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2023 UPDATES - AMERICAN DIABETES ASSOCIATION STANDARDS OF CARE ON CARDIOVASCULAR DISEASE AND CHRONIC KIDNEY DISEASE THERAPY & MANAGEMENT

Know Diabetes by Heart™

Alexander Chang, MD

Staff Nephrologist at Geisinger Medical Center

Associate Professor, Department of Population Health Sciences

Co-Director of the Center for Kidney Health Research Institute at Geisinger

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DISCLOSURES

Dennis Bruemmer, MD, PhD, Cleveland Clinic

Consultant/Advisor: Bayer, Esperion

Alexander Chang, MD, MS, Geisinger Health

Research: Novo Nordisk, Bayer

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Dennis Bruemmer, MD, PhD

Staff Cardiologist and Director of the Center for Cardiometabolic Health

Professor of Medicine at Cleveland Clinic Lerner School of Medicine
Case Western Reserve Medical School

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SECTION 10

CARDIOVASCULAR DISEASE AND RISK MANAGEMENT

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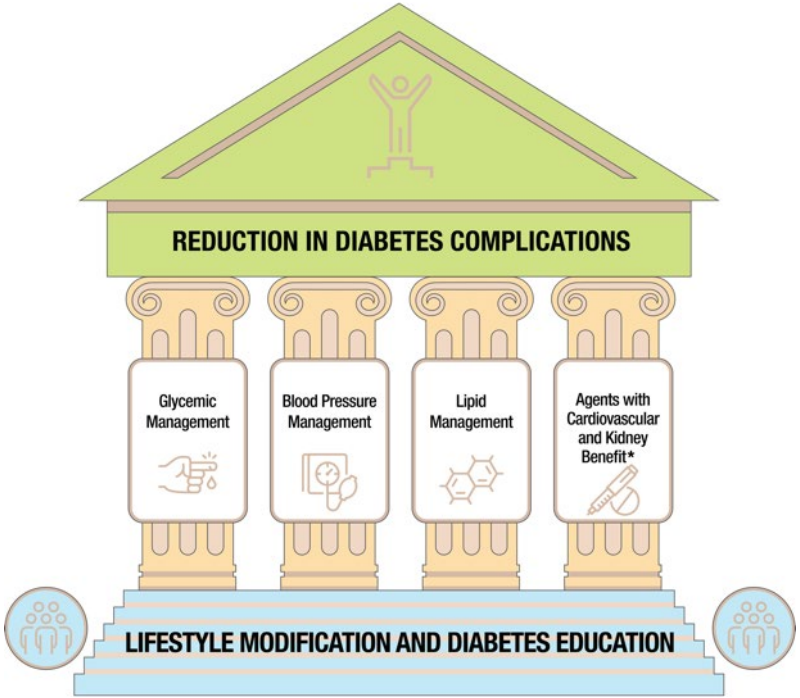
CARDIOVASCULAR DISEASE AND RISK MANAGEMENT



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Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

HYPERTENSION SCREENING AND DIAGNOSIS

10.1 Hypertension is defined as a systolic blood pressure ≥130 mmHg or a diastolic blood pressure ≥80 mmHg based on an average of ≥2 measurements obtained on ≥2 occasions. A Individuals with blood pressure ≥180/110 mmHg and cardiovascular disease could be diagnosed with hypertension at a single visit. E

10.2 All people with hypertension and diabetes should monitor their blood pressure at home. A

Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

HYPERTENSION TREATMENT GOALS

10.3 For patients with diabetes and hypertension, blood pressure targets should be individualized through a shared decision-making process that addresses cardiovascular risk, potential adverse effects of antihypertensive medications, and patient preferences. B

10.4 People with diabetes and hypertension qualify for antihypertensive drug therapy when the blood pressure is persistently elevated ≥130/80 mmHg.

The on-treatment target blood pressure goal is <130/80 mmHg, if it can be safely attained. B

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Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

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RANDOMIZED CONTROLLED TRIALS OF INTENSIVE VERSUS STANDARD HYPERTENSION TREATMENT STRATEGIES

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Table 10.1—Randomized controlled trials of intensive versus standard hypertension treatment strategies

Clinical trial	Population	Intensive	Standard	Outcomes
ACCORD BP (35)	4,733 participants with T2D aged 40–79 years with prior evidence of CVD or multiple cardiovascular risk factors	SBP target: <120 mmHg Achieved (mean) SBP/DBP: 119.3/64.4 mmHg	SBP target: 130–140 mmHg Achieved (mean) SBP/DBP: 135/70.5 mmHg	• No benefit in primary end point: composite of nonfatal MI, nonfatal stroke, and CVD death • Stroke risk reduced 41% with intensive control, not sustained through follow-up beyond the period of active treatment • Adverse events more common in intensive group, particularly elevated serum creatinine and electrolyte abnormalities
ADVANCE (36)	11,140 participants with T2D aged ≥55 years with prior evidence of CVD or multiple cardiovascular risk factors	Intervention: a single-pill, fixed-dose combination of perindopril and indapamide Achieved (mean) SBP/DBP: 136/73 mmHg	Control: placebo Achieved (mean) SBP/DBP: 141.6/75.2 mmHg	• Intervention reduced risk of primary composite end point of major macrovascular and microvascular events (9%), death from any cause (14%), and death from CVD (18%) • 6-year observational follow-up found reduction in risk of death in intervention group attenuated but still significant (242)
HOT (37)	18,790 participants, including 1,501 with diabetes	DBP target: ≤80 mmHg Achieved (mean): 81.1 mmHg, ≤80 group; 85.2 mmHg, ≤90 group	DBP target: ≤90 mmHg	• In the overall trial, there was no cardiovascular benefit with more intensive targets • In the subpopulation with diabetes, an intensive DBP target was associated with a significantly reduced risk (51%) of CVD events

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RANDOMIZED CONTROLLED TRIALS OF INTENSIVE VERSUS STANDARD HYPERTENSION TREATMENT STRATEGIES

Table 10.1—Randomized controlled trials of intensive versus standard hypertension treatment strategies

Clinical trial	Population	Intensive	Standard	Outcomes
SPRINT (43)	9,361 participants without diabetes	SBP target: <120 mmHg Achieved (mean): 121.4 mmHg	SBP target: <140 mmHg Achieved (mean): 136.2 mmHg	• Intensive SBP target lowered risk of the primary composite outcome 25% (MI, ACS, stroke, heart failure, and death due to CVD) • Intensive target reduced risk of death 27% • Intensive therapy increased risks of electrolyte abnormalities and AKI
STEP (34)	8,511 participants aged 60–80 years, including 1,627 with diabetes	SBP target: <130 mmHg Achieved (mean): 127.5 mmHg	SBP target: <150 mmHg Achieved (mean): 135.3 mmHg	• Intensive SBP target lowered risk of the primary composite outcome 26% (stroke, ACS [acute MI and hospitalization for unstable angina], acute decompensated heart failure, coronary revascularization, atrial fibrillation, or death from cardiovascular causes) • Intensive target reduced risk of cardiovascular death 28% • Intensive therapy increased risks of hypotension

ACCORD BP, Action to Control Cardiovascular Risk in Diabetes Blood Pressure trial; ACS, acute coronary syndrome; ADVANCE, Action in Diabetes and Vascular Disease: Preterax and Diamicron MR Controlled Evaluation; AKI, acute kidney injury; CVD, cardiovascular disease; DBP, diastolic blood pressure; HOT, Hypertension Optimal Treatment trial; MI, myocardial infarction; SBP, systolic blood pressure; SPRINT, Systolic Blood Pressure Intervention Trial; STEP, Strategy of Blood Pressure Intervention in the Elderly Hypertensive Patients; T2D, type 2 diabetes.

HYPERTENSION TREATMENT STRATEGIES—PHARMACOLOGIC INTERVENTIONS

10.9 Treatment for hypertension should include drug classes demonstrated to reduce cardiovascular events in people with diabetes. A

ACE inhibitors or angiotensin receptor blockers are recommended first-line therapy for hypertension in people with diabetes and coronary artery disease. A

Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

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LIPID MANAGEMENT
STATIN TREATMENT—PRIMARY PREVENTION

10.18 For people with diabetes aged 40–75 years without atherosclerotic cardiovascular disease, use moderate-intensity statin therapy in addition to lifestyle therapy. A

10.19 For people with diabetes aged 20–39 years with additional atherosclerotic cardiovascular disease risk factors, it may be reasonable to initiate statin therapy in addition to lifestyle therapy. C

10.20 For people with diabetes aged 40–75 at higher cardiovascular risk, including those with one or more atherosclerotic cardiovascular disease risk factors, it is recommended to use high-intensity statin therapy to reduce LDL cholesterol by ≥50% of baseline and to target an LDL cholesterol goal of <70 mg/dL. B

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Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

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LIPID MANAGEMENT
STATIN TREATMENT—PRIMARY PREVENTION

HEART PROTECTION STUDY: SIMVASTATIN IN 5963 PEOPLE WITH DIABETES

33% (95% CI 17-46, p=0.0003) reduction in cardiovascular event rates among 2912 participants with diabetes who did not have any diagnosed occlusive arterial disease at entry.

