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Cardiologists vs Endocrinologists in Glycemic Control for Coronary Artery Disease Patients with Type 2 Diabetes: A Cross-Sectional Study

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Background: The comorbidity of coronary artery disease (CAD) and type 2 diabetes mellitus (T2DM) presents significant challenges in clinical management, particularly regarding glycemic control. The clinical management of CAD complicated by T2DM requires coordinated glycemic control, as poor management can exacerbate cardiovascular risks and increase morbidity and mortality. While endocrinologists traditionally manage diabetes, cardiologists are increasingly involved due to the cardiovascular risks associated with poor glycemic control. This study explores the current practices of glycemic management by cardiologists and endocrinologists in patients with CAD and T2DM, focusing on treatment intensification in a Chinese hospital setting.

Methods: This cross-sectional study included 1,074 hospitalized patients with both CAD and T2DM, admitted to the Cardiology Department of Ruijin Hospital between January 2021 and December 2023. Data were retrospectively collected from electronic medical records, including demographic information, clinical characteristics, and treatment interventions. Patients were stratified by year, and differences in treatment strategies between cardiologists and endocrinologists were analyzed. Glycemic control was assessed using HbA1c levels, with treatment intensification defined by any adjustment in antidiabetic therapy and consideration for comprehensive cardiovascular risk factors.

Results: Endocrinologists were significantly more likely to initiate treatment intensification, especially in cases of severe hyperglycemia (HbA1c ≥9.0%), while cardiologists' role in glycemic management was limited, with a preference for outpatient endocrinology referrals over in-hospital adjustments. Despite improvements in glycemic control, the percentage of patients achieving comprehensive cardiovascular risk management targets remained low.

Conclusion: This study underscored the distinct yet complementary roles of cardiologists and endocrinologists in managing glycemic control among patients with CAD and T2DM, noting endocrinologists' more active involvement in treatment intensification. Future integrated care models should harness the unique expertise of both specialties to optimize patient outcomes, better address glycemic control needs, and enhance overall cardiovascular risk management in this high-risk patient population.

Keywords: coronary artery disease, type 2 diabetes mellitus, glycemic control, cardiologists, endocrinologists, treatment intensification

Background

The global rise in chronic non-communicable diseases has been driven by improvements in socioeconomic conditions, shifts in dietary patterns, and the aging population. Among these diseases, coronary heart disease (CHD) and type 2 diabetes mellitus (T2DM) are particularly prevalent and often coexist in clinical practice. In China, where rates of both CHD and T2DM are rising,[1,2] addressing this comorbidity has become a significant healthcare priority. The complex interaction between these conditions poses particular challenges in hospital settings, where specialized care is often needed. This comorbidity significantly increases the risk of cardiovascular events, as each condition exacerbates the other, creating a vicious cycle that complicates patient management. Effective glycemic control is essential in treating

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patients with both CHD and T2DM, as it directly influences both short- and long-term outcomes, including the risk of myocardial infarction, heart failure, and overall mortality.[3,4]

Traditionally, the management of glycemic control in patients with diabetes has been the domain of endocrinologists, who focus on optimizing blood glucose levels to prevent complications. However, the growing recognition of the interconnectedness between diabetes and cardiovascular disease has led to an increased involvement of cardiologists in managing glycemia, especially considering that cardiovascular diseases are the leading cause of death among T2DM patients.[5] Cardiologists are increasingly called upon to incorporate glycemic control into the broader context of cardiovascular risk management, as managing glycemic levels in patients with CHD and T2DM is complicated by the need to balance glycemic targets with cardiovascular safety, as overly aggressive glycemic control can sometimes lead to adverse cardiovascular events. This complexity underscores the need for clear, collaborative guidelines, especially with recent advancements in glucose-lowering therapies that offer cardiovascular benefits, such as SGLT2 inhibitors and GLP-1 receptor agonists, which are narrowing the gap in roles between cardiologists and endocrinologists, raising questions about optimal management strategies.[6–8]

