Kidney Health in the Primary Care Setting

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November 2021

Objectives

- Pretest questions
- Identify appropriate methods of Chronic Kidney Disease (CKD) evaluation by the healthcare team in at risk patients
- Discuss implementation strategies for CKD testing in primary care practice
- Evidence based glycemic management in patients with diabetic kidney disease (DKD)
- Evidence based management of Hypertension (HTN) in CKD
- Discuss interventions to reduce progression of cardiovascular and progressive kidney disease in Diabetes Mellitus (DM) and HTN

Question 1

Albuminuria and low estimated glomerular filtration rate

1. Increased mortality
2. Cardiovascular events
3. Progression of CKD
4. All the above

Question 2

The labs results of a patient you saw in your office yesterday is shown below. Which of the following levels of GFR and albumin-to –creatinine ratio indicate G3 A2?

1. GFR 10mL/min/ 1.73m2, ACR 350mg/g
2. GFR 55mL/min/1.73m2, ACR 400mg/g
3. GFR 45mL/min/1.7m2, ACR 50mg/g
4. GFR 90mL/min/1.7m2, ACR 10mg/g

Question 3

A 58-year-old women with HTN for 7 years and type 2 diabetes for 2 years comes for a routine physical. Which of the following should be included in the clinical evaluation for CKD?

1. ACR
2. HbA1c
3. eGFR
4. Blood pressure

Question 4

Which of the following is not required for screening kidney disease?

1. Estimation of GFR
2. Serum cystatin C
3. Spot urine albumin creatinine ratio
4. 24-hour urine collection for protein
5. 1& 3
6. All of the above

CKD in Primary Care

Case A

- A 45-year-old sees you in clinic for her routine visit. She has a history of anxiety, depression and hypertension. She is currently taking metoprolol XL 50mg daily. Her physical exam is normal with an office blood pressure of 120/ 76mmhg. Her labs are notable for eGFR of 50ml/min/1.73m2. Her two prior eGFR 1 year prior and 3 years prior were 74 and 75 ml/min/ 1.73m2.

What would indicate that this patient has markedly increased albuminuria?

A. 15mg/d total urine protein (24-hour collection)
B. 100mg/g spot urine albumin-to creatinine ratio (ACR)
C. 10mg/dL spot urine dipstick
D. None of the above

Burden of CKD in general population

CKD Is Common Among US Adults

Fast Facts

- More than 1 in 7, that is 15% of US adults or 37 million people, are estimated to have CKD.*
- As many as 9 in 10 adults with CKD **do not know** they have CKD.
- About 2 in 5 adults with severe CKD **do not know** they have CKD.

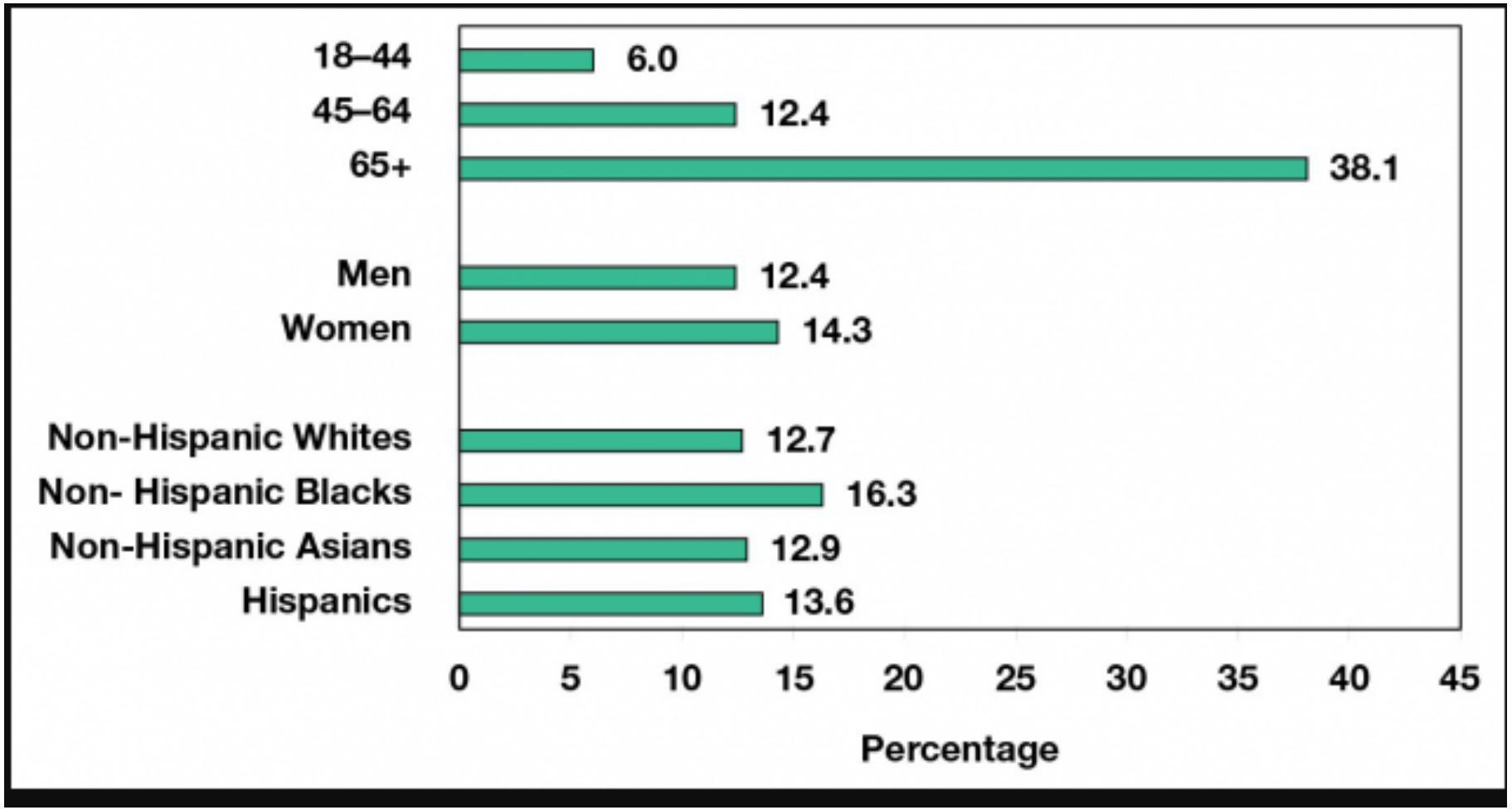
CDC data 2021

CKD by the Numbers

- Kidney diseases are a **leading cause of death** in the United States.
- About **37 million** US adults are estimated to have CKD, and most are undiagnosed.
- **40%** of people with severely reduced kidney function are not aware of having CKD.
- Every 24 hours, **360** people begin dialysis treatment for kidney failure.
- In the United States, diabetes and high blood pressure are the leading causes of kidney failure, representing about **3 out of 4 new cases**.
- In 2018, treating Medicare beneficiaries with CKD cost over **$81.8 billion**, and treating people with ESRD cost an additional **$36.6 billion**.

CDC data 2021

Population Distribution- Percentage of US adults aged 18 years or older with CKD



CDC data 2021

Conditions associated with Increased CKD Risk

- **Diabetes**
- **Hypertension**
- Cardiovascular disease
- Obesity
- Age > 60 years
- Family History of CKD
- **History of AKI**
- Ethnic/ racial minority

US Population crude estimates for 2018

- 37.0% had chronic kidney disease (stages 1–4), of which over half (52.5%) had moderate to severe chronic kidney disease (stage 3 or 4).
- 24.9% with moderate to severe chronic kidney disease (stage 3 or 4) were aware of their kidney disease.
- Crude incidence of end-stage kidney disease with diabetes as the primary cause was 180.3 per 1 million population

Clinical evaluation of CKD

- Blood pressure
- HbA1c, Glucose
- Serum creatinine / eGFR
- Urinalysis
- Albuminuria
- Electrolytes, CBC
- Depending on stage : Phosphate, Calcium, iPTH
- Other specific serologies depending on urine studies and history

Use of ACR and eGFR

- CKD is defined as sustained decrease in GFR < 60ml/min/m2 or markers of kidney damage for > 3 months
- Estimated GFR (eGFR) calculated using serum creatinine using CKD-EPI formula (Assumption made that patient is in steady state)
- Urine ACR on spot sample
- Both tests to be done for screening and annually for high-risk patients

CKD Risk Stratification

Prognosis of CKD by GFR and albuminuria category

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

GFR categories (ml/min/ 1.73 m²) Description and range				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	<15			

Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk; Orange: high risk; Red, very high risk.

Kidney International Supplements (2013) 3, 5–14

Primary Care: Gatekeeper in CKD care

- Most CKD patients are treated in primary care setting
- Identify high risk patients in your practice
- Identify the role of CKD as a risk for cardiovascular events
- Use standing orders for chronic diseases for yearly testing
- Accurate diagnosis to help better reimbursement and future research using registry data

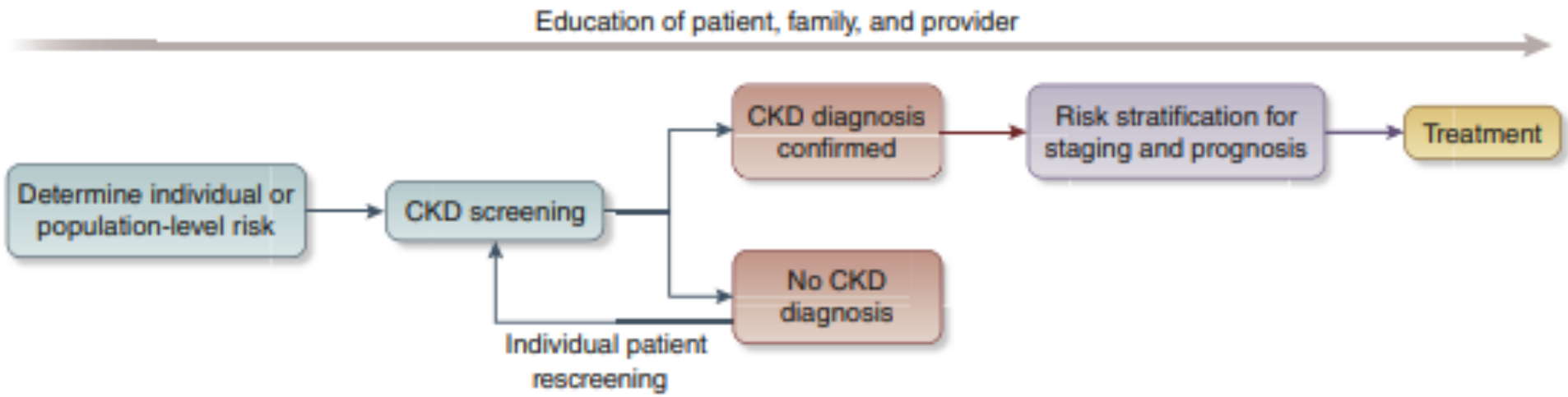
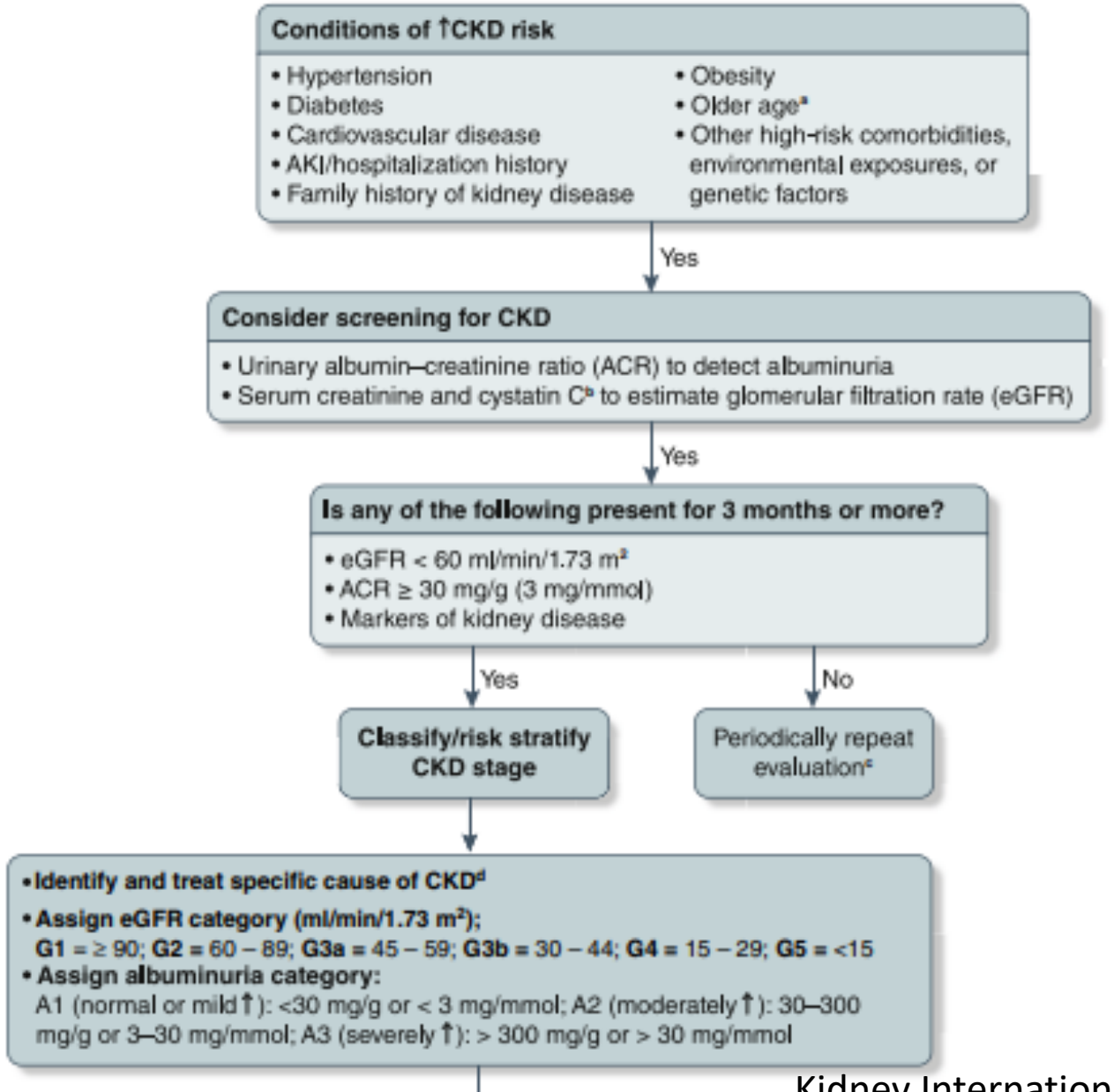