27% (95% CI 13-40, p=0.0007) reduction in cardiovascular events rates among the 2426 participants with diabetes whose pretreatment LDL cholesterol concentration was 116 mg/dL.

Lowering LDL cholesterol from 116 to 77 mg/dL in people with diabetes reduces macrovascular disease risk by about a quarter

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The Lancet 2003; 361 (9374): 2005-2016

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LIPID MANAGEMENT

Cholesterol Treatment Trialists' (CTT) Collaboration: Efficacy of more intensive lowering of LDL cholesterol: a meta-analysis of data from 170 000 participants in 26 randomized trials

All-cause mortality was reduced by 10% per 1.0 mmol/L LDL reduction (RR 0·90, 95% CI 0·87-0·93; p<0·0001), largely reflecting significant reductions in deaths due to coronary heart disease (RR 0·80, 99% CI 0·74-0·87; p<0·0001).

25% (99% CI 18–31; p<0·0001) risk reduction in vascular event rates per 1.0 mmol/L reduction in LDL cholesterol in participants with no previous history of vascular disease (19% of patient had a diagnosis of diabetes).

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The Lancet 2010; 367: 1670-1681

LIPID MANAGEMENT
STATIN TREATMENT—SECONDARY PREVENTION

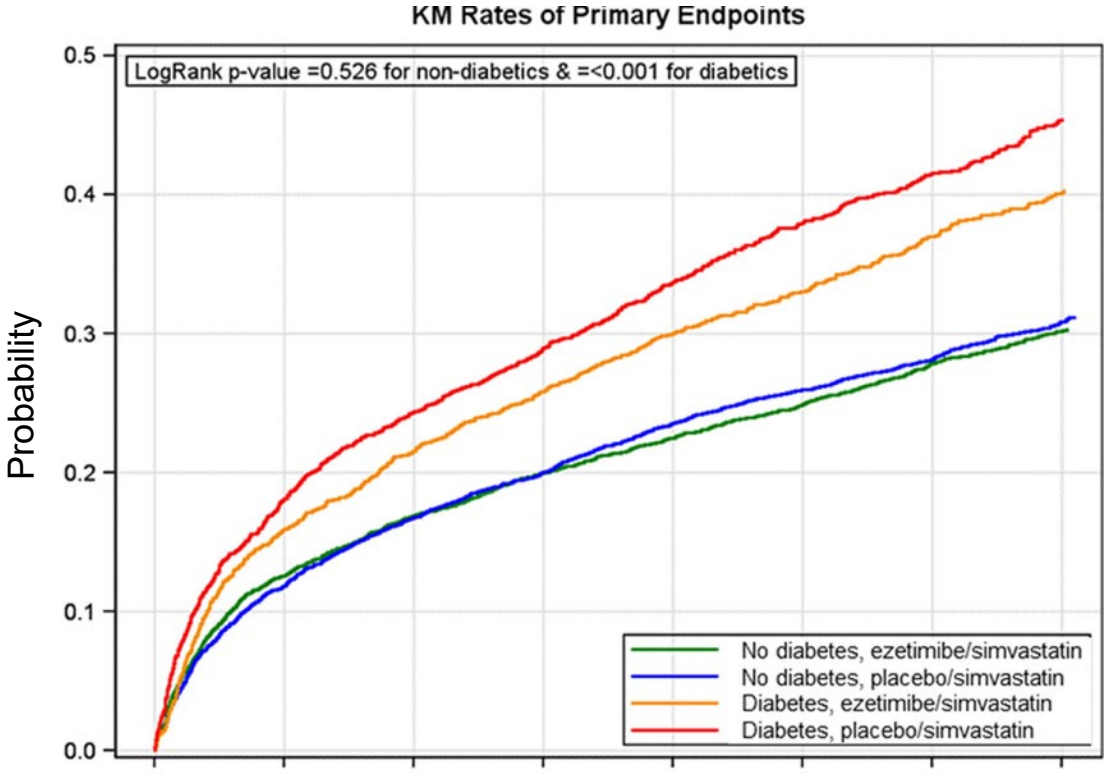
10.25 For people of all ages with diabetes and atherosclerotic cardiovascular disease, high intensity statin therapy should be added to lifestyle therapy. A

10.26 For people with diabetes and atherosclerotic cardiovascular disease, treatment with high intensity statin therapy is recommended to target an LDL cholesterol reduction of ≥50% from baseline and an LDL cholesterol goal of <55 mg/dL. Addition of ezetimibe or a PCSK9 inhibitor with proven benefit in this population is recommended if this goal is not achieved on maximum tolerated statin therapy. B

10.27 For individuals who do not tolerate the intended intensity, the maximum tolerated statin dose should be used. E

Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

IMPROVE IT: OUTCOMES IN PATIENTS WITH DIABETES



LDL 65 mg/dL
LDL 46 mg/dL

Circulation 2018;137:1571–1582

PCSK9 INHIBITOR THERAPY IN PATIENTS WITH DIABETES

ODYSSEY OUTCOMES: CVD in 5444 patients with diabetes, achieved LDL 31 mg/dl

Lancet Diabetes Endocrinol. 2017; 5:941–950.

FOURIER: CVD in 11,031 patients with diabetes, achieved LDL 30 mg/dl

Lancet Diabetes Endocrinol 2019; 7: 618–28.

GUIDELINES FOR THE MANAGEMENT OF CHOLESTEROL IN PATIENTS WITH DIABETES

Secondary Prevention

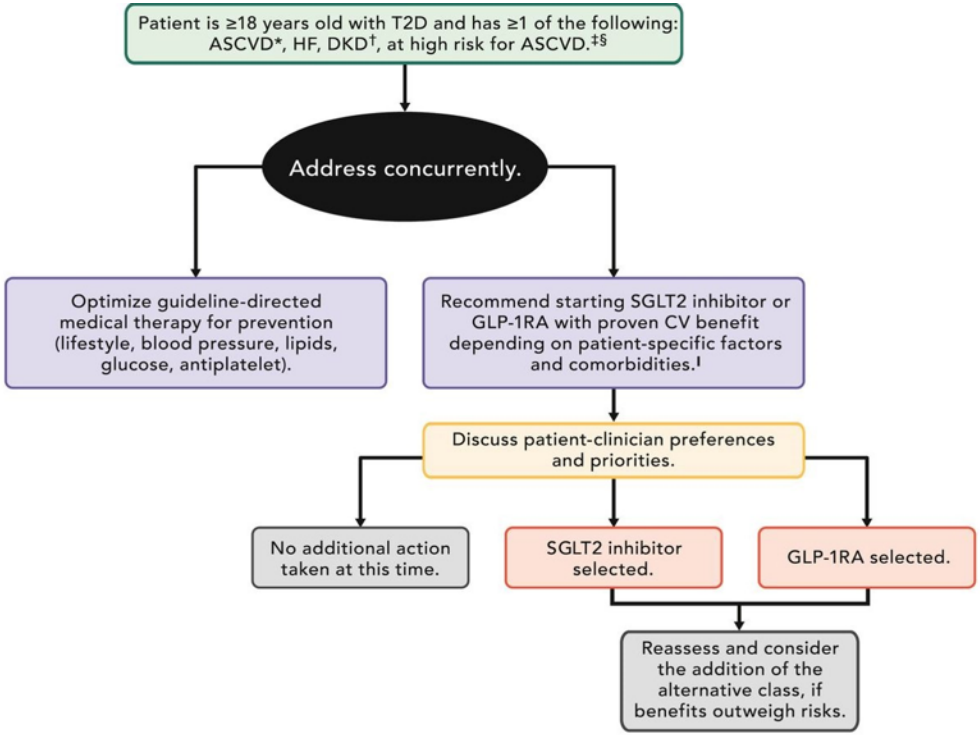
ACC/AHA 2018: > 50% Reduction in LDL; LDL>70 mg/dL add ezetimibe (no high risk) or PCSK9 inhibitor (high risk, including diabetes)

AACE 2017: **Extreme risk (CVD and diabetes): LDL goal < 55 mg/dL**

ESC/EAS 2019: **> 50% Reduction in LDL *AND* LDL goal < 55 mg/dL**

Diabetes Care 2020 Aug; 43(8): 1673-1678.
ENDOCRINE PRACTICE Vol 23 (Suppl 2) April 2017
European Heart Journal, Volume 41, Issue 1, 1 January 2020, Pages 111–188