Despite this evolving practice, there is still considerable debate about which specialty should take the lead in managing glycemic control in patients with both CHD and T2DM. Existing guidelines, such as those from the American Heart Association, underscore the importance of comprehensive cardiovascular care, yet they lack specific directives on the delegation of glycemic management tasks. This ambiguity contributes to variability in care and emphasizes the need for clearer, evidence-based role delineation. While guidelines from organizations like the American Heart Association stress the importance of comprehensive cardiovascular care, which includes glycemic management, there is no clear consensus on the optimal approach for integrating these responsibilities between cardiologists and endocrinologists.[9,10] This lack of clarity often leads to inconsistent practices in clinical settings, where the management strategy may vary depending on the healthcare provider's specialty and the individual patient's needs. To address these uncertainties, this study aims to explore the current practices in glycemic management among cardiologists in a Chinese hospital, with a particular focus on how treatment intensification is approached in patients with uncontrolled blood glucose levels.

Methods

Study Design

This study was a cross-sectional analysis conducted on hospitalized patients from the Cardiology Department of Ruijin Hospital, spanning from January 2021 to December 2023. Patients were stratified by year and selected through random sampling based on predefined inclusion criteria and an estimated sample size. The inclusion criteria were: (1) age over 18 years, (2) a confirmed diagnosis of both coronary artery disease (CAD) and type 2 diabetes mellitus (T2DM). Patients were excluded if they had heart failure with a left ventricular ejection fraction (LVEF) below 40%, renal insufficiency with an estimated glomerular filtration rate (eGFR) below 45 mL/min/1.73 m², or incomplete laboratory data. The sample size was calculated using the formula $N=[t_{a/2}{}^2\times p\times(1\text{-}p)]/d^2$, where α was set at 0.05 and $t_{a/2}$ =1.96. Based on previous studies,[11,12] the glycemic control rate in the Chinese population was estimated at approximately 44%, leading to a p value of 0.56, with d set at 10% of p to determine the allowable error. This calculation yielded a required sample size of 302.

Data Collection

Data were collected retrospectively from electronic medical records, including demographic information, clinical characteristics, and laboratory results. The primary variables of interest included glycemic control (HbA1c levels), blood pressure, and lipid profiles (LDL-C levels) at the time of admission and throughout hospitalization. Data on the interventions made by endocrinologists and cardiologists, such as adjustments in antidiabetic regimens or referrals for outpatient follow-up, were also collected. The dataset was cleaned and validated to ensure accuracy and completeness before analysis.

Diagnostic Criteria

In this study, glycated hemoglobin (HbA1c) was utilized as the primary biomarker for evaluating glycemic control. Consistent with established guidelines, optimal glycemic control for patients with coronary artery disease (CAD) was defined as achieving an HbA1c level of less than 7%.[13] Blood pressure targets for CAD patients with type 2 diabetes mellitus (T2DM) were set at a systolic blood pressure (SBP) of less than 130 mmHg and a diastolic blood pressure (DBP) of less than 80 mmHg, with an optimal serum low-density lipoprotein cholesterol (LDL-C) level of less than 1.8 mmol/L (70 mg/dL).[14] Treatment intensification strategies encompassed increasing the dosage of existing hypoglycemic agents, switching or adding new hypoglycemic drugs, initiating insulin therapy, or adjusting the frequency or dosage of insulin injections.[15] These criteria ensured a standardized approach to assessing and managing glycemic control in the study population.

Ethical Considerations

The Ethics Committee of Ruijin Hospital affiliated with Shanghai Jiao Tong University School of Medicine approved this study (approval number: 022313). Due to the retrospective nature of the study, the need for informed consent of patients was waived by Ruijin Hospital Ethics Committee. To ensure confidentiality, all patient data were anonymized prior to analysis, and strict measures were taken to protect privacy. All methods were carried out in accordance with the declaration of Helsinki.