Figure 1 | Conceptual framework of a chronic kidney disease (CKD) screening, risk stratification, and treatment program.



Kidney International (2021) 99, 34–47

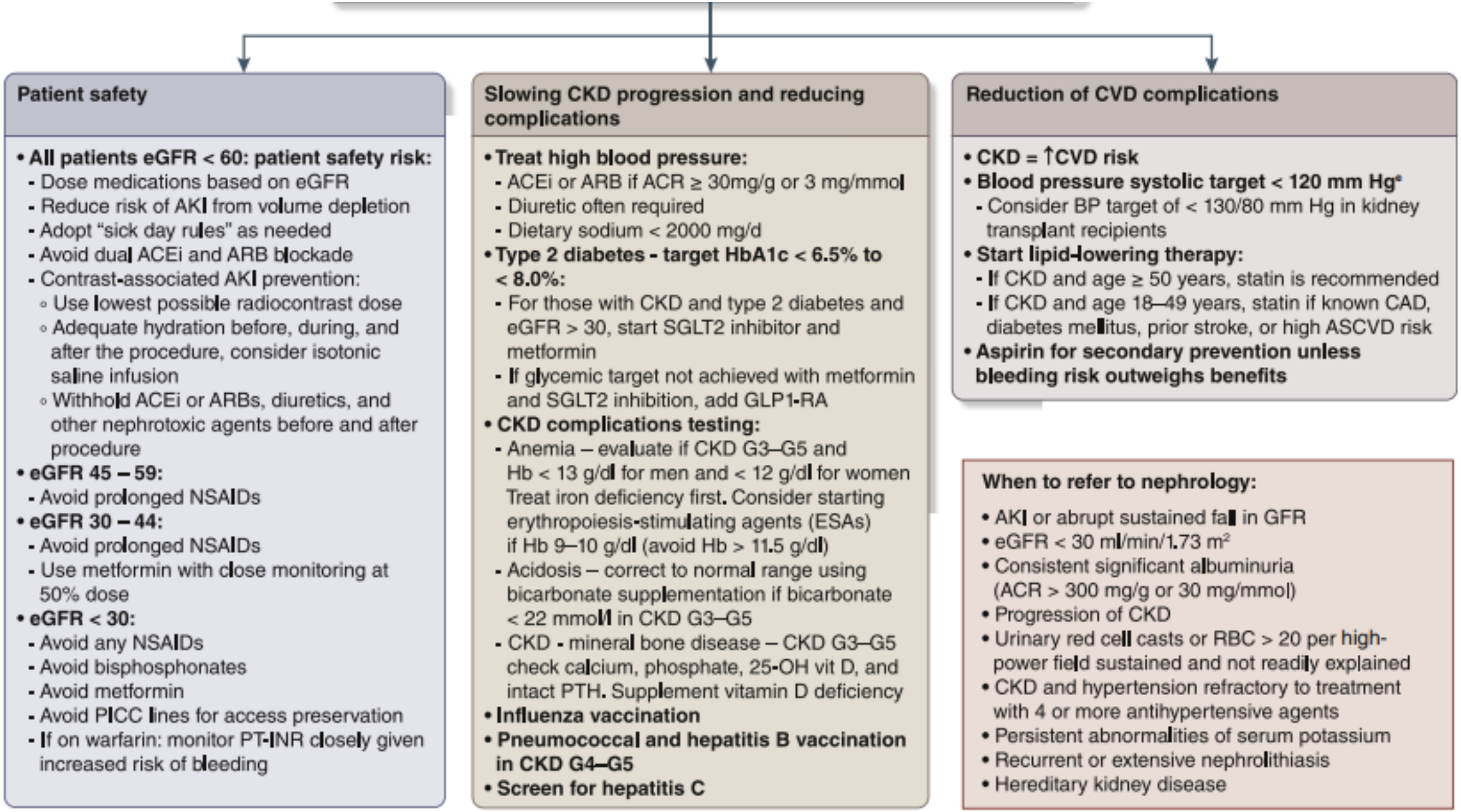


Figure 2| Algorithm to screen, risk stratify, and treat chronic kidney disease (CKD). Based on Kidney Disease: Improving Global

Kidney International (2021) 99, 34–47

Translating CKD Research into Primary Care Practice: a Group-Randomized Study

Cara B. Litvin, MD, MS[1], Paul J. Nietert, PhD[2], Ruth G. Jenkins, PhD[3], Andrea M. Wessell, PharmD[3], Lynne S. Nemeth, PhD, RN[4], and Steven M. Ornstein, MD[3]

[1]Division of General Internal Medicine, Department of Medicine, Medical University of South Carolina, Charleston, SC, USA; [2]Depa Health Sciences, Medical University of South Carolina, Charleston, SC, USA; [3]Department of Family Medicine, Medical University of Charleston, SC, USA; [4]College of Nursing, Medical University of South Carolina, Charleston, SC, USA.

J Gen Intern Med 35(5)1435-43 , 2019

- Objective To assess if implementation of primary care improvement model results in improved identification and management of CKD
- Design: 18-month Randomized study
- Participants : 21 primary care practices in 13 US states with 107,094 patients
- Intervention arm received clinical quality measure (CMQ) reports quarterly , On site visit, 2 webinars, best practice meetings for clinician and staff. Control group received quarterly reports
- End point : Change in practice with regards to 11 CKD CQMs

J Gen Intern Med 35(5)1435-43 , 2019

Results

- Significant improvements among intervention practices for annual albuminuria in patients with diabetes or Hypertension (22% in intervention vs -2.6% in control group, $p < 0.0001$)
- Annual monitoring for albuminuria in patients in CKD was better (21% vs -2% in control, $p <0.0001$)
- Avoidance of NSAIDs in patients with CKD declined in both groups (-5% in intervention group and -10 % in control)
- Increased use of statins in CKD group compared to control (not statistically significant)

J Gen Intern Med 35(5)1435-43 , 2019

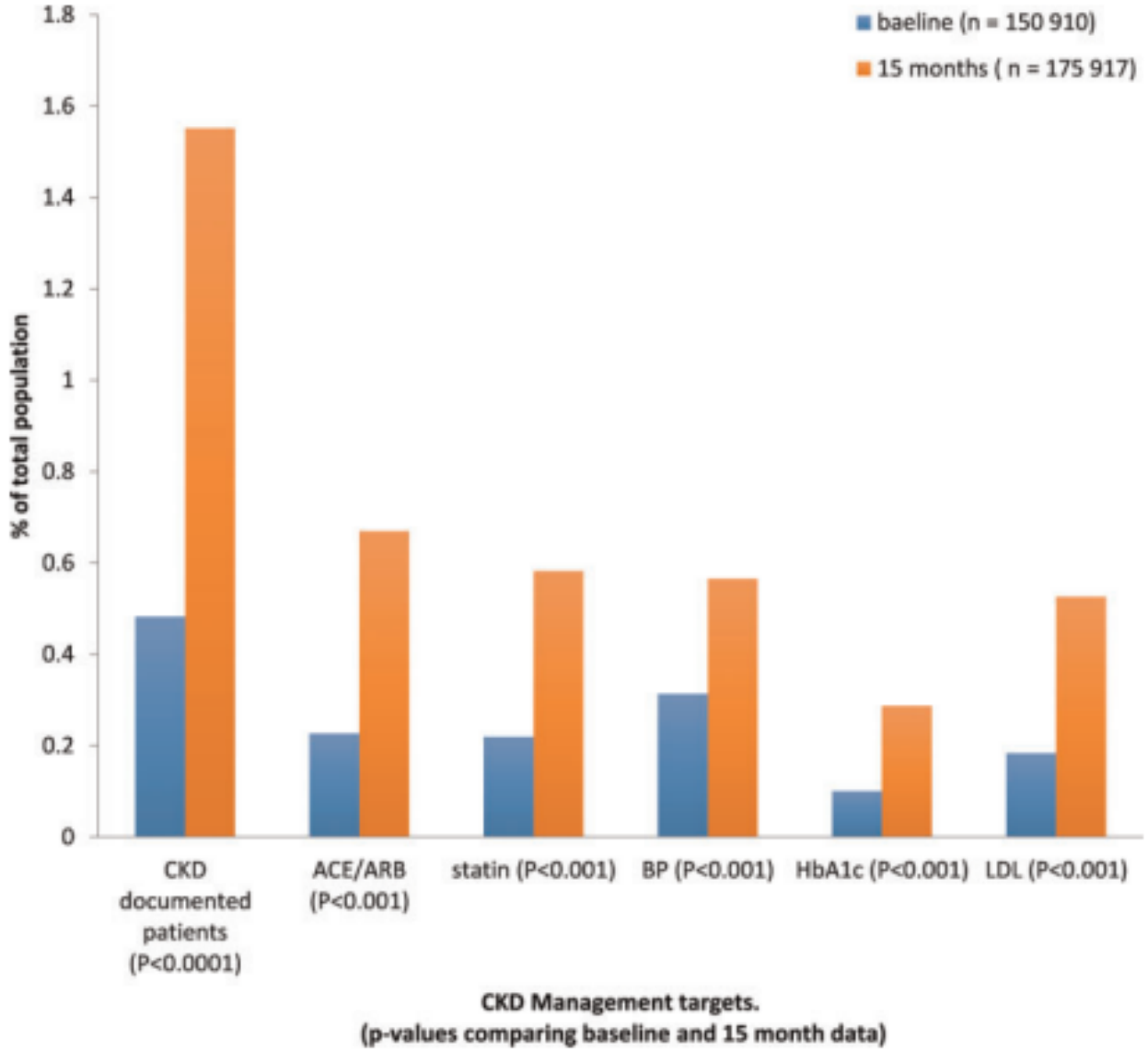
eMAP:CKD: electronic diagnosis and management assistance to primary care in chronic kidney disease

Aspasia Pefanis[1], Roslin Botlero[2,3], Robyn G. Langham[4] and Craig L. Nelson[1,3,5,6]

Nephrol Dial Transplant (2018) 33: 121–128

- Aim : Pilot program to address gap between current and best practice care for CKD.
- Methods: Customized software programs were developed to integrate with primary care electronic health records (EHRs) with real time prompting for CKD risk factors, testing, diagnosis and management.
- Data from 150,910 at baseline, 175917 at 15 month follow up
- Results -Improvement in all aspects of CKD management

Nephrol Dial Transplant (2018) 33: 121–128



CKD Management targets.
(p-values comparing baseline and 15 month data)

Nephrol Dial Transplant (2018) 33: 128–138

Medication Prescribing in CKD – Dosing

- **Antimicrobial** - Fluroquinolones, Antifungals, Trimethoprim, Macriolides
- **Antihypertensives/ cardiac medications** – RAAS blockade, Beta blockers
- **Hypoglycemic agents**- Insulin, Sulphonylureas, Insulin, Metformin, certain DDP4 inhibitors
- **Lipid Lowering agents** – Statins, Fenofibrate
- **Analgesics** – Gapapentin, Morphine, NSAIDs, Meperidine (avoid)

Clin J Am Soc Nephrol 13: 1738–1746, Nov, 2018

Medication Prescribing in CKD

- **Narrow therapeutic index** - Aminoglycosides, Lithium, Phenytoin, Tacrolimus, Warfarin
- **Contrast agents -** use lowest dose possible
- **Bowel Preparations –** Avoid fleet enemas, phosphate containing prep
- **Herbal supplements –** Avoid Licorice, St John's wort, Ginko Biloba, Ephedra alkaloids, Noni Juice

Clin J Am Soc Nephrol 13: 1738–1746, November, 2018

Diabetes and CKD Management in Primary care

Pretest Questions A

- A 60-year-old with CKD, HTN and DM is here for follow up. He is currently on an ACE inhibitor and an anti diabetic agent. BP is 136/86mmhg and HbA1c is 5.6%. Which of the following interventions is most appropriate?