EXPERT CONSENSUS DECISION PATHWAY ON NOVEL THERAPIES FOR CARDIOVASCULAR RISK REDUCTION IN PATIENTS WITH TYPE 2 DIABETES



Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

CARDIOVASCULAR DISEASE—TREATMENT

10.41a In people with type 2 diabetes and established atherosclerotic cardiovascular disease, multiple atherosclerotic cardiovascular disease risk factors, or diabetic kidney disease, a sodium–glucose cotransporter 2 inhibitor with demonstrated cardiovascular benefit is recommended to reduce the risk of major adverse cardiovascular events and/or heart failure hospitalization. A

10.41b In people with type 2 diabetes and established atherosclerotic cardiovascular disease or multiple risk factors for atherosclerotic cardiovascular disease, a glucagon-like peptide 1 receptor agonist with demonstrated cardiovascular benefit is recommended to reduce the risk of major adverse cardiovascular events. A

Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

CARDIOVASCULAR DISEASE—TREATMENT

10.41c In people with type 2 diabetes and established atherosclerotic cardiovascular disease or multiple risk factors for atherosclerotic cardiovascular disease, combined therapy with a sodium–glucose cotransporter 2 inhibitor with demonstrated cardiovascular benefit and a glucagon-like peptide 1 receptor agonist with demonstrated cardiovascular benefit may be considered for additive reduction in the risk of adverse cardiovascular and kidney events. A

Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

CARDIOVASCULAR DISEASE—TREATMENT

10.42a In people with type 2 diabetes and established heart failure with either preserved or reduced ejection fraction, a sodium–glucose cotransporter 2 inhibitor with proven benefit in this patient population is recommended to reduce risk of worsening heart failure and cardiovascular death. A

10.42b In people with type 2 diabetes and established heart failure with either preserved or reduced ejection fraction, a sodium–glucose cotransporter 2 inhibitor with proven benefit in this patient population is recommended to improve symptoms, physical limitations, and quality of life. A

Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

CARDIOVASCULAR DISEASE—TREATMENT

10.43 For people with type 2 diabetes and chronic kidney disease with albuminuria treated with maximum tolerated doses of ACE inhibitor or angiotensin receptor blocker, addition of finerenone is recommended to improve cardiovascular outcomes and reduce the risk of chronic kidney disease progression. A

CASE 1

51-year-old Caucasian male with obesity class I presents to the ED with chest pain.

Home Medications: none

Social History: Lifelong non-smoker, no alcohol

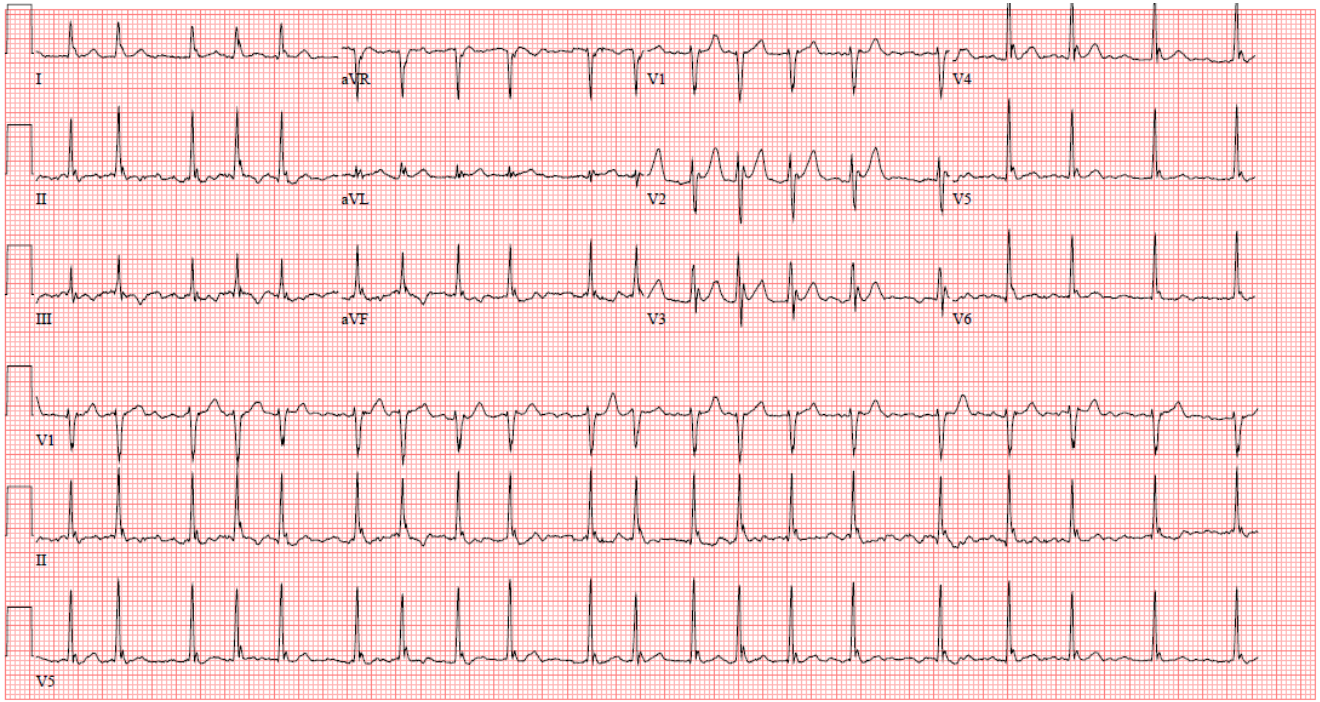
Family History: no premature coronary artery disease

Vital Signs: BP 94/54, Pulse 62, Ht 185.4 cm (6' 1"), Wt 116.6 kg (257 lb), BMI 33.9 kg/m²

Physical Exam: Obese, otherwise unremarkable.

CASE 1

51-year-old male with obesity class I presents to the ED with chest pain.



Troponin T
(0.000 - 0.029 ng/mL)
0.025
0.035 High
0.039 High

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CASE 1

Patient given aspirin 325 mg, clopidogrel 600 mg, heparin i.v., metoprolol tartrate 25 mg twice daily, rosuvastatin 40 mg

Baseline Lipid panel: Total cholesterol 255 mg/dL
Triglycerides 255 mg/dL
HDL cholesterol 59 mg/dL
LDL cholesterol 145 mg/dL

A1C: 8.6%

NPO for coronary angiography

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QUESTION

What percentage of patients with acute coronary syndrome have newly diagnosed type 2 diabetes?

A. 10%

B. 30%

C. 50%

D. 70 %

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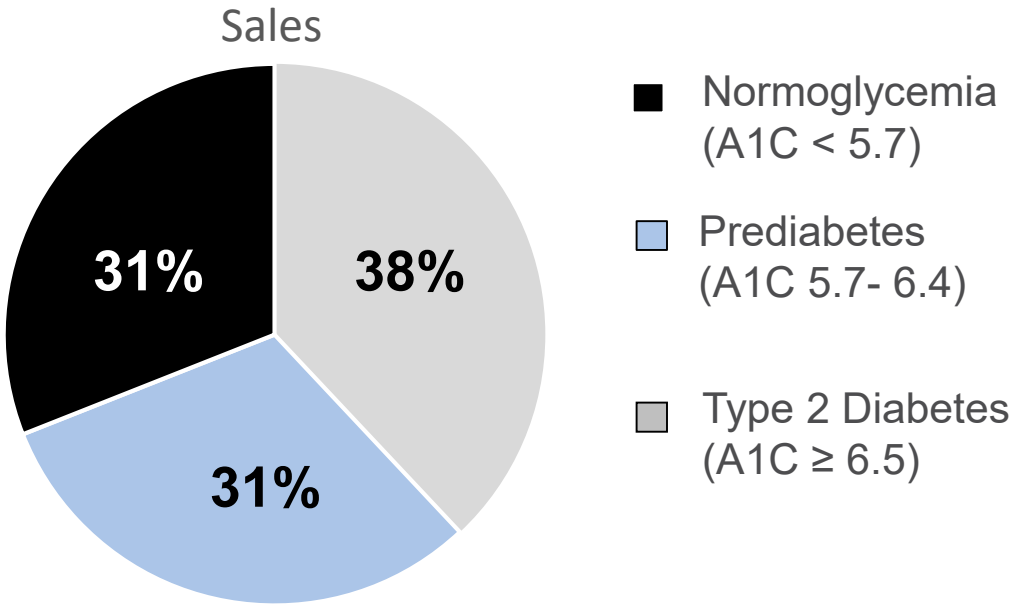
PREVALENCE OF DIABETES IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

69% of patients with acute myocardial infarction have diabetes or prediabetes

55% of these patients have new diabetes or prediabetes (i.e. previously undiagnosed, patient unaware)



TRIUMPH Registry (n=2853)

Am Heart J 2014; 168(4): 466-470

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BACK TO THE CASE

Patient undergoes PCI/DES to his LCX

He also undergoes TEE-guides cardioversion to restore sinus rhythm

Current Medications:

- Aspirin 81 mg
- Clopidogrel 75 mg
- Apixaban 5 mg every 12 h
- Metoprolol Succinate 50 mg
- Ramipril 2.5 mg
- Rosuvastatin 40 mg

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QUESTION

How often is treatment for diabetes adjusted in patients with uncontrolled diabetes admitted with acute myocardial infarction?