Statistical Analysis

Descriptive statistics were used to summarize the baseline characteristics of the study population. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The chi-square test was used to assess differences between categorical variables, while analysis of variance (ANOVA) was employed for continuous variables across the three years of study. A P-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS software version 26.0 (IBM Corp., Armonk, NY, USA).

Results

General Characteristics of Participants

A total of 1,074 patients were included in the study, with 358 enrolled in 2021, 355 in 2022, and 361 in 2023. The sociodemographic and clinical characteristics of these participants are detailed in Table 1. The gender distribution remained relatively stable across the years, showing a slight male predominance, with no statistically significant variation ($P = 0.302$). The average age of the participants was consistent, around 65 years, and the mean BMI was approximately 25 kg/m², showing no significant changes over the study period ($P > 0.05$).

Notably, there was a significant upward trend in the proportion of patients admitted with Chronic Coronary Syndrome (CCS) among those with coronary artery disease (CAD), increasing from 42.74% in 2021 to 71.19% in 2023 ($P < 0.001$). Concurrently, the prevalence of hypertension decreased significantly over the past two years, reflecting improved hypertension management or changes in the patient population ($P < 0.001$). Additionally, the proportion of non-smokers increased each year, rising from 60.61% in 2021 to 71.75% in 2023 ($P < 0.001$). The average length of hospital stay also showed a significant increase, from 5.57 ± 3.52 days in 2021 to 6.9 ± 4.1 days in 2023 ($P = 0.002$), possibly indicating more complex cases or evolving treatment protocols.

Comparative Analysis of Glycemic Management Strategies by Endocrinologists and Cardiologists in Hospitalized Patients with Uncontrolled Diabetes

The comparison of interventions by endocrinologists and cardiologists in managing patients with uncontrolled glycemia from 2021 to 2023 reveals a clear preference for intensified treatment in patients with higher HbA1c levels, with significant differences in approach. Patients with HbA1c levels ≥9.0% consistently received more aggressive treatment across all years, highlighting the focus on severe cases ($P < 0.001$). Endocrinology consultations significantly impacted treatment adjustments, especially for those with HbA1c ≥9.0%, where a majority saw changes in their regimens ($P <$

Table 1 Sociodemographic Characteristics of the Study Population

Patient Characteristics	2021 (n=358)	2022 (n=355)	2023 (n=361)	χ^2/F	P
Male	251 (70.11%)	230(64.79%)	240(66.48%)	2.393	0.302
Female	107 (29.89%)	125(35.21%)	121(33.52%)	–	–
Age (years)	65.47±9.94	65.97±8.633	65.88±10.46	0.156	0.848
BMI (kg/m^2)	25.78±3.51	25.67±3.143	25.43±3.42	0.605	0.546
CCS	153 (42.74%)	206(58.03%)	257(71.19%)	59.596	<0.001
ACS	205 (57.26%)	149(41.97%)	104(28.81%)	–	–
UA	175 (48.88%)	127(35.77%)	89(24.65%)	–	–
NSTEMI	13 (3.63%)	12(3.38%)	10(2.77%)	–	–
STEMI	17 (4.75%)	10(2.82%)	5(1.39%)	–	–
Duration of T2DM (years)					
<1	21 (5.87%)	29(8.17%)	36(9.97%)	–	–
1–3	44 (12.30%)	31(8.73%)	24(6.65%)	–	–
3–5	38 (10.61%)	29(8.17%)	12(3.32%)	–	–
5–10	65 (18.16%)	77(21.69%)	57(15.79%)	–	–
10–20	106 (29.61%)	117(32.96%)	148(41.00%)	–	–
20–30	64 (17.88%)	53(14.93%)	65(18.01%)	–	–
30–40	20 (5.59%)	19(5.35%)	19(5.26%)	–	–
Hypertension					
None	81 (22.63%)	199(56.06%)	184(50.97%)	94.277	<0.001
Grade 1	48 (13.41%)	103(29.01%)	104(28.81%)	–	–
Grade 2	106 (29.61%)	46(12.96%)	58(16.06%)	–	–
Grade 3	123 (34.36%)	7(1.97%)	15(4.16%)	–	–
Duration of smoking (years)					
Nonsmoker	217 (60.61%)	226(63.67%)	259(71.75%)	10.514	<0.001
Occasionally	10 (2.79%)	10(2.82%)	3(0.83%)	–	–
<5	8 (2.23%)	2(0.56%)	0	–	–
5–10	7 (1.96%)	12(3.38%)	0	–	–
10–20	12 (3.35%)	7(1.97%)	15(4.16%)	–	–
20–30	28 (7.82%)	19(3.53%)	19(5.26%)	–	–
30–40	37 (10.33%)	48(13.52%)	36(9.97%)	–	–
40–50	24 (6.70%)	19(5.35%)	12(3.32%)	–	–
>50	15 (4.19%)	12(3.38%)	17(4.71%)	–	–
Average length of stay (days)	5.57±3.52	5.9±3.2	6.9±4.1	6.387	0.002