1. Lower dose of ACE inhibitor
2. Add a diuretic
3. Lower the dose of the current anti-diabetic agent
4. Replace the ACE inhibitor with a thiazide diuretic

Question B

- Which of the following statements of sodium glucose co – transporter-2 inhibitors are true?

1. Data does not support the use of any SGLT2 inhibitors in diabetic kidney disease to slow progression
2. SGLT2 inhibitors reduce cardiovascular risk in patients with type 2 DM only through improvement in glycemic control
3. SGLT2 inhibitors have shown to reduce risk of hospitalization in patients with heart failure
4. All of the above

Question C

- Complications associated with diabetes include which of the following?

1. Retinopathy
2. Neuropathy
3. Increased cardiovascular events
4. Increased risk of chronic kidney disease
5. A, B, D
6. All of the above

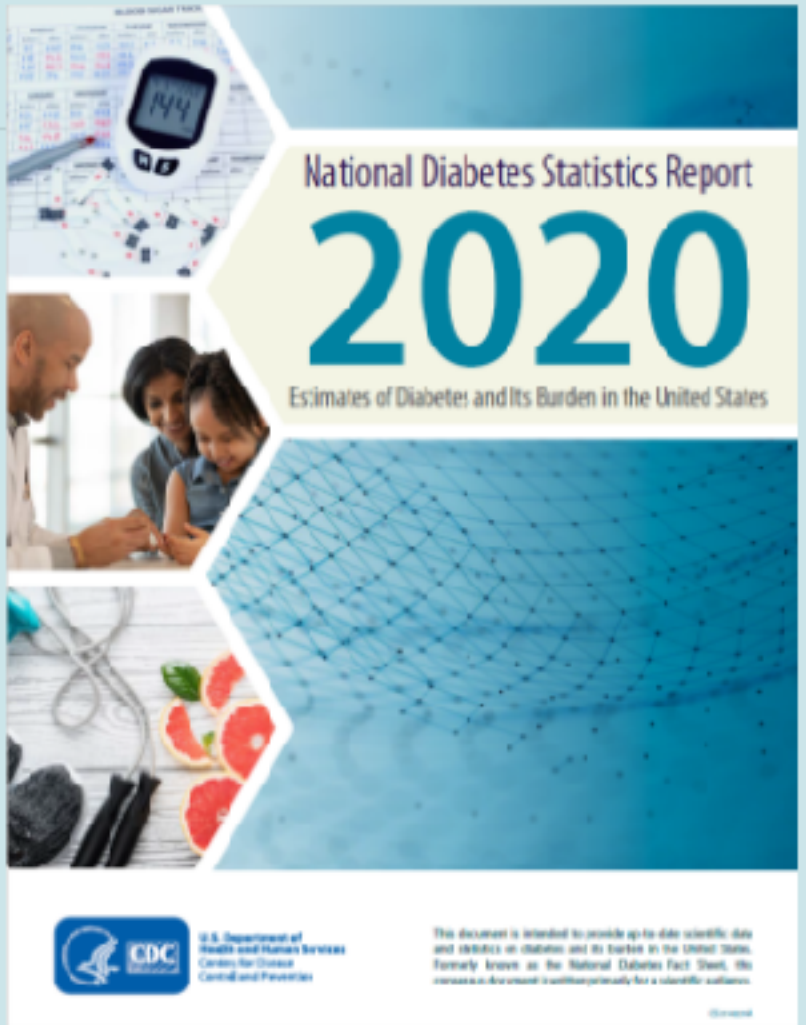
Fast Facts on Diabetes

Diabetes

- **Total:** 34.2 million people have diabetes (10.5% of the US population)
- **Diagnosed:** 26.9 million people, including 26.8 million adults
- **Undiagnosed:** 7.3 million people (21.4% are undiagnosed)

Prediabetes

- **Total:** 88 million people aged 18 years or older have prediabetes (34.5% of the adult US population)
- **65 years or older:** 24.2 million people aged 65 years or older have prediabetes

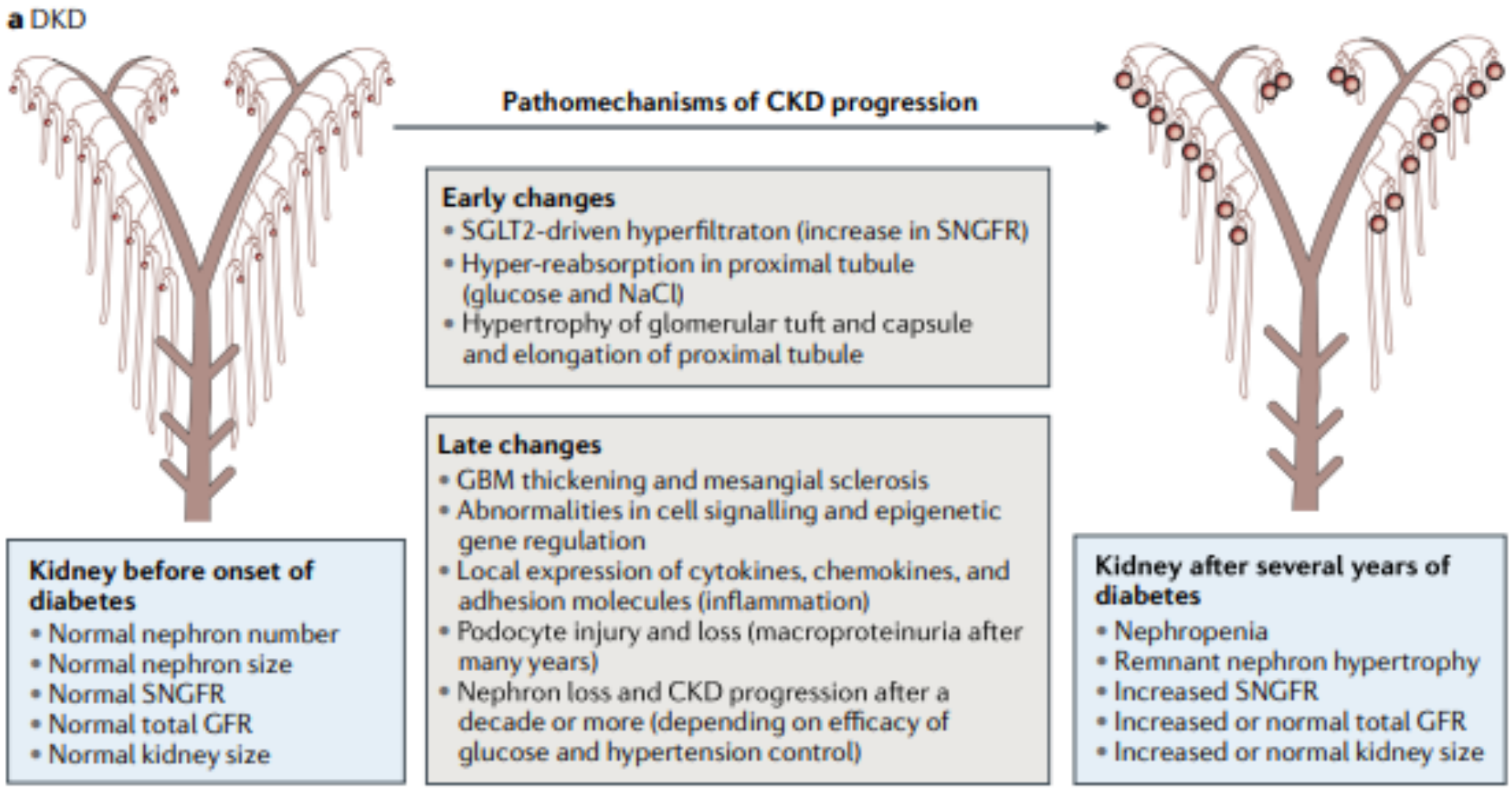


Diabetic Kidney Disease (DKD)

- Affects 30% of those with type I diabetes and 40% of type II
- Develops

a. Glomerular hyperfiltration
b. Persistent albuminuria
c. Hypertension and declining eGFR

Pathomechanisms of CKD in Diabetes



NATuRe RevIewS | NePHRology Reviews volume 14 | JUNE 2018 | 367

Prevention of DKD

- BP goal < 130/80mmHg
- Smoking cessation
- HbA1C < 7 %
- ARB and ACEI are not indicated for DKD prevention but for slowing progression
- Monitor eGFR and Urine ACR annually