A. Always

B. Two thirds of the time

C. One third of the time

D. Never

E. Ask the Endocrinologist

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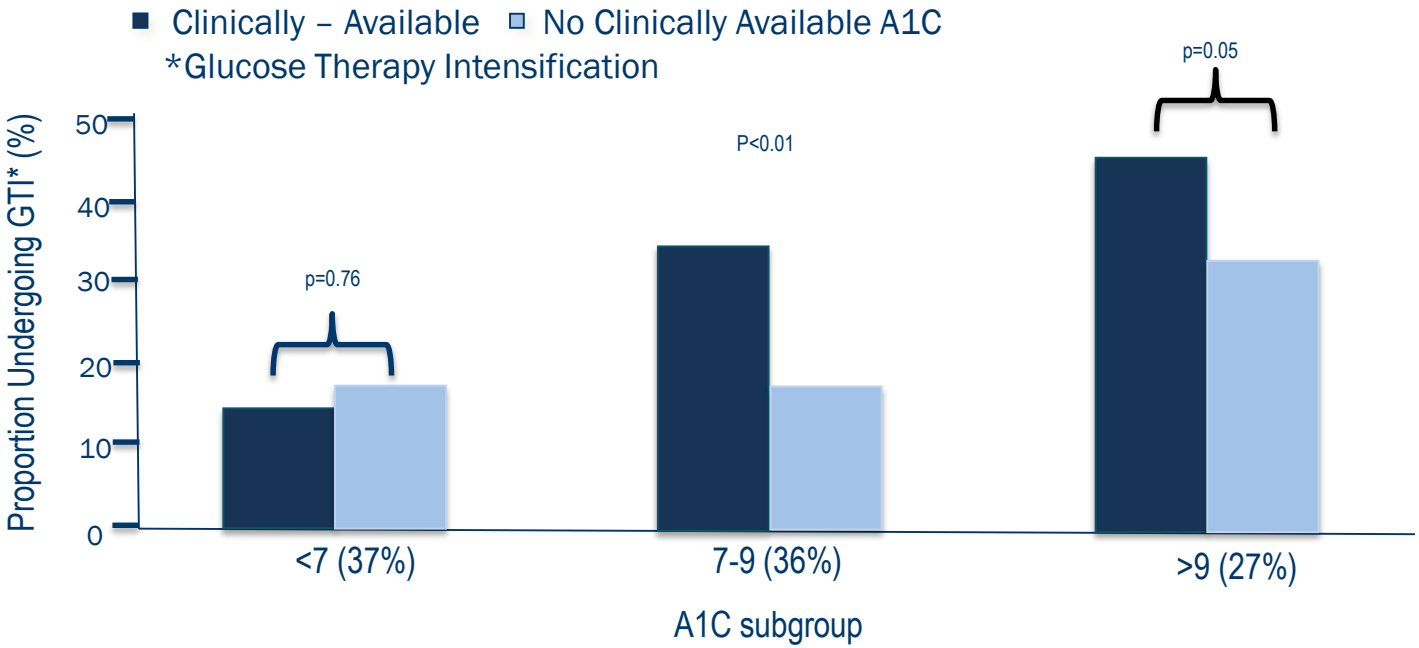
MANAGEMENT OF T2DM IS SUBOPTIMAL IN ACS PATIENTS



Diabetes Care. 2012 May;35(5):991-3.

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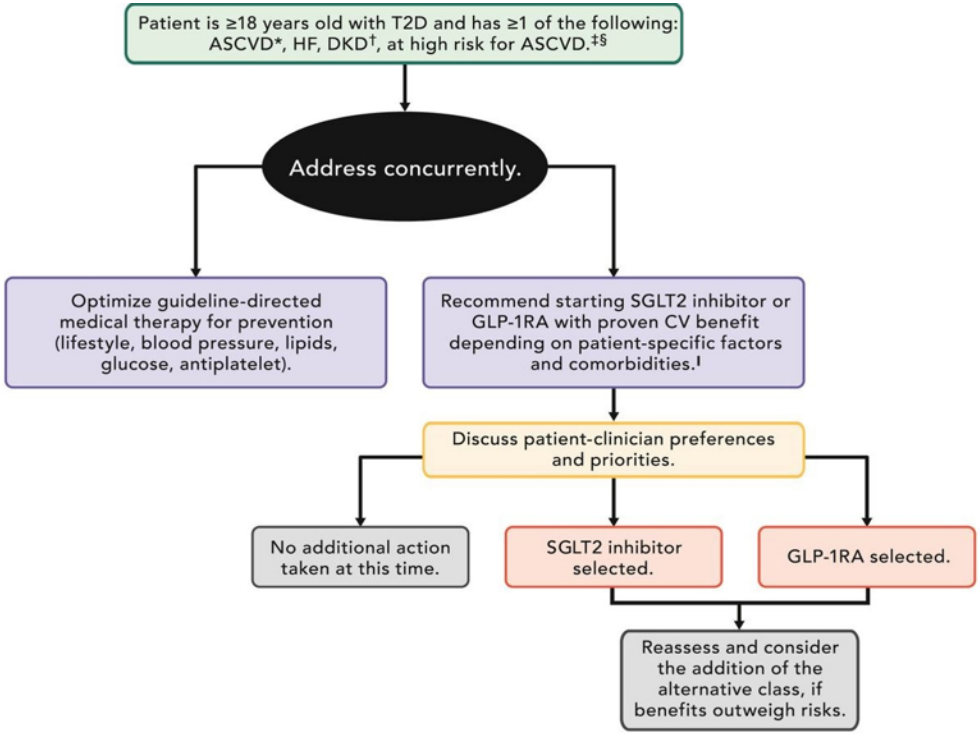
EXPERT CONSENSUS DECISION PATHWAY ON NOVEL THERAPIES FOR CARDIOVASCULAR RISK REDUCTION IN PATIENTS WITH TYPE 2 DIABETES



Cardiovascular Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S158-S190

BACK TO THE CASE

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He also undergoes TEE-guided cardioversion to restore sinus rhythm

Current Medications:

- Aspirin 81 mg
- Clopidogrel 75 mg
- Apixaban 5 mg every 12 h
- Metoprolol Succinate 50 mg
- Ramipril 2.5 mg
- Rosuvastatin 40 mg

SGLT2 Inhibitor is started at discharge

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Patient follows-up after one week in your office. He offers no complaints and tolerates all his medications. He is inquiring whether he should take metformin, which he heard helps to treat diabetes.

Should he be started on metformin?

A. 1. Yes

B. 2. No

C. 3. Not sure

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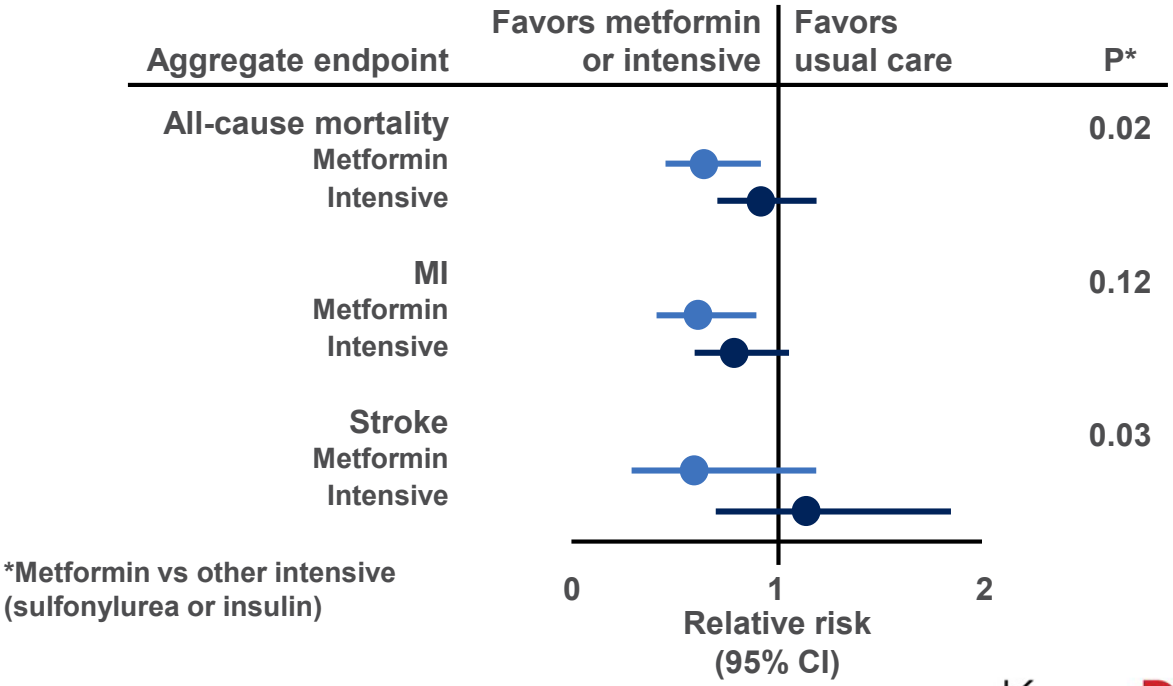
METFORMIN AS FIRST LINE AGENT: UKPS 34