0.001). Conversely, cardiologists were less involved in making independent adjustments to glycemic management, particularly for patients with lower HbA1c levels, suggesting a potential gap in their involvement in this aspect of care. Additionally, there was an increasing trend of patients being referred for outpatient endocrinology follow-up without changes in their antidiabetic regimen during hospitalization, particularly for those with lower HbA1c, indicating a shift towards post-discharge management strategies (Table 2).

Inpatient Management Trends of Glycemic, Blood Pressure, and Lipid Parameters in CAD Patients with T2DM

The results of this study reveal significant trends in the inpatient management of glycemic, blood pressure, and lipid parameters among patients with coronary artery disease (CAD) and type 2 diabetes mellitus (T2DM) over three years (2021–2023). The proportion of patients achieving optimal glycemic control (HbA1c < 7.0%) improved significantly, increasing from 39.11% in 2021 to 51.80% in 2023 ($P < 0.001$). A similar trend was observed in the management of blood pressure, with the percentage of patients achieving target levels (<130/80 mmHg) rising from 25.70% to 34.35% during the same period ($P = 0.039$). However, there was no significant improvement in lipid management, as the proportion of patients with LDL-C levels below 1.8 mmol/L decreased slightly, although this change was not statistically

Table 2 Comparison of Interventions by Endocrinologists and Cardiologists in Patients with Uncontrolled Glycemia

HbA1c Level	2021				2022				2023			
	≥9.0% (n=50)	8.0–8.9% (n=58)	7.0–7.9% (n=110)	P	≥9.0% (n=46)	8.0–8.9% (n=53)	7.0–7.9% (n=113)	P	≥9.0% (n=53)	8.0–8.9% (n=48)	7.0–7.9% (n=78)	P
Number of patients receiving intensified treatment (n)	36 (72%)	26 (44.83%)	34 (30.91%)	<0.001	39 (84.78%)	31 (58.49%)	36 (31.86%)	<0.001	36 (67.92%)	17 (35.42%)	17 (21.79%)	<0.001
Number of patients whose antidiabetic regimen was adjusted after endocrinology consultation (n)	16 (32%)	5 (8.62%)	6 (5.45%)	<0.001	29 (63.04%)	17 (32.08%)	17 (15.04%)	<0.001	19 (35.85%)	10 (20.83)	10 (12.82%)	0.007
Number of patients whose glycemic management was adjusted independently by a cardiologist (n)	20 (40%)	21 (36.21%)	28 (25.45%)	0.127	10 (21.74%)	14 (26.42%)	19 (16.81%)	0.344	17 (32.08%)	7 (14.58%)	7 (8.97%)	0.002
Number of patients for whom no changes were made to the antidiabetic regimen during hospitalization, with a recommendation for outpatient endocrinology follow-up after discharge (n)	14 (28%)	32 (55.17%)	76 (69.09%)	<0.001	7 (15.22%)	22 (41.51%)	77 (68.14%)	<0.001	17 (32.08%)	31 (64.58%)	61 (78.21%)	<0.001

