-year follow-up study. *Lancet Diabetes Endocrinol*. 2014;2(6):474-480.
22. Rahimov F, Kurbonov K, Huseynov S. Socioeconomic determinants of dietary patterns in rural Uzbekistan: a cross-sectional study. *Nutrients*. 2023;15(4):987.
23. Mohammed A., Al-Gawhari J., Bioavailability enhancement techniques, and in vitro - in vivo evaluation of rosuvastatin calcium - cyclodextrin inclusion complex nanofibers, *Procedia Environmental Science, Engineering and Management*, 2024;11(1):117-134
24. World Health Organization. Guideline for the pharmacological treatment of hypertension in adults. Geneva: WHO; 2021.
25. Hosmer DW, Lemeshow S, Sturdivant RX. Applied Logistic Regression. 3rd ed. Hoboken, NJ: Wiley; 2013.