n = 1704 overweight with type 2 diabetes; n = 342 metformin group



*Metformin vs other intensive (sulfonylurea or insulin)

UKPDS Group. Lancet 1998 Nov 7;352(9139):1558.

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SGLT2 INHIBITORS WITH AND WITHOUT METFORMIN: A META-ANALYSIS OF CARDIOVASCULAR AND MORTALITY OUTCOMES

Meta-Analysis of six trials of four SGLT2 inhibitors that enrolled a total of 51743 participants.

Metformin use ranged from 21% in DAPA-HF to 82% in DECLARE-TIMI 58.

SGLT2 inhibitors reduced the risk of MACE, with and without concomitant metformin use (HR 0.93, 95% CI 0.87-1.00 and HR 0.82, 95% CI 0.71-0.86, respectively; P-heterogeneity = 0.14).

Diabetes Obes Metab 2021 23(2): 382

BACK TO THE CASE

Patient follows-up after one week in your office. He offers no complaints and tolerates all his medications. He is inquiring whether he should take metformin, which he heard helps to treat diabetes.

Should he be started on metformin?

There are better choices. We may need to add metformin if the A1C does not improve.

The patient monitors his blood glucose levels, fasting levels are 130-145 mg/dL and bedtime 190 mg/dL.

Since you mention better choices, the patient's wife saw an advertisement on TV for a drug for diabetes which is injected and lowers the risk of heart attack.

She asks whether that would be an option for her husband.

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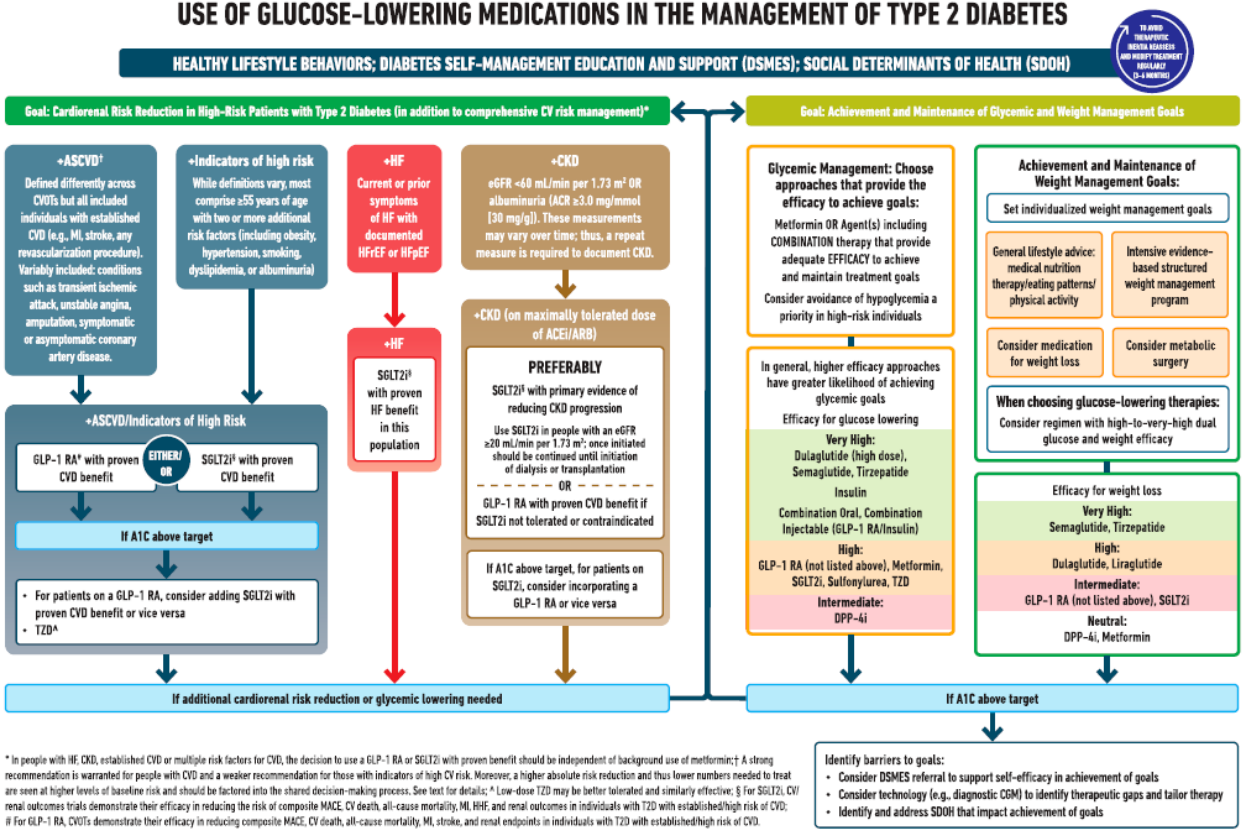
USE OF GLUCOSE-LOWERING MEDICATIONS IN THE MANAGEMENT OF TYPE 2 DIABETES



* In people with HF, CKD, established CVD or multiple risk factors for CVD, the decision to use a GLP-1 RA or SGLT2i with proven benefit should be independent of background use of metformin; † A strong recommendation is warranted for people with CVD and a weaker recommendation for those with indicators of high CV risk. Moreover, a higher absolute risk reduction and thus lower numbers needed to treat are seen at higher levels of baseline risk and should be factored into the shared decision-making process. See text for details; ^ Low-dose TZD may be better tolerated and similarly effective; § For SGLT2i, CV/renal outcomes trials demonstrate their efficacy in reducing the risk of composite MACE, CV death, all-cause mortality, MI, HHF, and renal outcomes in individuals with T2D with established/high risk of CVD; # For GLP-1 RA, CVOTs demonstrate their efficacy in reducing composite MACE, CV death, all-cause mortality, MI, stroke, and renal endpoints in individuals with T2D with established/high risk of CVD.