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Table 3 Inpatient Management of Glycemic, Blood Pressure, and Lipid Parameters in Patients with Coronary Artery Disease and Type 2 Diabetes Mellitus

Variables	2021 (n=358)	2022 (n=355)	2023 (n=361)	$\chi 2$	P
HbA1c<7.0%	140 (39.11%)	144(40.56%)	187(51.80%)	14.097	<0.001
ACS	71 (34.63%)	55(38.19%)	56(29.95%)	3.179	0.204
CCS	69 (45.10%)*	89(61.81%)	131(70.05%)	27.368	<0.001
FBG<7.0 mmol/L	202 (56.42%)	221(62.25%)	188(52.08%)	7.605	0.022
BP<130/80 mmHg	92 (25.70%)	110(30.99%)	124(34.35%)	6.463	0.039
LDL-C<1.8 mmol/L	147 (41.06%)	146(41.13%)	126(34.90%)	3.861	0.145
Three-goal achievers (HbA1c, BP, LDL-C)	21 (5.86%)	26(7.32%)	22(6.09%)	0.729	0.695
Dual-goal achievers (HbA1c, LDL-C)	69 (19.27%)	79(22.25%)	75(20.78%)	0.962	0.618
Dual-goal achievers (HbA1c, BP)	35 (9.78%)	41(11.55%)	53(14.68%)	4.199	0.123
No-goal achievers	106 (29.61%)	101(28.45%)	87(24.10%)	3.053	0.217

Notes: *: p<0.05 (CCS vs ACS).

significant (P = 0.145). Additionally, while the proportion of patients achieving all three therapeutic goals (HbA1c, BP, LDL-C) remained low and stable, the data suggest ongoing challenges in comprehensive risk factor management for this patient population (Table 3).

Discussion

This study investigated the comparative roles of cardiologists and endocrinologists in the management of glycemic control in patients with coronary artery disease (CAD) and type 2 diabetes mellitus (T2DM). The findings underscored the complexities and challenges in achieving optimal glycemic control in this high-risk population, reflecting broader trends in the management of patients with coexisting cardiovascular and metabolic diseases.

One of the key findings of this study is the significant involvement of endocrinologists in the intensification of treatment among patients with uncontrolled glycemia, particularly those with HbA1c levels ≥9.0%. This observation is consistent with existing literature, which highlights the specialized knowledge and skills that endocrinologists bring to the management of complex diabetes cases.[9,16] Endocrinologists are often more adept at adjusting antidiabetic regimens, initiating insulin therapy, and managing complications associated with severe hyperglycemia. This expertise is crucial, especially given the strong association between poor glycemic control and adverse cardiovascular outcomes.[17,18]

Conversely, cardiologists in this study were less likely to make independent adjustments to glycemic management, particularly in patients with less severe hyperglycemia. This finding aligns with the broader discourse on the division of labor between cardiologists and endocrinologists in the management of patients with both CAD and T2DM.[7,19] Cardiologists typically focus on optimizing cardiovascular outcomes, which may lead to a less aggressive approach to glycemic control, particularly when blood glucose levels are not critically high. However, with the advent of glucose-lowering therapies that have proven cardiovascular benefits, there is a growing recognition that cardiologists need to be more actively involved in managing glycemia in their patients.[6,20–22]

The study also revealed an increasing trend of referring patients for outpatient endocrinology follow-up without making significant changes to their antidiabetic regimen during hospitalization, particularly among those with near-target HbA1c levels. This practice reflected an understanding of the need for continuous, long-term management of diabetes, which is often best handled in an outpatient setting.[23,24] Continuity of care is critical in managing chronic conditions like diabetes, where the risk of complications persists beyond the acute phase of care.[25] The decision to defer intensive glycemic management to the outpatient setting may also reflect concerns about the risks of hypoglycemia and other complications associated with aggressive glycemic control during hospitalization.[26–28]