Screening for DKD

- **When to screen**

- At diagnosis for type II
- 5years after onset of type I

- **Screening tests**

-Spot Urine ACR

-eGFR from serum creatinine

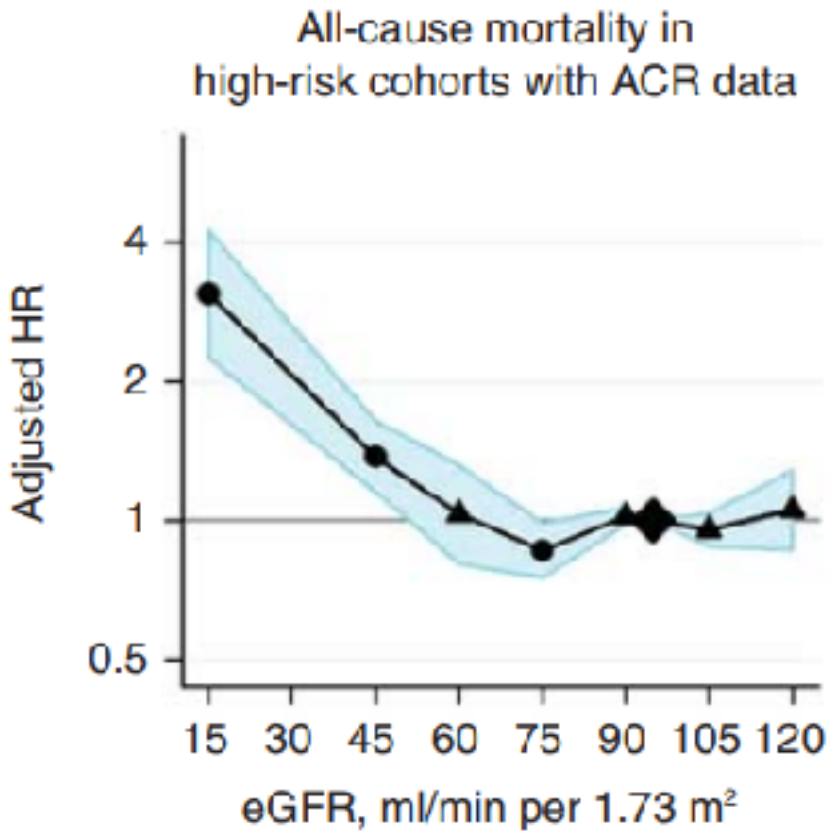
- **Screening frequency**

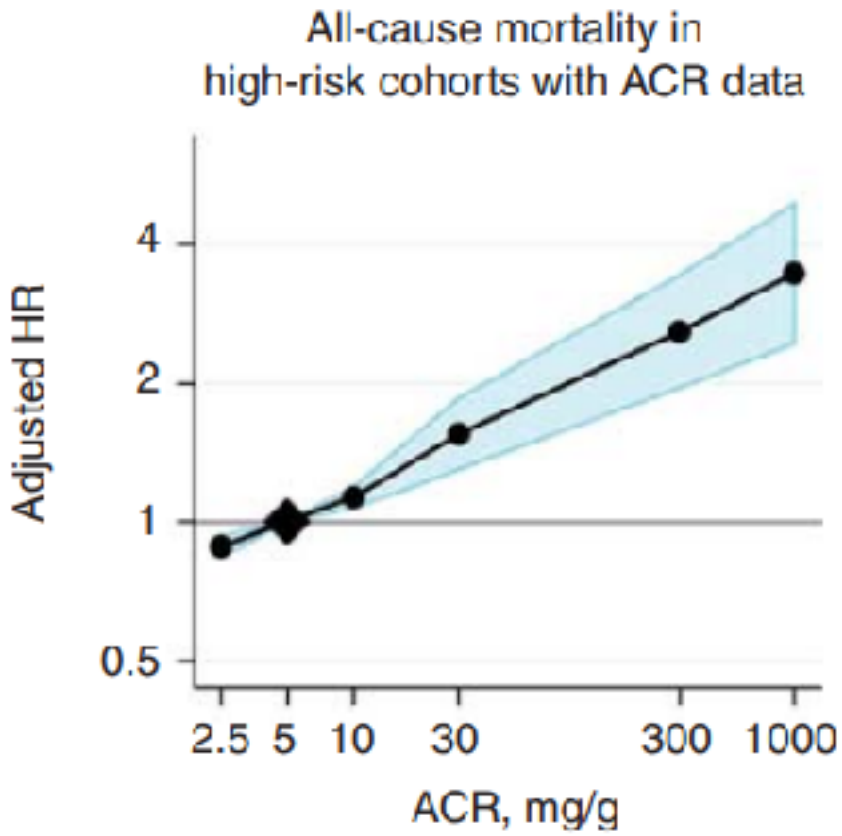
-Annual

Management of DKD

- Prevent microvascular complications
- Reduce cardiovascular deaths
- Decrease CKD progression
- Hyperfiltration driven by SGLT co transporter 2 and RAAS is a common upstream mechanism that drives kidney disease

Mortality with eGFR and ACR





Pooled adjusted hazard ratios (95% confidence interval) for all-cause mortality

Kidney International (2011) 79, 1341–1352

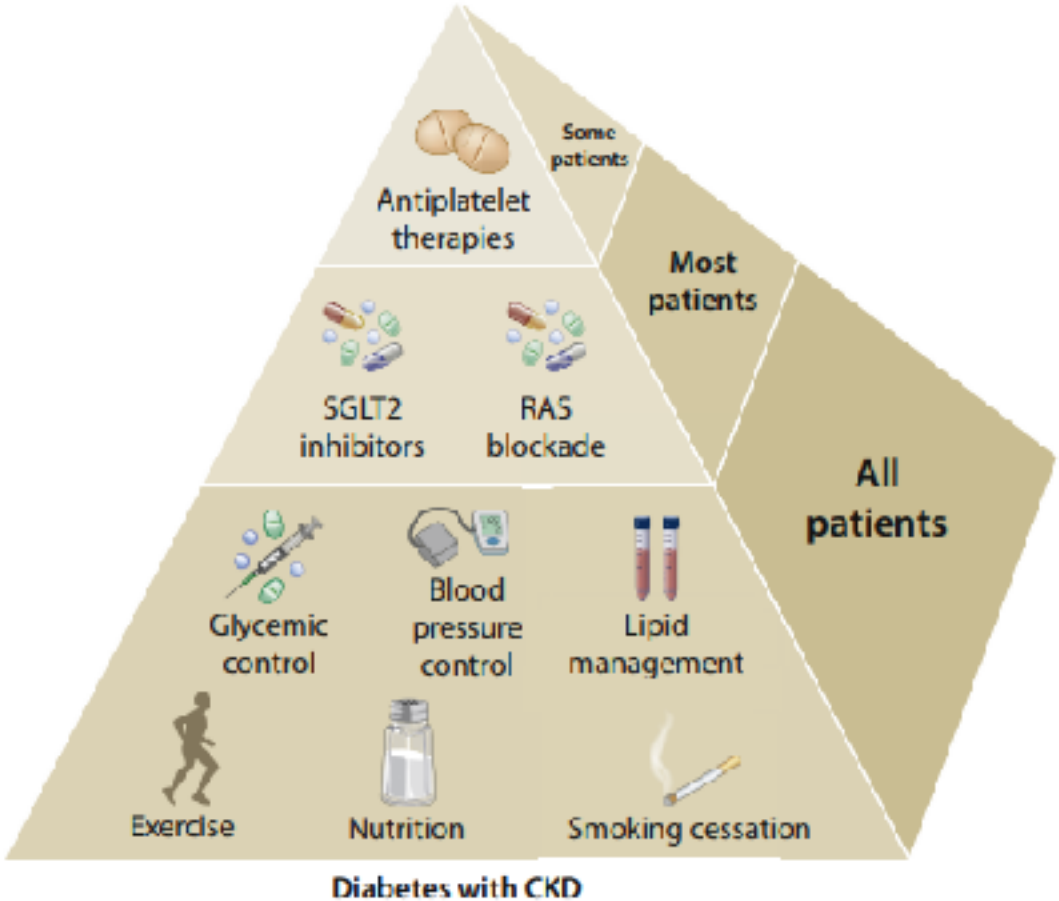
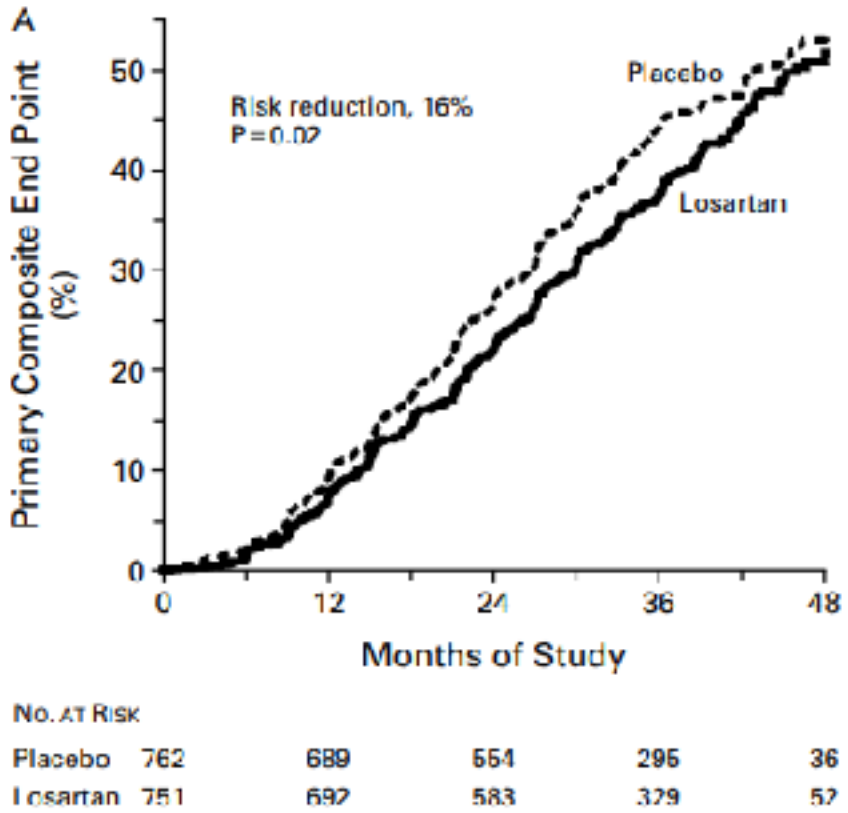
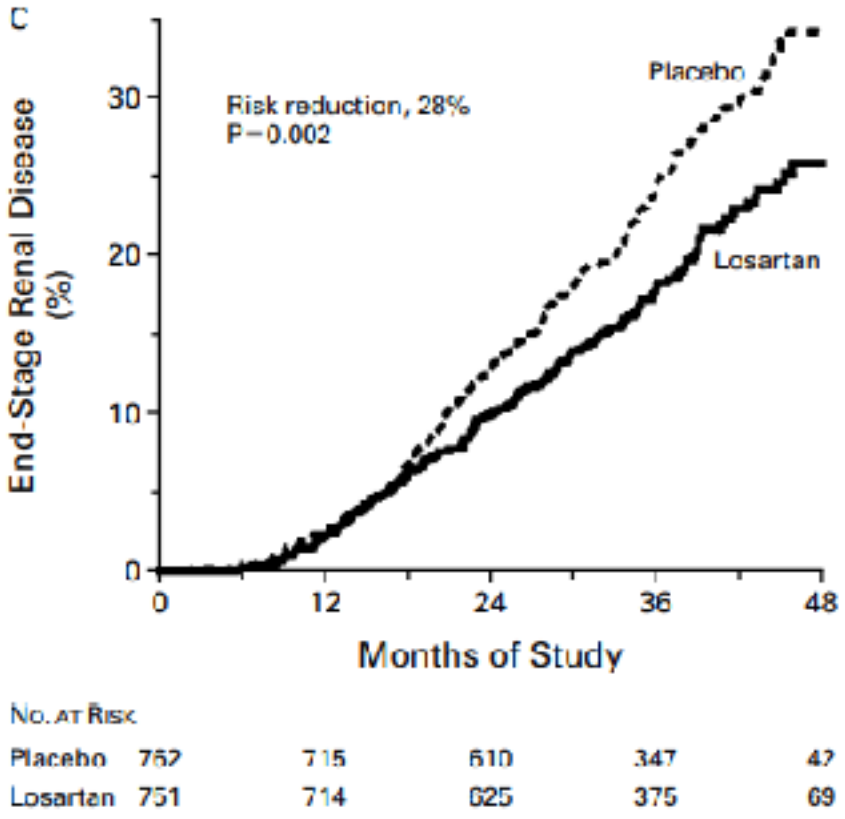


Figure 2 | Kidney–heart risk factor management. Glycemic control is based on insulin for type 1 diabetes and a combination of metformin and SGLT2 inhibitors (SGLT2i) for type 2 diabetes, when eGFR is ≥30 ml/min per 1.73 m^2. SGLT2i are recommended for patients with type 2 diabetes and chronic kidney disease (CKD). Renin–angiotensin system (RAS) inhibition is recommended for patients with albuminuria and hypertension. Aspirin generally should be used lifelong for secondary prevention among those with established cardiovascular disease and may be considered for primary prevention among high risk individuals, with dual antiplatelet therapy used in patients after acute coronary syndrome or percutaneous coronary intervention. RAS, renin-angiotensin system; SGLT2, sodium–glucose cotransporter-2.

Kidney International (2020) 98, S1–S115

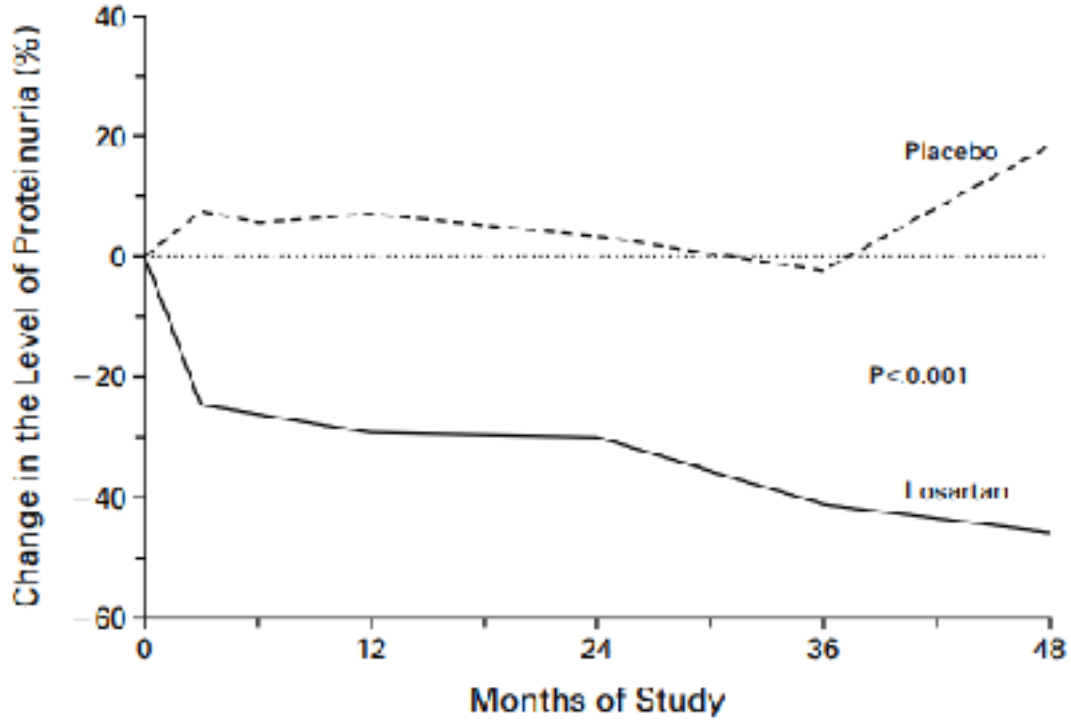
RENAAL Trial: RCT, double blind with 1513 patients followed for 3.4years.