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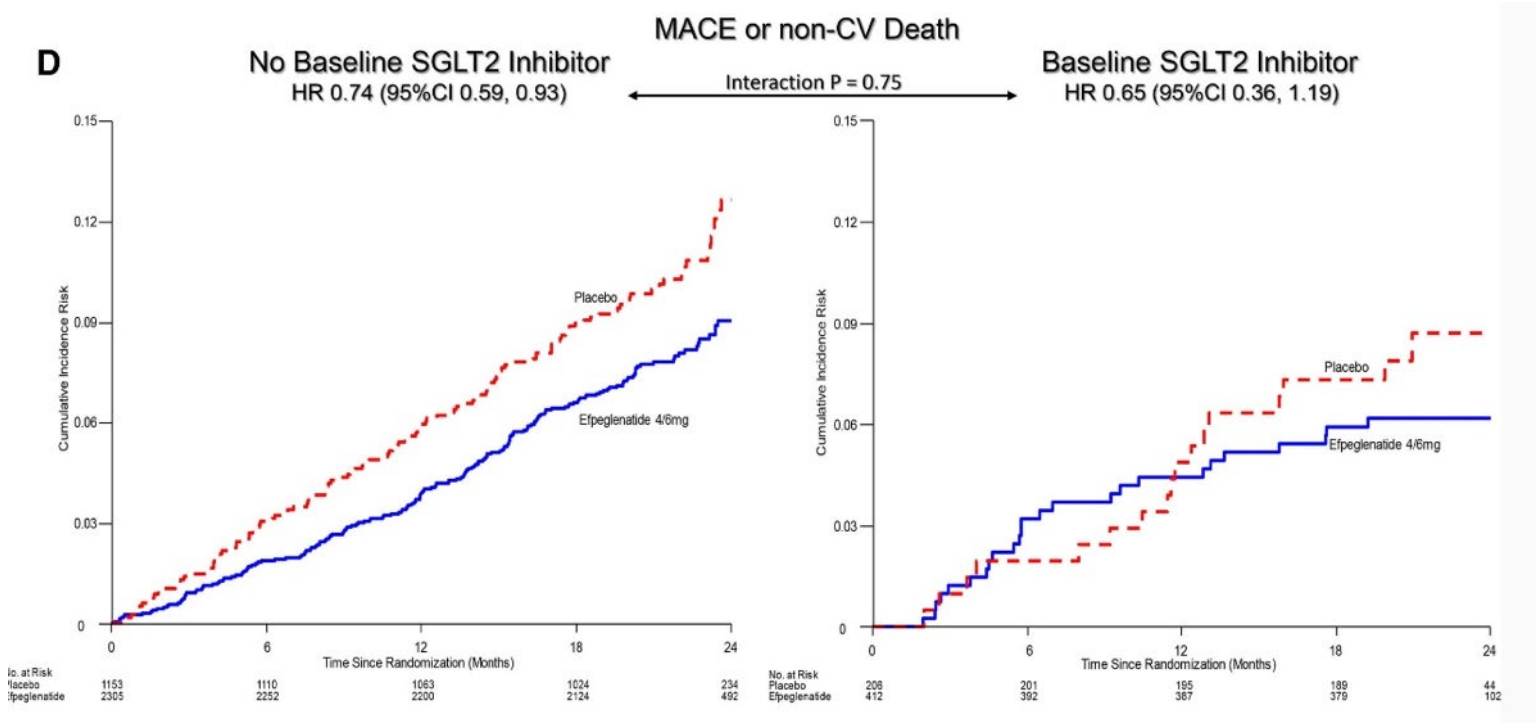
Diabetes Care 2022;45(Supplement_1):S125–S143.

Combining SGLT-2 Inhibitors and GLP-1–Receptor Agonists for CV Risk Reduction in Type 2 Diabetes: AMPLITUDE-O Trial



Effect of Efpeglenatide on Cardiovascular Outcomes: Trial stratified randomization by use of SGLT2 inhibitors (N=618, 15.2%)

Circulation. 2022;145:565–574

BACK TO THE CASE

The patient monitors his blood glucose levels, fasting levels are 130-145 mg/dL and bedtime 190 mg/dL.

Since you mention better choices, the patient's wife saw an advertisement on TV for a drug for diabetes which is injected and lowers the risk of heart attack.

She asks whether that would be an option for her husband.

Patient is started on GLP1-RA once weekly.

QUESTION

What Percentage of Patients with Diabetes meet Guideline-Directed Treatment Goals?

A. Less than 20%

B. Less than 40%

C. More than 60%

D. More than 80 %

GUIDELINE-RECOMMENDED THERAPY IN PATIENTS WITH DIABETES AND CARDIOVASCULAR DISEASE

Evidence-based pharmacotherapy use among a real-world population of 324,706 US patients with type 2 diabetes and atherosclerotic cardiovascular disease

58.6% of patients receive a statin, 26.8% of patients receive a high-intensity statin

45.5% of patients receive an angiotensin-converting enzyme inhibitor or angiotensin-receptor blocker

3.9% of patients receive a GLP1-RA, and 2.8% of patients receive a SGLT2 inhibitor

Fewer than 1 in 20 patients were prescribed all 3 evidence-based therapies

JAMA Netw Open. 2022 Feb; 5(2): e2148030.

BACK TO THE CASE

Patient returns 6 weeks later after laboratory testing for LDL cholesterol to discuss the results. He tolerates the rosuvastatin well without myalgia.

Total cholesterol 134 mg/dL
Triglycerides 98 mg/dL
HDL cholesterol 51 mg/dL
LDL cholesterol 63 mg/dL

QUESTION

What is the next step in treatment for this patient?

A. He is at his LDL cholesterol goal

B. Repeat lipid panel in 6 weeks

C. Consult to Nutrition

D. Add Ezetimibe 10 mg

E. Add PCSK9 inhibitor

USE COMBINATION THERAPY FOR ADDITIVE LDL-CHOLESTEROL LOWERING TO REDUCE CVD RISK

IMPROVE-IT: ezetimibe + simvastatin vs. simvastatin, after ACS
Primary endpoint: CV death, MI, unstable angina requiring hospitalization, coronary revascularization (≥30 days), stroke. Median follow-up: 6 years
HR: 0.936 (95%CI: 0.89-0.99), P=0.016

FOURIER trial: evolocumab vs. placebo, plus background statin therapy after ACS
Primary endpoint: CV death, MI, stroke, hospitalization for unstable angina, or coronary revascularization. Median follow-up: 2.2 years
HR: 0.85 (95%CI: 0.79-0.99), P<0.001

ODYSSEY OUTCOMES trial: alirocumab vs placebo, on top of high-intensity statin therapy, after ACS
Primary endpoint: death from coronary heart disease, nonfatal MI, fatal or nonfatal ischemic stroke, or unstable angina requiring hospitalization. Median follow-up: 2.8 years
HR: 0.85 (95%CI: 0.78-0.93), P<0.001

Cannon CP et al., N Engl J Med. 2015;372(25):2387-97, Sabatine MS et al., New Engl J Med 2017;376:1713, Schwartz et al., N Engl J Med. 2018;379(22):2097-2107.

BACK TO THE CASE

Patient returns 6 weeks later after laboratory testing for LDL cholesterol to discuss the results. He tolerates the rosuvastatin well without myalgia.

Total cholesterol 134 mg/dL
Triglycerides 98 mg/dL
HDL cholesterol 51 mg/dL
LDL cholesterol 63 mg/dL

Ezetimibe 10 mg is added.

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SECTION 11

CHRONIC KIDNEY DISEASE AND RISK MANAGEMENT

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CHRONIC KIDNEY DISEASE AND RISK MANAGEMENT

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Who and when to screen?

T1D Yearly starting 5 years after diagnosis

T2D Yearly starting at diagnosis

How to screen?

Spot urine ACR

and

eGFR

What to do with a positive result?

Repeat and confirm:
- Evaluate possible temporary or spurious causes
- Consider using cystatin C and creatinine to more precisely estimate GFR
- Only persistent abnormalities define CKD

Initiate evidence-based treatments

What defines CKD diagnosis?

Persistent urine ACR ≥30 mg/g

and/or

Persistent eGFR <60 mL/min/1.73 m^2

and/or

Other evidence of kidney damage

Ian H. de Boer, Kamlesh Khunti, Tami Sadusky, Katherine R. Tuttle, Joshua J. Neumiller, Connie M. Rhee, Sylvia E. Rosas, Peter Rossing, George Bakris; Diabetes Management in Chronic Kidney Disease: A Consensus Report by the American Diabetes Association (ADA) and Kidney Disease: Improving Global Outcomes (KDIGO). *Diabetes Care* 1 December 2022; 45 (12): 3075–3090. https://doi.org/10.2337/dci22-0027

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CKD is classified based on:
- **Cause (C)**
- **GFR (G)**
- **Albuminuria (A)**

GFR categories (mL/min/1.73 m²) Description and range				Albuminuria categories Description and range		
				A1	**A2**	**A3**
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–299 mg/g 3–29 mg/mmol	≥300 mg/g ≥30 mg/mmol
	G1	Normal or high	≥90	Screen 1	Treat 1	Treat and refer 3
	G2	Mildly decreased	60–89	Screen 1	Treat 1	Treat and refer 3
	G3a	Mildly to moderately decreased	45–59	Treat 1	Treat 2	Treat and refer 3
	G3b	Moderately to severely decreased	30–44	Treat 2	Treat and refer 3	Treat and refer 3
	G4	Severely decreased	15–29	Treat and refer* 3	Treat and refer* 3	Treat and refer 4+
	G5	Kidney failure	<15	Treat and refer 4+	Treat and refer 4+	Treat and refer 4+

Low risk (if no other markers of kidney disease, no CKD)

Moderately increased risk

High risk

Very high risk

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Chronic Kidney Disease—Treatment

11.2 Optimize glucose control to reduce the risk or slow the progression of chronic kidney disease. A

11.3 Optimize blood pressure control and reduce blood pressure variability to reduce the risk or slow the progression of chronic kidney disease. A