Despite the progress in managing glycemic control, the study highlighted persistent challenges in achieving comprehensive cardiovascular risk management in patients with CAD and T2DM. The low percentage of patients who achieved all three therapeutic goals (optimal HbA1c, blood pressure, and LDL-C levels) underscored the difficulty of managing multiple risk factors simultaneously.[29–31] This finding is consistent with other studies that have documented the

challenges of achieving guideline-recommended targets in patients with complex comorbidities.[32–34] The reasons for this may include therapeutic inertia, patient non-adherence, and the inherent challenges of managing multiple chronic conditions.[35]

The variability in clinical practice observed in this study, particularly regarding who takes primary responsibility for glycemic control, reflects the broader uncertainty and debate in the medical community. Guidelines from major organizations such as the American Heart Association and the European Society of Cardiology emphasize the importance of comprehensive cardiovascular care, including glycemic management, but they do not clearly delineate the roles of cardiologists and endocrinologists. This lack of clarity often leads to inconsistent practices, as observed in this study, where the approach to glycemic management varied depending on the specialty of the treating physician.

Limitations

While our study offers valuable insights into the roles of cardiologists and endocrinologists in managing glycemic control among patients with CAD and T2DM, it is not without limitations. First, the study's cross-sectional design, while useful for capturing trends over time, limits our ability to establish causal relationships between the interventions and outcomes observed. Additionally, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other settings or populations with different healthcare structures and practices, particularly outside China. Another limitation is inter-physician variability; while our analysis focuses on practice patterns across specialties, it does not account for individual differences among cardiologists and endocrinologists, which might introduce variability. Furthermore, the retrospective nature of data collection could introduce bias, particularly in the selection and accuracy of recorded interventions and outcomes.

Future Directions

Future studies should consider a multicenter approach to enhance the generalizability of the findings and include a prospective design to better establish causality between interventions and outcomes. Additionally, randomized controlled trials could provide more definitive evidence on the most effective strategies for managing glycemic control in patients with CAD and T2DM. Longitudinal studies assessing long-term outcomes post-discharge would also be valuable in understanding the sustained impact of different management approaches.

Conclusion

This study provides valuable insights into the roles of cardiologists and endocrinologists in managing glycemic control in patients with CAD and T2DM. While endocrinologists are more likely to intensify treatment in patients with severe hyperglycemia, cardiologists play a crucial role in the holistic management of cardiovascular health. However, it is important to note that, due to the cross-sectional design of this study, the relationships observed do not imply causality. Future research should focus on integrating the strengths of both specialties to optimize care for patients with coexisting cardiovascular and metabolic diseases, ideally through prospective or randomized studies to establish causal relationships and assess long-term impacts.