N Engl J Med, Vol. 345, No. 12 · September 20, 2001

Level of Proteinuria in RENAAL Trial



No. at Risk

Placebo	767	637	529	390	130
Losartan	751	661	558	438	167

Figure 3. Median Changes from Base Line in the Level of Proteinuria.

Proteinuria was measured as the urinary albumin-to-creatinine ratio in a first morning specimen. The mean follow-up time was 3.4 years.

Using ACE I or ARB

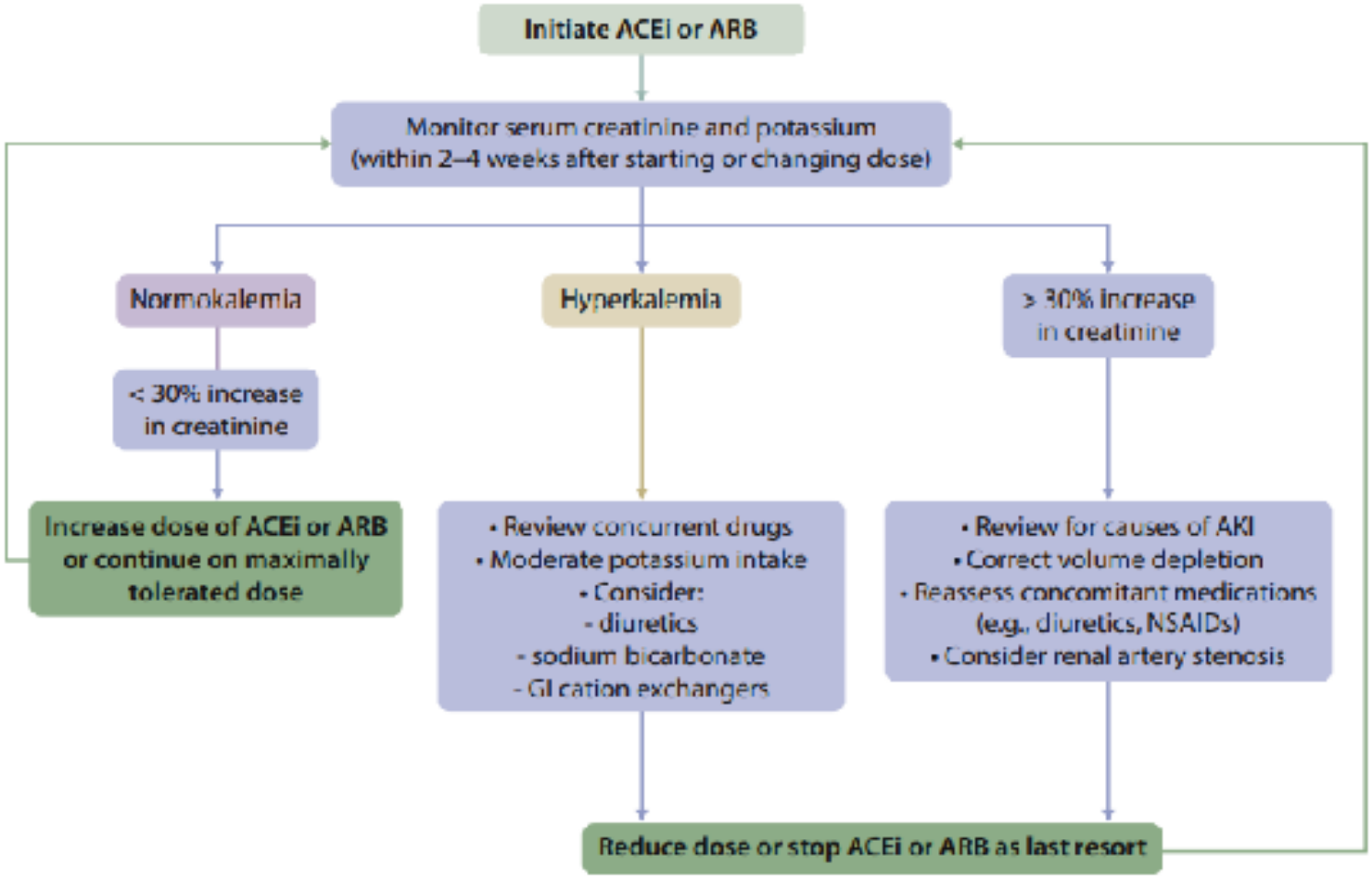


Figure 4 | Monitoring of serum creatinine and potassium during ACEi or ARB treatment—dose adjustment and monitoring of side effects. ACEi, angiotensin converting enzyme inhibitor; AKI, acute kidney injury; ARB, angiotensin II receptor blocker; GI, gastrointestinal; NSAID, nonsteroidal anti-inflammatory drug.

Kidney International (2020) 98, S1–S115

Glycemic Control

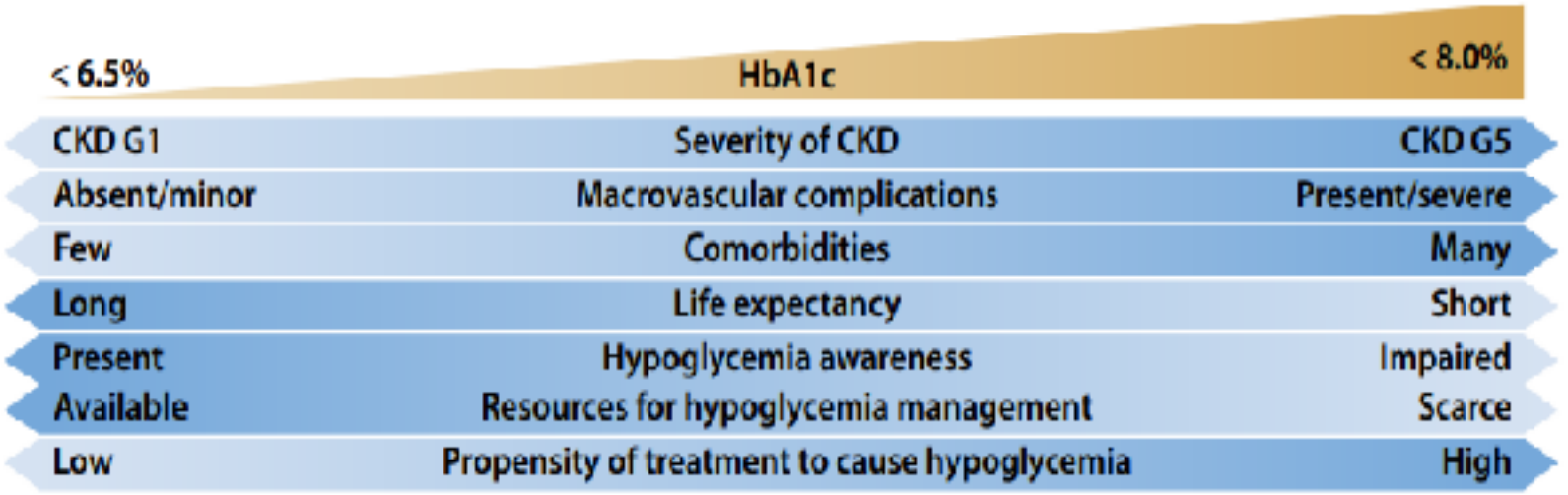


Figure 9 | Factors guiding decisions on individual HbA1c targets. CKD, chronic kidney disease; G1, estimated glomerular filtration rate (eGFR) ≥90 ml/min per 1.73 m^2; G5, eGFR <15 ml/min per 1.73 m^2; HbA1c, glycated hemoglobin.

Kidney International (2020) 98, S1–S115

Kidney Function Decline in Type 2 Diabetes
Slope Analysis From the EMPA-REG OUTCOME® Trial

METHODS

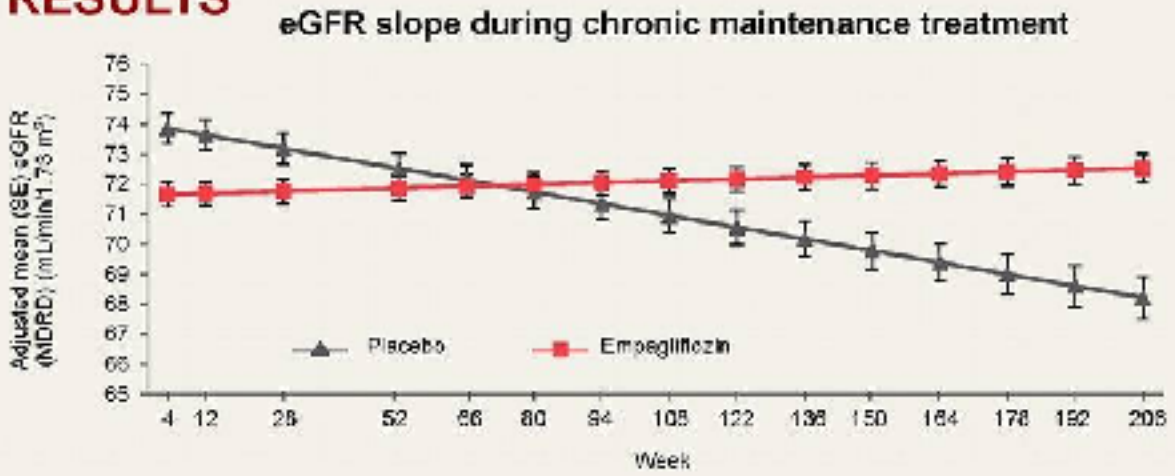
EMPA-REG OUTCOME® studied 7020 people with type 2 diabetes and established CVD over a median follow-up of 3.1 years. This manuscript reports a pre-specified 'eGFR slope' analysis from this trial, evaluating changes in kidney function over time.

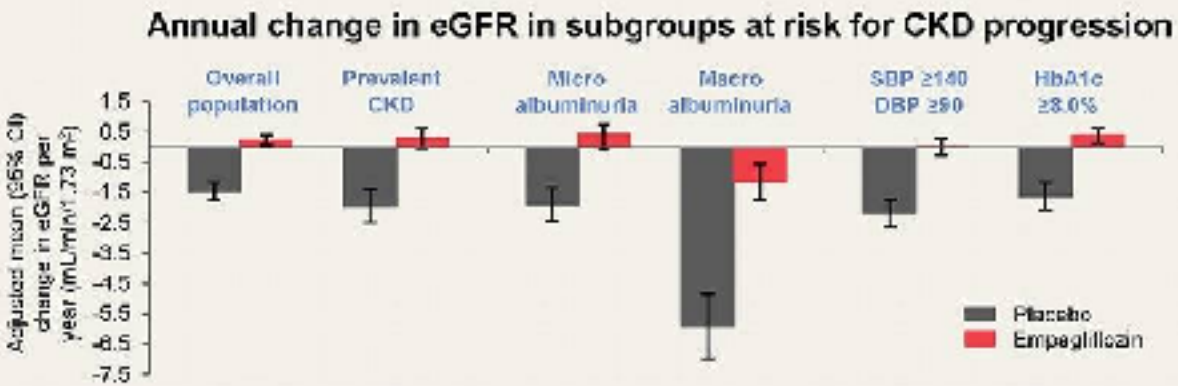
eGFR slopes for pooled empagliflozin or placebo groups were calculated using a random intercept, random coefficient model.