11.4a In nonpregnant people with diabetes and hypertension, either an ACE inhibitor or an angiotensin receptor blocker is recommended for those with moderately increased albuminuria (urinary albumin-to-creatinine ratio 30–299 mg/g creatinine) B and is strongly recommended for those with severely increased albuminuria (urinary albumin-to-creatinine ratio ≥300 mg/g creatinine) and/or estimated glomerular filtration rate <60 mL/min/1.73 m^2. A

Chronic Kidney Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S191-S202

Chronic Kidney Disease—Treatment (continued)

11.4b Periodically monitor serum creatinine and potassium levels for the development of increased creatinine and hyperkalemia when ACE inhibitors, angiotensin receptor blockers, and mineralocorticoid receptor antagonists are used, or hypokalemia when diuretics are used. B

11.4c An ACE inhibitor or an angiotensin receptor blocker is not recommended for the primary prevention of chronic kidney disease in people with diabetes who have normal blood pressure, normal urinary albumin-to-creatinine ratio (<30 mg/g creatinine), and normal estimated glomerular filtration rate. A

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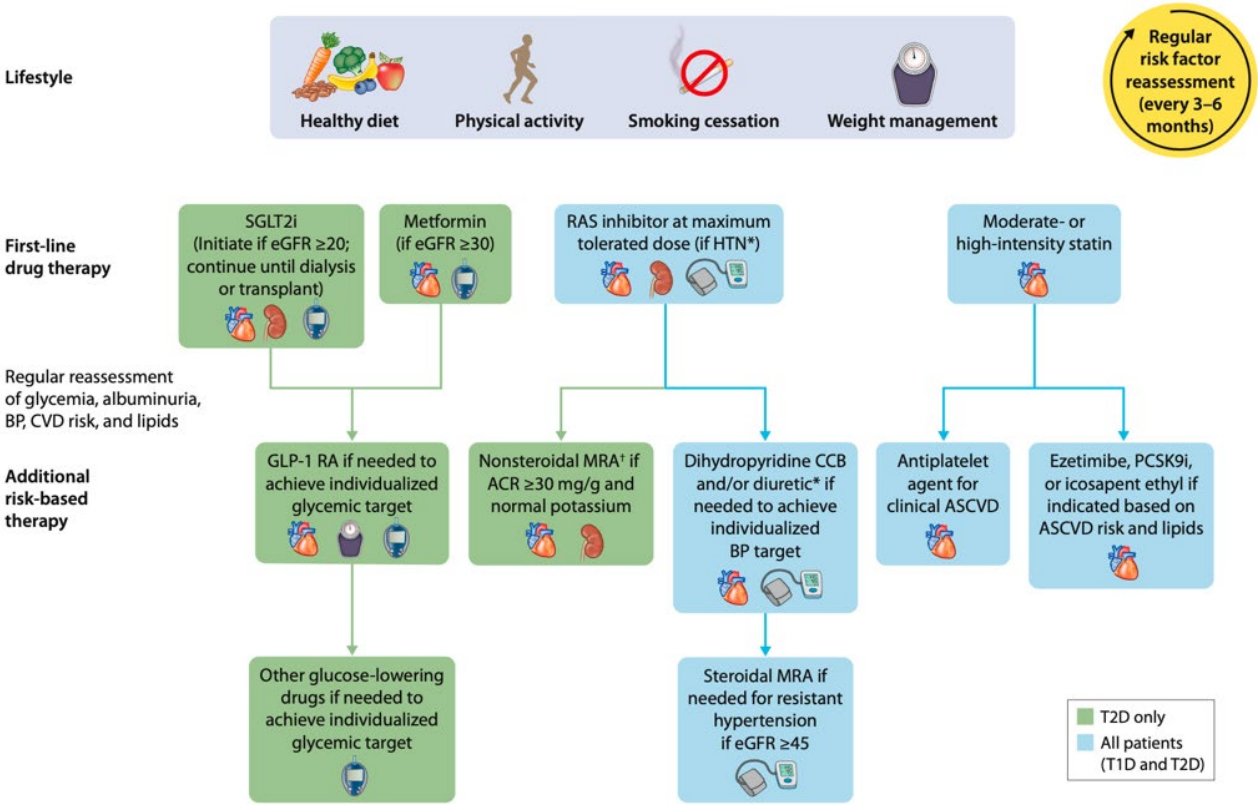

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Chronic Kidney Disease—Treatment (continued)

11.4d Do not discontinue renin-angiotensin system blockade for increases in serum creatinine (≤30%) in the absence of volume depletion. A

11.5a For people with type 2 diabetes and diabetic kidney disease, use of a sodium–glucose cotransporter 2 inhibitor is recommended to reduce chronic kidney disease progression and cardiovascular events in patients with n estimated glomerular filtration rate ≥20 mL/min/1.73 m^2 and urinary albumin ≥200 mg/g creatinine. A

Chronic Kidney Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S191-S202

Chronic Kidney Disease—Treatment (continued)

11.5b For people with type 2 diabetes and diabetic kidney disease, use of a sodium–glucose cotransporter 2 inhibitor is recommended to reduce chronic kidney disease progression and cardiovascular events in patients with an estimated glomerular filtration rate ≥20 mL/min/1.73 m2 and urinary albumin ranging from normal to 200 mg/g creatinine. B

11.5c In people with type 2 diabetes and diabetic kidney disease, consider use of sodium–glucose cotransporter 2 inhibitors (if estimated glomerular filtration rate is ≥20 mL/min/1.73 m2), a glucagon-like peptide 1 agonist, or a nonsteroidal mineralocorticoid receptor antagonist (if estimated glomerular filtration rate is ≥25 mL/min/1.73 m2) additionally for cardiovascular risk reduction. A

Chronic Kidney Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S191-S202

Chronic Kidney Disease—Treatment (continued)

11.5d In people with chronic kidney disease and albuminuria who are at increased risk for cardiovascular events or chronic kidney disease progression, a nonsteroidal mineralocorticoid receptor antagonist shown to be effective in clinical trials is recommended to reduce chronic kidney disease progression and cardiovascular events. A

11.6 In people with chronic kidney disease who have ≥300 mg/g urinary albumin, a reduction of 30% or greater in mg/g urinary albumin is recommended to slow chronic kidney disease progression. B

Chronic Kidney Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S191-S202

Chronic Kidney Disease—Treatment (continued)

11.7 For people with non–dialysis dependent stage 3 or higher chronic kidney disease, dietary protein intake should be aimed to a target level of 0.8 g/kg body weight per day. A For patients on dialysis, higher levels of dietary protein intake should be considered since protein energy wasting is a major problem in some individuals on dialysis. B

11.8 Patients should be referred for evaluation by a nephrologist if they have continuously increasing urinary albumin levels and/or continuously decreasing estimated glomerular filtration rate and if the estimated glomerular filtration rate is <30 mL/min/1.73 m^2. A

Chronic Kidney Disease and Risk Management:
Standards of Care in Diabetes - 2023. Diabetes Care 2023;46(Suppl. 1):S191-S202

Table 2—Considerations for selecting glucose-lowering agents in patients with T2D and CKD (2,17)

	Progression of CKD	ASCVD	Heart failure	Glucose-lowering efficacy	Hypoglycemia risk	Weight effects	Cost
Metformin	Neutral	Potential benefit	Potential benefit	High	Low	Neutral	Low
SGLT2 inhibitors	Benefit[a]	Benefit[c]	Benefit	Intermediate	Low	Loss	High
GLP-1 receptor agonists	Benefit[b]	Benefit[c]	Potential benefit	High	Low	Loss	High
DPP-4 inhibitors	Neutral	Neutral	Potential risk[c] (saxagliptin)	Intermediate	Low	Neutral	High
Insulin	Neutral	Neutral	Neutral	Highest	High	Gain	High (analogs) Low (human)
Sulfonylureas	Neutral	Neutral	Neutral	High	High	Gain	Low
Thiazolidinediones	Neutral	Potential benefit (pioglitazone)	Increased risk	High	Low	Gain	Low
α-Glucosidase inhibitors	Neutral	Neutral	Neutral	Intermediate	Low	Neutral	Low

Neutral

Potential benefit or intermediate glucose-lowering efficacy

Benefit (organ protection, high efficacy, low hypoglycemia risk, weight loss, or low cost)

Potential risk or high cost to patient

Increased risk for adverse effects

[a]Benefit supported by primary and secondary outcome data. [b]Benefit supported by secondary outcome data. [c]Benefit or risk is agent specific. ASCVD, atherosclerotic cardiovascular disease; CKD, chronic kidney disease; DPP-4, dipeptidyl peptidase 4; GLP-1, glucagon-like peptide 1; SGLT2, sodium–glucose cotransporter 2.