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Disclosure

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References

1.. Writing Committee of the Report on Cardiovascular Health and Diseases in China. Report on Cardiovascular Health and Diseases in China 2021: an Updated Summary. *Biomed Environ Sci*. 2022;35(7):573–603. doi:10.3967/bes2022.079.
2. Wang L, Peng W, Zhao Z, et al. Prevalence and Treatment of Diabetes in China, 2013–2018. *JAMA*. 2021;326(24):2498–2506. doi:10.1001/jama.2021.22208
3. Sarwar N, Gao P, Emerging Risk Factors Collaboration, et al. 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. doi:10.1016/S0140-6736(10)60484-9.
4. Grundy SM, Benjamin IJ, Burke GL, et al. Diabetes and cardiovascular disease: a statement for healthcare professionals from the American Heart Association. *Circulation*. 1999;100(10):1134–1146. doi:10.1161/01.cir.100.10.1134
5. Joseph JJ, Deedwania P, Acharya T, et al. Comprehensive Management of Cardiovascular Risk Factors for Adults With Type 2 Diabetes: a Scientific Statement From the American Heart Association. *Circulation*. 2022;145(9):e722–e759. doi:10.1161/CIR.0000000000001040
6. 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. doi:10.1016/S0140-6736(18)32590-X
7. 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. doi:10.1093/eurheartj/ehz486
8. Gunawan F, Nassif ME, Partridge C, Ahmad T, Kosiborod M, Inzucchi SE. Relative frequency of cardiology vs endocrinology visits by type 2 diabetes patients with cardiovascular disease in the USA: implications for implementing evidence-based use of glucose-lowering medications. *Cardiovasc Endocrinol Metab*. 2020;9(2):56–59. doi:10.1097/XCE.0000000000000195
9. Khunti K, Ceriello A, Cos X, De Block C. Achievement of guideline targets for blood pressure, lipid, and glycaemic control in type 2 diabetes: a meta-analysis. *Diabet Res Clin Pract*. 2018;137:137–148. doi:10.1016/j.diabres.2017.12.004
10. Aroda VR, Eckel RH. Reconsidering the role of glycaemic control in cardiovascular disease risk in type 2 diabetes: a 21st century assessment. *Diabetes Obes Metab*. 2022;24(12):2297–2308. doi:10.1111/dom.14830
11. Wang J, Li J, Wen C, Liu Y, Ma H. Predictors of poor glycemic control among type 2 diabetes mellitus patients treated with antidiabetic medications: a cross-sectional study in China. *Medicine*. 2021;100(43):e27677. doi:10.1097/MD.0000000000027677
12. Zhai Z, Yang Y, Lin G, et al. The hypertension and hyperlipidemia status among type 2 diabetic patients in the community and influencing factors analysis of glycemic control. *Diabetol Metab Syndr*. 2023;15(1):73. doi:10.1186/s13098-023-01013-0
13. American Diabetes Association Professional Practice Committee. Classification and Diagnosis of Diabetes: standards of Medical Care in Diabetes-2022. *Diabetes Care*. 2022;45(Suppl 1):S17–S38. doi:10.2337/dc22-S002.
14. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: a Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2019;140(11):e596–e646. doi:10.1161/CIR.0000000000000678
15. Upadhyay J, Polyzos SA, Perakakis N, et al. Pharmacotherapy of type 2 diabetes: an update. *Metabolism*. 2018;78:13–42. doi:10.1016/j.metabol.2017.08.010
16. McGuire DK, Shih WJ, Cosentino F, et al. Association of SGLT2 Inhibitors With Cardiovascular and Kidney Outcomes in Patients With Type 2 Diabetes: a Meta-analysis. *JAMA Cardiol*. 2021;6(2):148–158. doi:10.1001/jamacardio.2020.4511
17. Zoungas S, Chalmers J, Neal B, et al. Follow-up of blood-pressure lowering and glucose control in type 2 diabetes. *N Engl J Med*. 2014;371(15):1392–1406. doi:10.1056/NEJMoa1407963
18. American Diabetes Association. Diabetes Care in the Hospital: standards of Medical Care in Diabetes-2021. *Diabetes Care*. 2021;44(Suppl 1):S211–S220. doi:10.2337/dc21-S015.
19. Gregg EW, Li Y, Wang J, et al. Changes in diabetes-related complications in the United States, 1990–2010. *N Engl J Med*. 2014;370(16):1514–1523. doi:10.1056/NEJMoa1310799
20. Verma S, McMurray JJV. SGLT2 inhibitors and mechanisms of cardiovascular benefit: a state-of-the-art review. *Diabetologia*. 2018;61(10):2108–2117. doi:10.1007/s00125-018-4670-7
21. Bethel MA, Patel RA, Merrill P, et al. Cardiovascular outcomes with glucagon-like peptide-1 receptor agonists in patients with type 2 diabetes: a meta-analysis. *Lancet Diabetes Endocrinol*. 2018;6(2):105–113. doi:10.1016/S2213-8587(17)30412-6
22. Zweck E, Roden M. GLP-1 receptor agonists and cardiovascular disease: drug-specific or class effects? *Lancet Diabetes Endocrinol*. 2019;7(2):89–90. doi:10.1016/S2213-8587(18)30351-6
23. Neal B, Perkovic V, Mahaffey KW, et al. Canagliflozin and Cardiovascular and Renal Events in Type 2 Diabetes. *N Engl J Med*. 2017;377(7):644–657. doi:10.1056/NEJMoa1611925
24. Davies MJ, D'Alessio DA, Fradkin J, et al. Management of Hyperglycemia in Type 2 Diabetes, 2018. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*. 2018;41(12):2669–2701. doi:10.2337/dci18-0033
25. Holman RR, Paul SK, Bethel MA, Matthews DR, Neil HA. 10-year follow-up of intensive glucose control in type 2 diabetes. *N Engl J Med*. 2008;359(15):1577–1589. doi:10.1056/NEJMoa0806470
26. Rodriguez-Gutierrez R, Gonzalez-Gonzalez JG, Zuñiga-Hernandez JA, McCoy RG. Benefits and harms of intensive glycemic control in patients with type 2 diabetes. *BMJ*. 2019;367(l5887). doi:10.1136/bmj.l5887
27. Zhang KX, Kan CX, Sun XD. Balancing act: the dilemma of rapid hyperglycemia correction in diabetes management. *World J Diabetes*. 2024;15(2):129–132. doi:10.4239/wjd.v15.i2.129
28. Mongkolpun W, Provenzano B, Preiser JC. Updates in Glycemic Management in the Hospital. *Curr Diab Rep*. 2019;19(11):133. doi:10.1007/s11892-019-1274-7
29. Zhang Z, Du C, Zhong X, Wang R, Tang L, Liu X. The secondary prevention of coronary heart disease in US adults 75 Years and older in daily practice: results from the National Health and Nutrition Examination Survey 1999–2018 survey. *Heliyon*. 2024;10(7):e28239. doi:10.1016/j.heliyon.2024.e28239