CONCLUSION

During long-term chronic treatment (from Week 4 to last value on treatment), empagliflozin significantly slowed kidney function loss, and this effect was consistent among individuals at high risk of progressive kidney disease. These data support the utility of slope analysis as an emerging surrogate endpoint of CKD progression.

RESULTS





doi: 10.1681/ASN.2018010103

JASN

EMPA- REG TRIAL: Cardiovascular outcomes in Type 2 DM

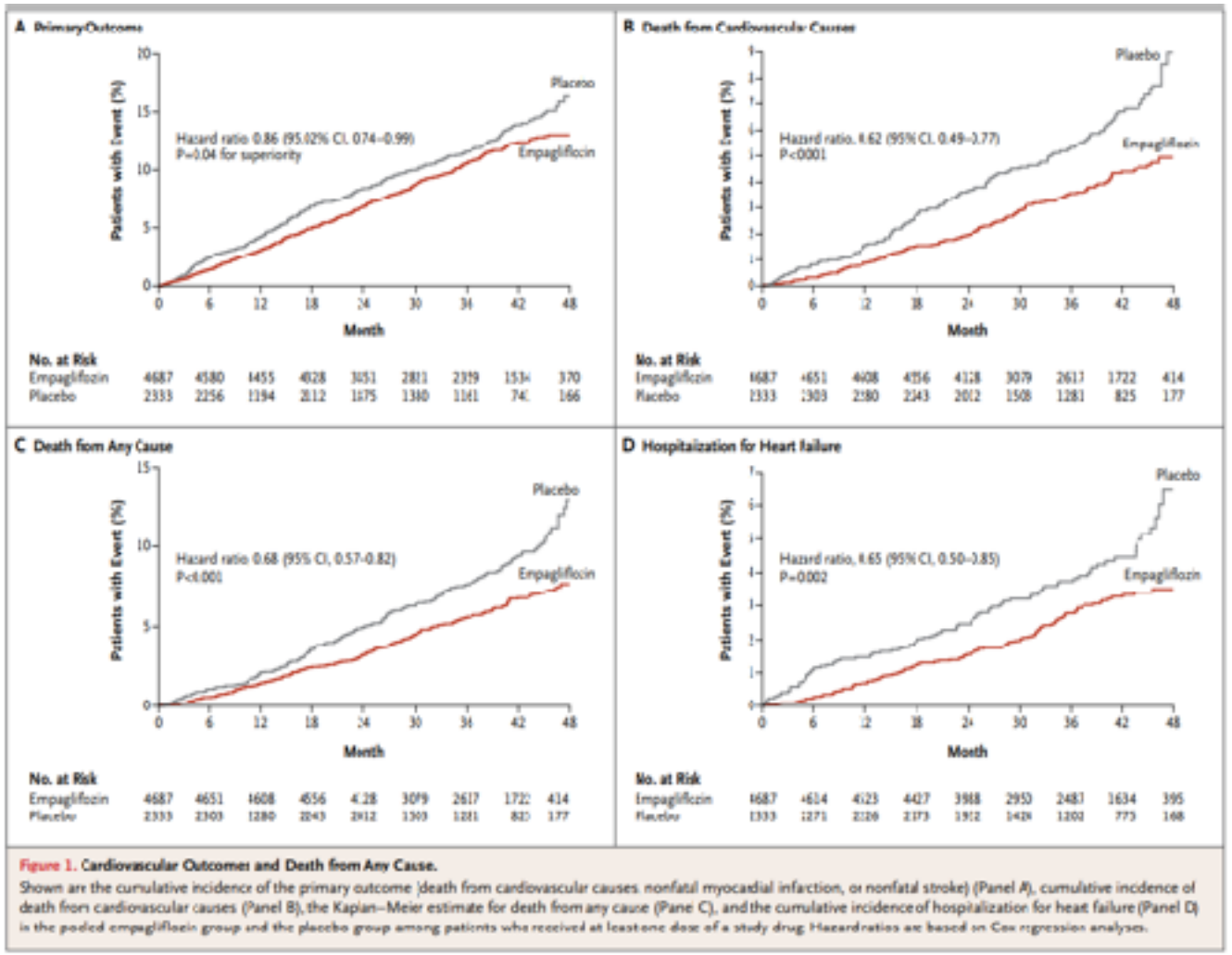


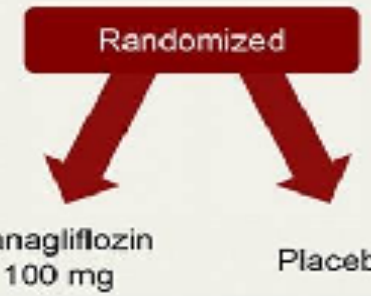
Figure 1. **Cardiovascular Outcomes and Death from Any Cause.**
Shown are the cumulative incidence of the primary outcome (death from cardiovascular causes, nonfatal myocardial infarction, or nonfatal stroke) (Panel A), cumulative incidence of death from cardiovascular causes (Panel B), the Kaplan–Meier estimate for death from any cause (Panel C), and the cumulative incidence of hospitalization for heart failure (Panel D) in the pooled empagliflozin group and the placebo group among patients who received at least one dose of a study drug. Hazard ratios are based on Cox regression analyses.

n engl j med 373;22 nejm.org November 26, 2015

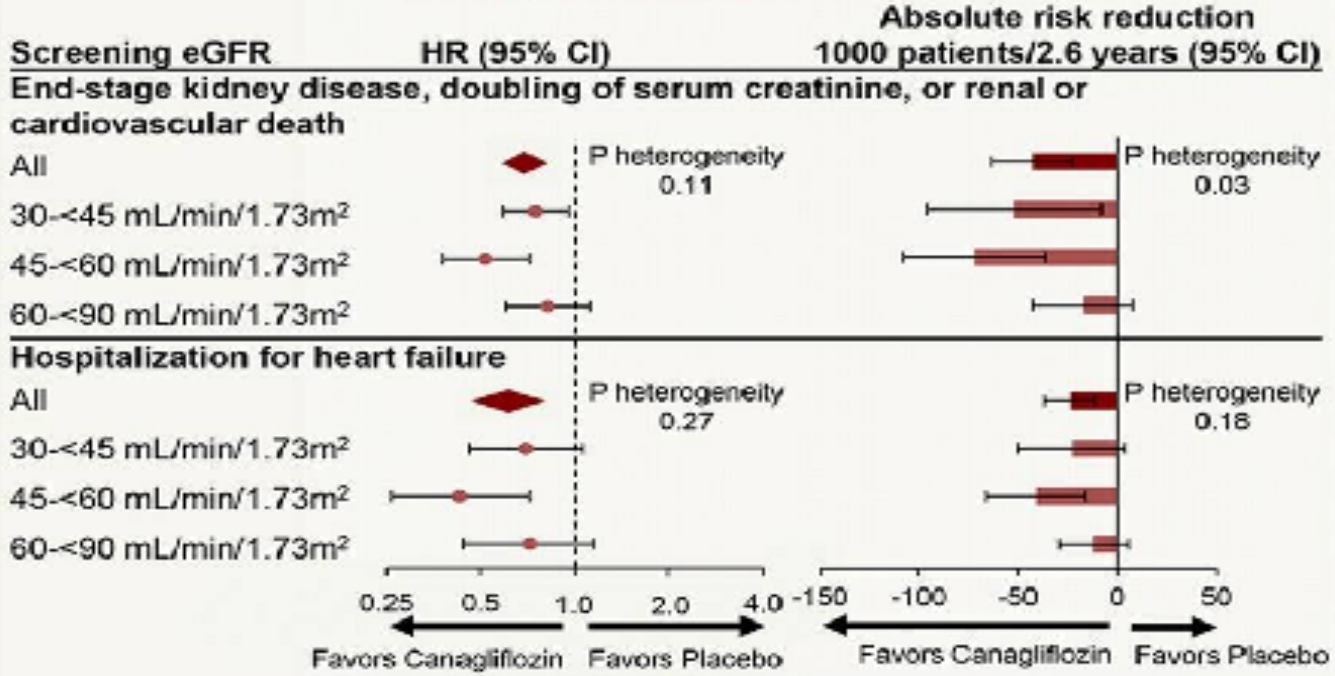
Renal, Cardiovascular, and Safety Outcomes of Canagliflozin By Baseline Kidney Function: Post hoc Secondary Analysis of the CREDENCE Randomized Trial

METHODS

4401 participants with T2DM and screening eGFR 30-<90 mL/min/1.73m²



Effect of Canagliflozin on Kidney and Cardiovascular Outcomes

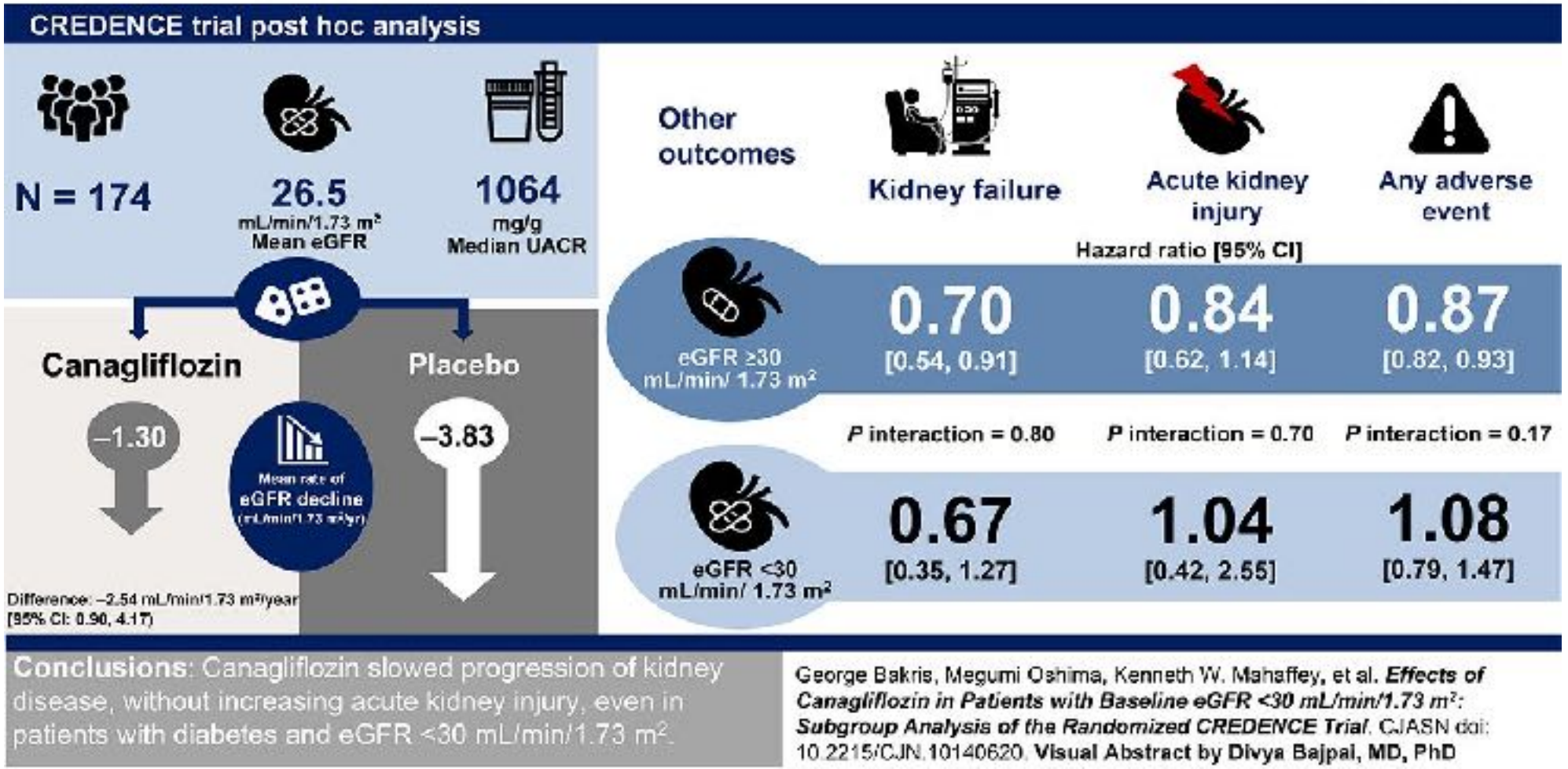


CONCLUSION In CREDENCE, canagliflozin safely reduced the risk of renal and cardiovascular events with consistent results across eGFR subgroups, including those initiating treatment with eGFR 30-<45 mL/min/1.73m². Absolute benefits for renal outcomes were greatest in lower initial eGFR subgroups.

doi: 10.1681/ASN.2019111168

JASN

What are the effects of canagliflozin in patients with type 2 diabetes and baseline eGFR <30mL/min/1.73m²?