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	Stage 3b (eGFR 30–44 mL/min/1.73 m²)	Stage 4 (eGFR 15–29 mL/min/1.73 m²)	Stage 5 (eGFR <15 mL/min/1.73 m²)
Metformin	Reduce dose to 1000 mg/day	Contraindicated	
Insulin	Initiate and titrate conservatively to avoid hypoglycemia		
SGLT2 inhibitors*			
Canagliflozin	Maximum 100 mg daily	Initiation not recommended; may continue 100 mg daily if tolerated for kidney and CV benefit until dialysis	
Dapagliflozin	10 mg daily†	Initiation not recommended with eGFR <25 mL/min/1.73 m²; may continue if tolerated for kidney and CV benefit until dialysis	
Empagliflozin	10 mg daily‡	Initiation not recommended with eGFR <20 mL/min/1.73 m²; may continue if tolerated for kidney and CV benefit until dialysis	
Ertugliflozin	Use not recommended with eGFR <45 mL/min/1.73 m²		
GLP-1 receptor agonists§			
Exenatide	Caution initiating or increasing dose; avoid once-weekly formulation	Use not recommended	
Dulaglutide	No dose adjustment required		
Liraglutide	No dose adjustment required		
Lixisenatide	No dose adjustment required		Use not recommended
Semaglutide	No dose adjustment required		

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	Stage 3b (eGFR 30–44 mL/min/1.73 m²)	Stage 4 (eGFR 15–29 mL/min/1.73 m²)	Stage 5 (eGFR <15 mL/min/1.73 m²)
DPP-4 inhibitors			
Alogliptin	Maximum 12.5 mg daily	Maximum 6.25 mg daily	
Linagliptin	No dose adjustment required		
Saxagliptin	Maximum 2.5 mg daily		
Sitagliptin	Maximum 50 mg daily	Maximum 25 mg once daily	
Sulfonylureas (2nd generation)			
Glimepiride	Initiate conservatively at 1 mg daily and titrate slowly to avoid hypoglycemia		
Glipizide	Initiate conservatively (e.g., 2.5 mg once daily) and titrate slowly to avoid hypoglycemia		
Glyburide	Use not recommended		
Thiazolidinediones			
Pioglitazone	No dose adjustment required		
α-Glucosidase inhibitors			
Acarbose	No dose adjustment required	Use not recommended	
Miglitol	No dose adjustment required	Use not recommended	

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Chronic Kidney Disease—Treatment (continued)

11.9 Promptly refer to a nephrologist for uncertainty about the etiology of kidney disease, difficult management issues, and rapidly progressing kidney disease. A

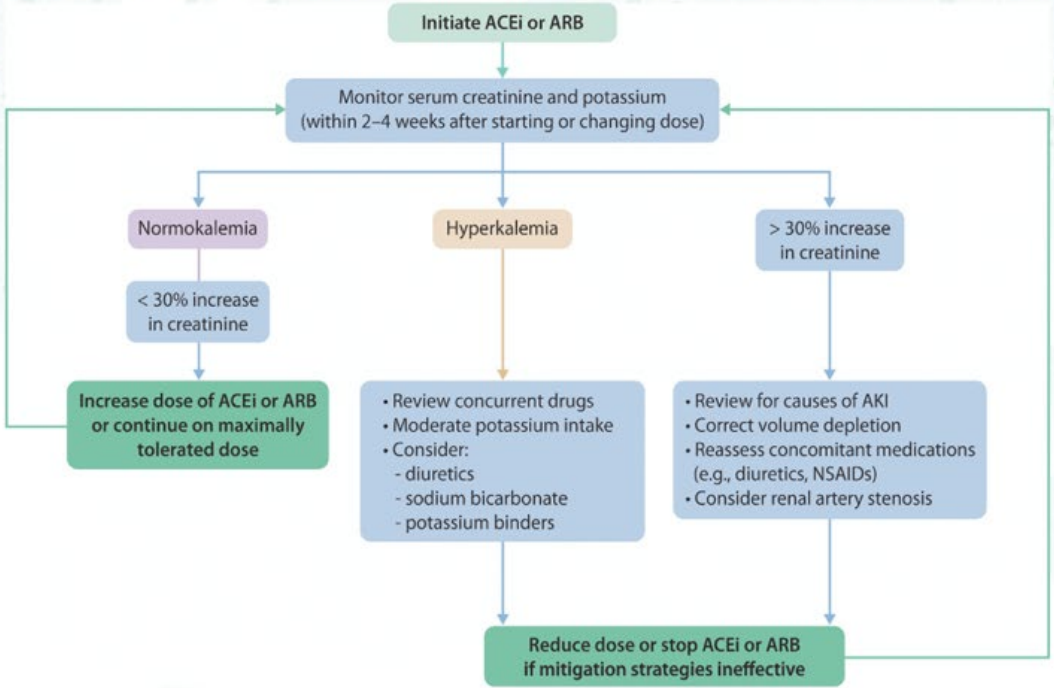
Case 2

55-year-old patient with type 2 diabetes is seen in clinic for follow-up. He has no complaints and is currently taking metformin, lisinopril and empagliflozin. BP is 136/82.

Labs show: K 5.6, CO2 24, eGFR 45. BP is 136/82 and he says it's about the same at home. One year ago his eGFR was 50 and his K was 5.0. What would you do next?

A. Start on a potassium binding medication
B. Start on hydrochlorothiazide 25mg a day
C. Decrease lisinopril dose by ½
D. Discuss reducing potassium in diet

FIGURE 4. MONITORING OF SERUM CREATININE AND POTASSIUM DURING ACEI OR ARB TREATMENT - DOSE ADJUSTMENT AND MONITORING OF SIDE EFFECTS



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DISCUSSION

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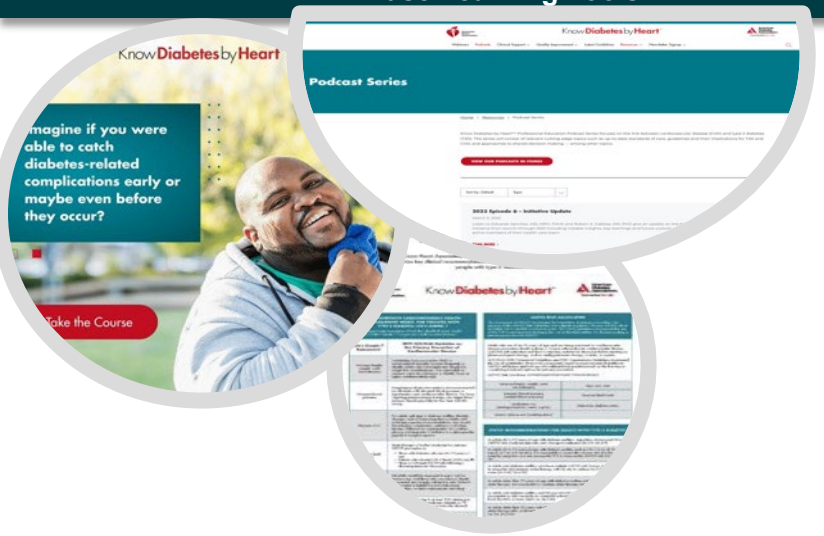

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Target: Type 2 Diabetes℠

Inpatient & Outpatient Program summary

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Outpatient

Completes all parts of data submission process including aggregate measure information

Achieves participant award level and meets specified thresholds for each of the selected clinical measures

Inpatient

American Heart Association. Get With The Guidelines. Heart Failure

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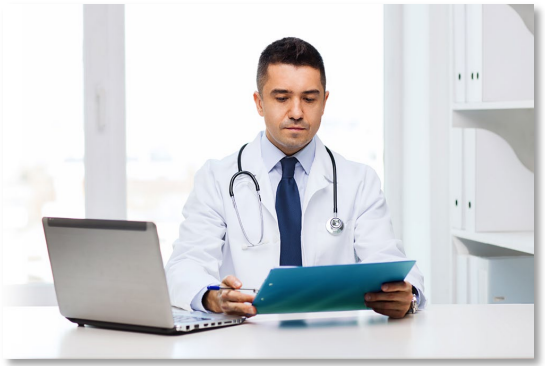
DIABETES INSIDE™

The ADA's **Diabetes INSIDE** program is a quality improvement framework aimed to catalyze, accelerate and sustain health care improvement projects across health systems, public health departments, payers, industry, federal, state and local governments, large employers, community services, nonprofits, and philanthropic organizations.

Diabetes INSIDE is designed to facilitate health care systems/facilities in **the identification of current system and clinical gaps,** and in the implementation of improvements which **will impact guideline-based care for patients with type 2 diabetes.**



The program engages health care systems by providing:

- Quality improvement training
- Coaching and facilitation
- Data analysis
- Shared learning and guideline support

To learn more, contact **diabetesinside@diabetes.org**

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