30. Baharudin N, Ramli AS, Ramland SS, Badlie-Hisham NI, Mohamed-Yassin MS. Factors Associated With Achievement of Blood Pressure, Low-Density Lipoprotein Cholesterol (LDL-C), and Glycemic Targets for Primary Prevention of Cardiovascular Diseases Among High Cardiovascular Risk Malaysians in Primary Care. *J Prim Care Community Health*. 2023;14:21501319231191017. doi:10.1177/21501319231191017
31. Bakke Å, Dalen I, Thue G, et al. Variation in the achievement of HbA1c, blood pressure and LDL cholesterol targets in type 2 diabetes in general practice and characteristics associated with risk factor control. *Diabet Med*. 2020;37(9):1471–1481. doi:10.1111/dme.14159
32. Brunström M, Carlberg B. Association of Blood Pressure Lowering With Mortality and Cardiovascular Disease Across Blood Pressure Levels: a Systematic Review and Meta-analysis. *JAMA Intern Med*. 2018;178(1):28–36. doi:10.1001/jamainternmed.2017.6015
33. Zhong VW, Yu D, Zhao L, et al. Achievement of Guideline-Recommended Targets in Diabetes Care in China: a Nationwide Cross-Sectional Study. *Ann Intern Med*. 2023;176(8):1037–1046. doi:10.7326/M23-0442
34. Bellary S, Kyrou I, Brown JE, Bailey CJ. Type 2 diabetes mellitus in older adults: clinical considerations and management. *Nat Rev Endocrinol*. 2021;17(9):534–548. doi:10.1038/s41574-021-00512-2
35. Karam SL, Dendy J, Polu S, Blonde L. Overview of Therapeutic Inertia in Diabetes: prevalence, Causes, and Consequences. *Diabetes Spectr*. 2020;33(1):8–15. doi:10.2337/ds19-0029