Conclusions: Canagliflozin slowed progression of kidney disease, without increasing acute kidney injury, even in patients with diabetes and eGFR <30 mL/min/1.73 m².

George Bakris, Megumi Oshima, Kenneth W. Mahaffey, et al. ***Effects of Canagliflozin in Patients with Baseline eGFR <30 mL/min/1.73 m²: Subgroup Analysis of the Randomized CREDENCE Trial***. CJASN doi: 10.2215/CJN.10140620. **Visual Abstract by Divya Bajpai, MD, PhD**

George Bakris et al. CJASN 2020;15:1705-1714

			Primary outcome		Kidney outcomes		
Drug	**Trial**	**Kidney-related eligibility criteria**	**Primary outcome**	**Effect on primary outcome**	**Effect on albuminuria or albuminuria-containing composite outcome**	**Effect on GFR loss[a]**	**Adverse effects**
SGLT2 inhibitors							
Empagliflozin	EMPA-REG OUTCOME	eGFR ≥30 ml/min per 1.73 m^2	MACE	↓	⇊	⇊	Genital mycotic infections, DKA
Canagliflozin	CANVAS trials	eGFR ≥30 ml/min per 1.73 m^2	MACE	↓	⇊	⇊	Genital mycotic infections, DKA, amputation
	CREDENCE	ACR >300 mg/g [30 mg/mmol] and eGFR 30–90 ml/min per 1.73 m^2	Progression of CKD[b]	⇊	⇊	⇊	Genital mycotic infections, DKA
Dapagliflozin	DECLARE-TIMI 58	CrCl ≥60 ml/min	Dual primary outcomes: MACE and the composite of hospitalization for heart failure or CV death[c]	↔/↓	↓	⇊	Genital mycotic infections, DKA

Kidney International (2020) 98, S1–S115

			Primary outcome		Kidney outcomes		
Drug	Trial	Kidney-related eligibility criteria	Primary outcome	Effect on primary outcome	Effect on albuminuria or albuminuria-containing composite outcome	Effect on GFR loss[a]	Adverse effects
GLP-1 receptor agonists							
Lixisenatide	ELIXA	eGFR ≥30 ml/min per 1.73 m^2	MACE	↔	↓	↔	None notable
Liraglutide	LEADER	eGFR ≥15 ml/min per 1.73 m^2	MACE	↓	↓	↔	GI
Semaglutide[d]	SUSTAIN-6	Patients treated with dialysis excluded	MACE	↓	↓↓	NA	GI
	PIONEER 6	eGFR ≥30 ml/min per 1.73 m^2	MACE	↔	NA	NA	GI
Exenatide	EXSCEL	eGFR ≥30 ml/min per 1.73 m^2	MACE	↔	↔	↔	None notable
Albiglutide	HARMONY	eGFR ≥30 ml/min per 1.73 m^2	MACE	↓	↔	NA	Injection site reactions
Dulaglutide	REWIND	eGFR ≥15 ml/min per 1.73 m^2	MACE	↓	↓	↓	GI

Kidney International (2020) 98, S1–S115

			Primary outcome		Kidney outcomes		
Drug	Trial	Kidney-related eligibility criteria	Primary outcome	Effect on primary outcome	Effect on albuminuria or albuminuria-containing composite outcome	Effect on GFR loss[a]	Adverse effects
DPP-4 inhibitors							
Saxagliptin	SAVOR-TIMI 53	eGFR ≥15 ml/min per 1.73 m²	MACE	↔	↓	↔	HF; any hypoglycemic event (minor and major) also more common
Alogliptin	EXAMINE	Patients treated with dialysis excluded	MACE	↔	NA	NA	None notable
Sitagliptin	TECOS	eGFR ≥30 ml/min per 1.73 m²	MACE	↔	NA	NA	None notable
Linagliptin	CARMELINA	eGFR ≥15 ml/min per 1.73 m²	Progression of CKD[b]	↔	↓	↔	None notable

Kidney International (2020) 98, S1–S115

Recommendations for SGLT2i versus GLP-1 RA on the basis of kidney failure risk stratification.

eGFR	UACR <30 mg/g	UACR 30–299 mg/g	UACR ≥300 mg/g
>60 ml/min per 1.73 m²	SGLT2i or GLP-1 RA[a]	SGLT2i is preferred. GLP-1 RA as an alternative if SGLT2i is contraindicated or not tolerated, and as an add-on for uncontrolled metabolic risk[b]	SGLT2i should be initiated. GLP-1 RA as an add-on for uncontrolled metabolic risk[c]
30–60 ml/min per 1.73 m²	SGLT2i is preferred. GLP-1 RA as an alternative if SGLT2i is contraindicated or not tolerated, and as an add-on for uncontrolled metabolic risk[b]		SGLT2i should be initiated. GLP-1 RA as an add-on for uncontrolled metabolic risk[c]
15–29 ml/min per 1.73 m²	GLP-1 RA (dulaglutide) is preferred. Initiation of SGLT2i is currently contraindicated[d]		

SGLT2i, sodium glucose co transporter 2 inhibitor; GLP-1 RA, glucagon like peptide 1 receptor agonist; UACR, urinary albumin to creatinine ratio.
[a]In patients with low kidney failure risk, SGLT2i and GLP1-RA are similar in preventing worsening albuminuria. Consider SGLT2i if patients have a high risk for heart failure hospitalization. Consider GLP-1 RA if patients have uncontrolled metabolic risks.
[b]In patients with moderate kidney failure risk and adequate eGFR >30 ml/min per 1.73 m², SGLT2i is preferred. Consider adding GLP-1 RA for uncontrolled metabolic risks.
[c]In patients with high kidney failure risk and adequate eGFR >30 ml/min per 1.73 m², SGLT2i is preferred. Consider adding GLP-1 RA for uncontrolled metabolic risks.
[d]In patients with high kidney failure risk but eGFR is <30 ml/min per 1.73 m², GLP-1 RA (dulaglutide) is recommended for safer glycemic control and potential kidney protection. Currently, the data to support the use of SGLT2i for kidney failure prevention in eGFR <30 ml/min per 1.73 m² are lacking.

Jiahua Li et al. CJASN 2020;15:1678-1688

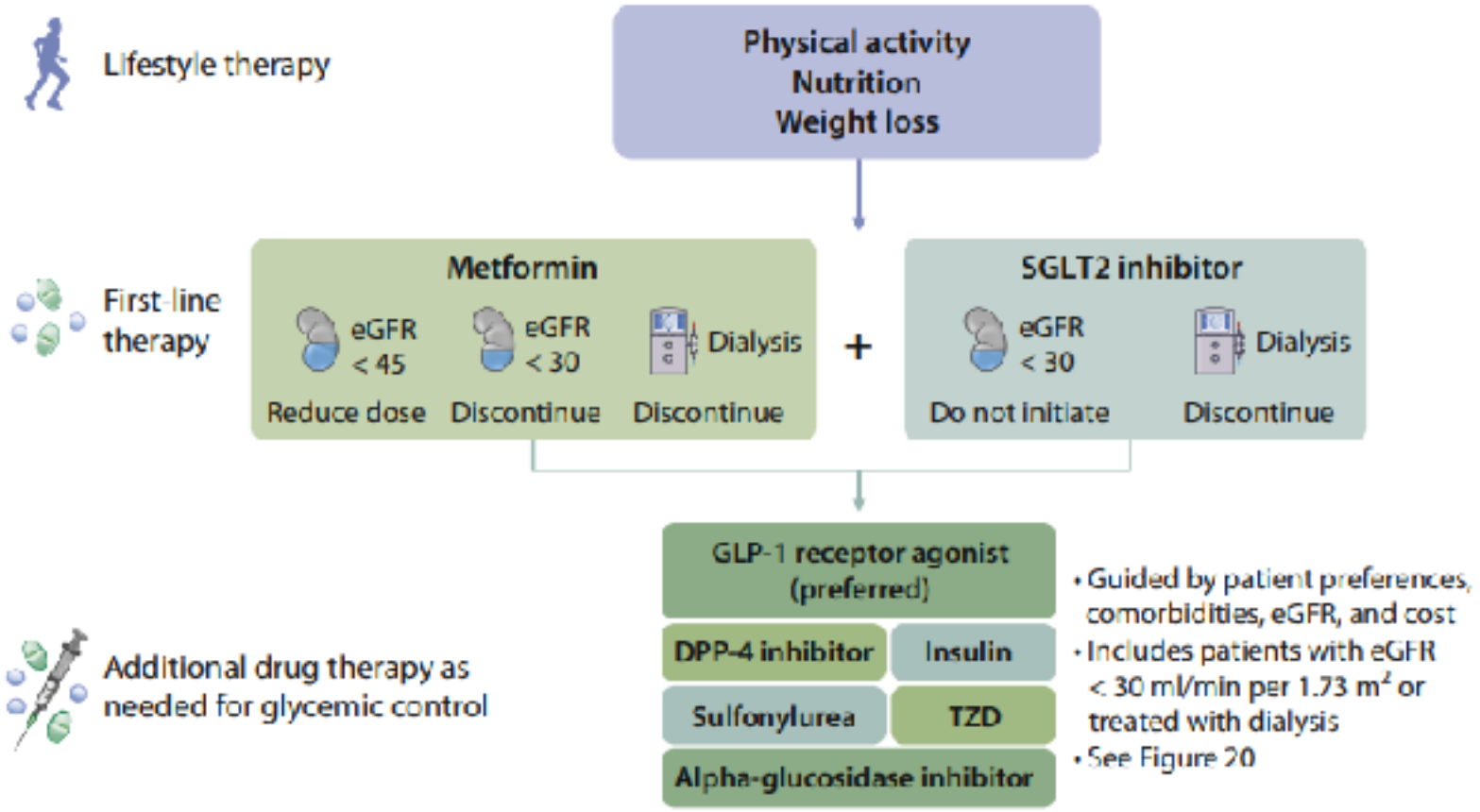


Figure 18 | Treatment algorithm for selecting antihyperglycemic drugs for patients with T2D and CKD. Kidney icon indicates estimated glomerular filtration rate (eGFR; ml/min per 1.73 m^2); dialysis machine icon indicates dialysis. CKD, chronic kidney disease; DPP-4, dipeptidyl peptidase-4; GLP-1, glucagon-like peptide-1; SGLT2, sodium–glucose cotransporter-2; T2D, type 2 diabetes; TZD, thiazolidinedione.

Kidney International (2020) 98, S1–S115

When to consider other causes for CKD

- Absence of diabetic retinopathy
- Low or rapidly decreasing GFR
- Rapidly increasing proteinuria or nephrotic syndrome
- Refractory hypertension
- Presence of active urinary sediment
- Signs or symptoms of other systemic disease
- >30% reduction in GFR within 2-3 months after initiation of an ACE inhibitor or ARB.

CKD and HTN in Primary Care

Pretest Question A

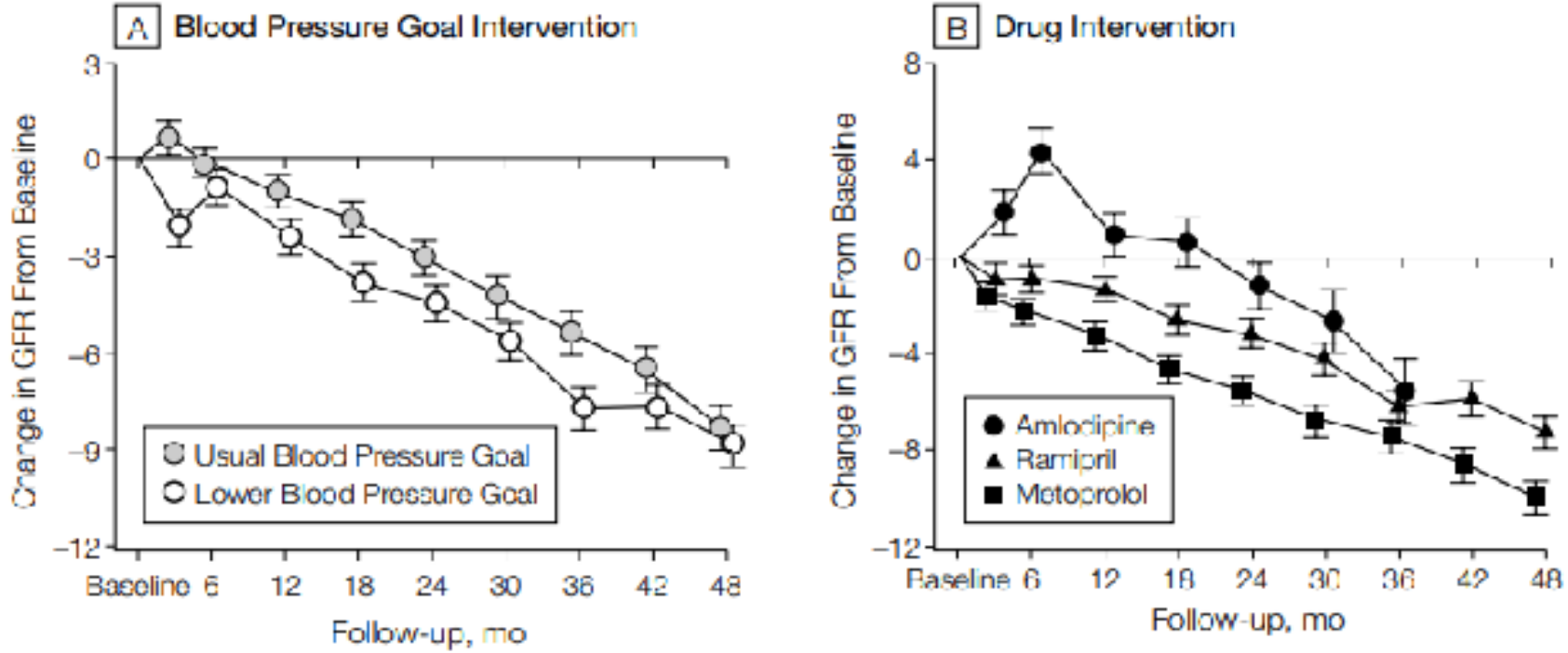
- 72-year-old male with CKD stage 3a eGFR 54ml/min/1.73m2 related to long standing HTN and Coronary artery disease presents to office. Her albuminuria is 35mg/g. His BP measures 3 times after 5 minutes of rest is an average of 148/72mmHg. He takes amlodipine 5mg and losartan 25mg daily. His PCP targets a SBP < 120 and increases amlodipine to 10mg daily and adds Chlorthalidone 25mg.
- At 3 month follow up, patient feels well, and BP (average of 3 readings) is 118/65mmhg. eGFR has dropped to 49ml/min/1.73m2

The best evidence-based care at this point is

1. The change in BP is consistent with international guidelines for CKD and no medication changes are needed.
2. The decline in eGFR is concerning and posses a greater risk for future need for dialysis. The medications changes should be reversed to prior regimen.
3. Office blood pressure are unreliable, the blood pressure is too low and medication changes should be reversed.

AASK Trial :1094 African Americans aged 18 to 70 years with hypertensive renal disease (GFR, 20-65 mL/min per 1.73 m2)

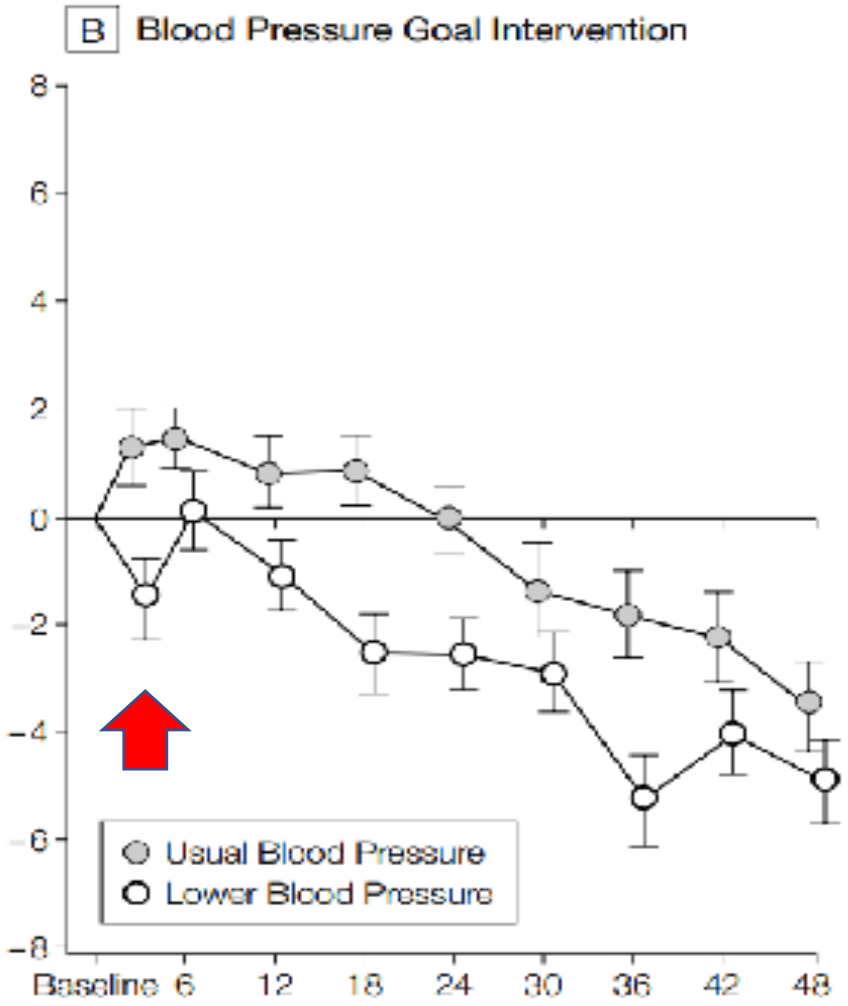
Figure 2. Mean Change in Glomerular Filtration Rate by Randomized Group



Shown are the estimated mean changes (SE) in glomerular filtration rate (GFR) (mL/min per 1.73 m^2) from baseline through follow-up in the 2 blood pressure goal interventions (A) and in the 3 drug interventions (B). The plot is based on a multislope generalization of the 2-slope mixed-effects model in which different mean slopes are estimated within each treatment group for each interval between scheduled GFR measurements. Numbers of patients with GFRs at years 0, 1, 2, 3, 4, and 5 in all treatment groups combined were 1091, 953, 837, 731, 469, and 262, respectively.

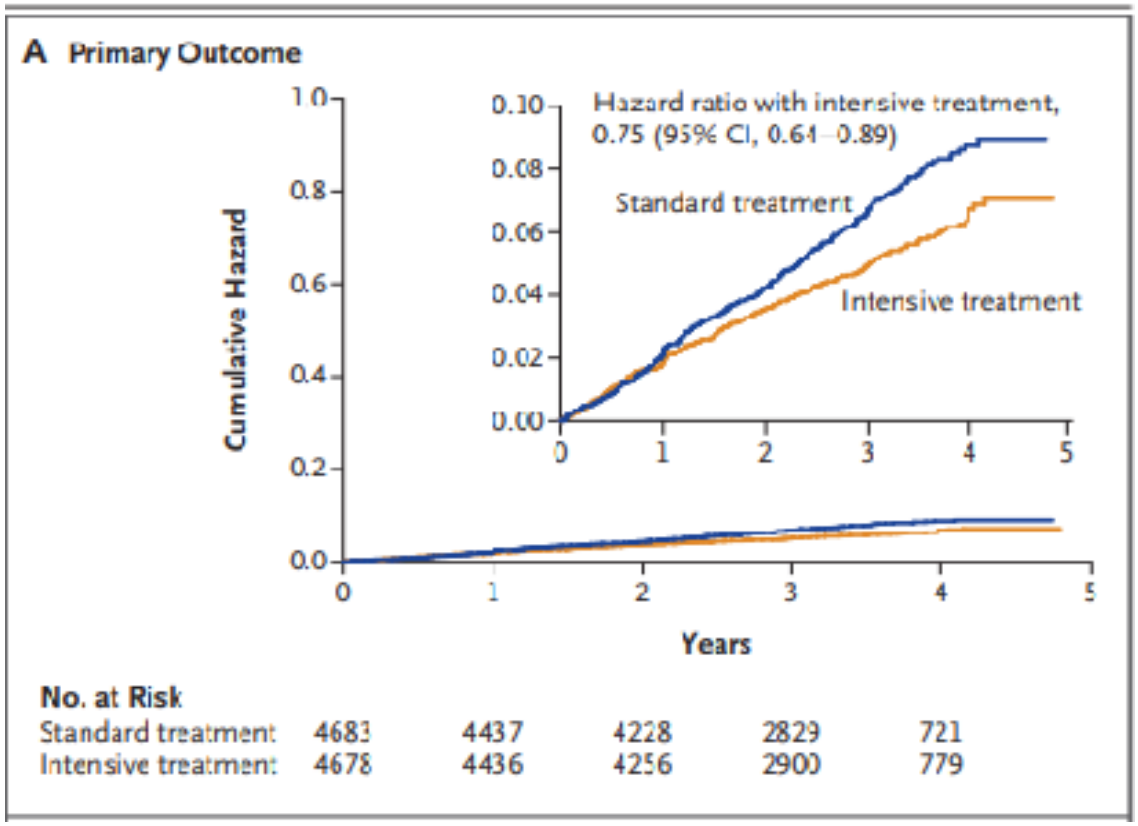
JAMA, November 20, 2002—Vol 288, No. 19

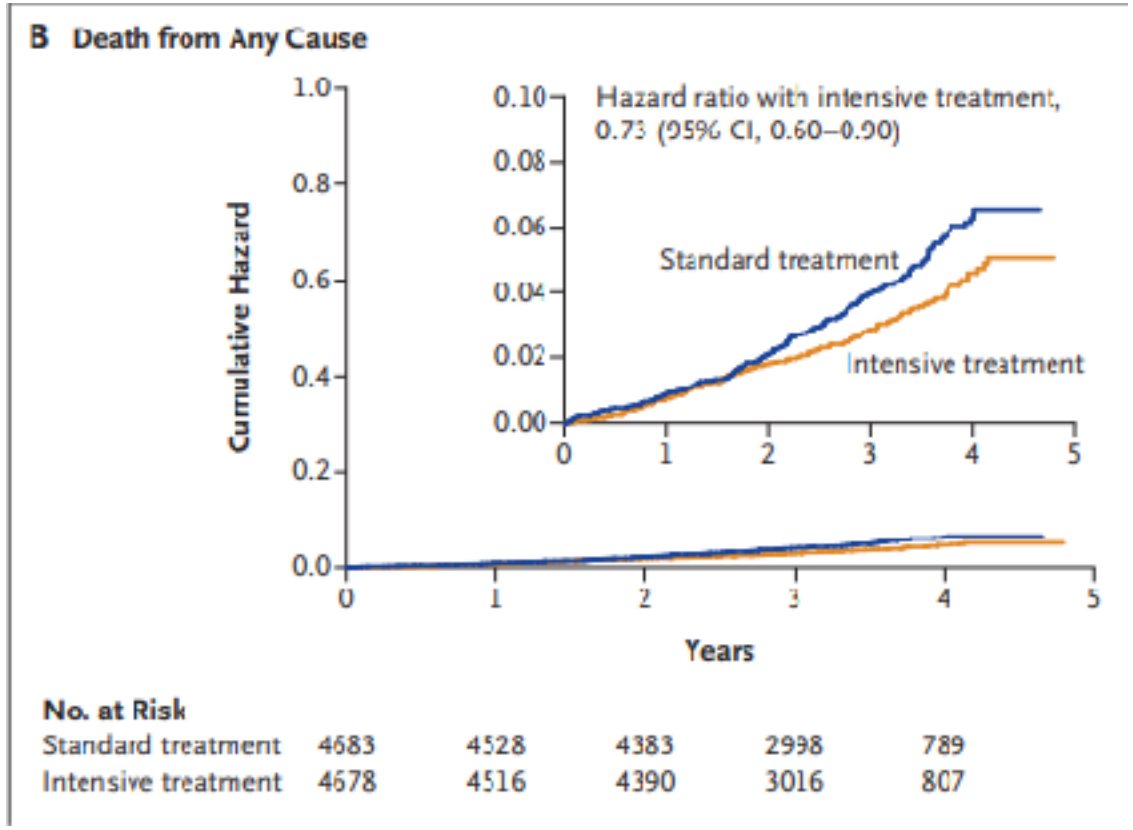
AASK Trial : Standard BP arm vs lower BP



JAMA, November 20, 2002—Vol 288, No. 19

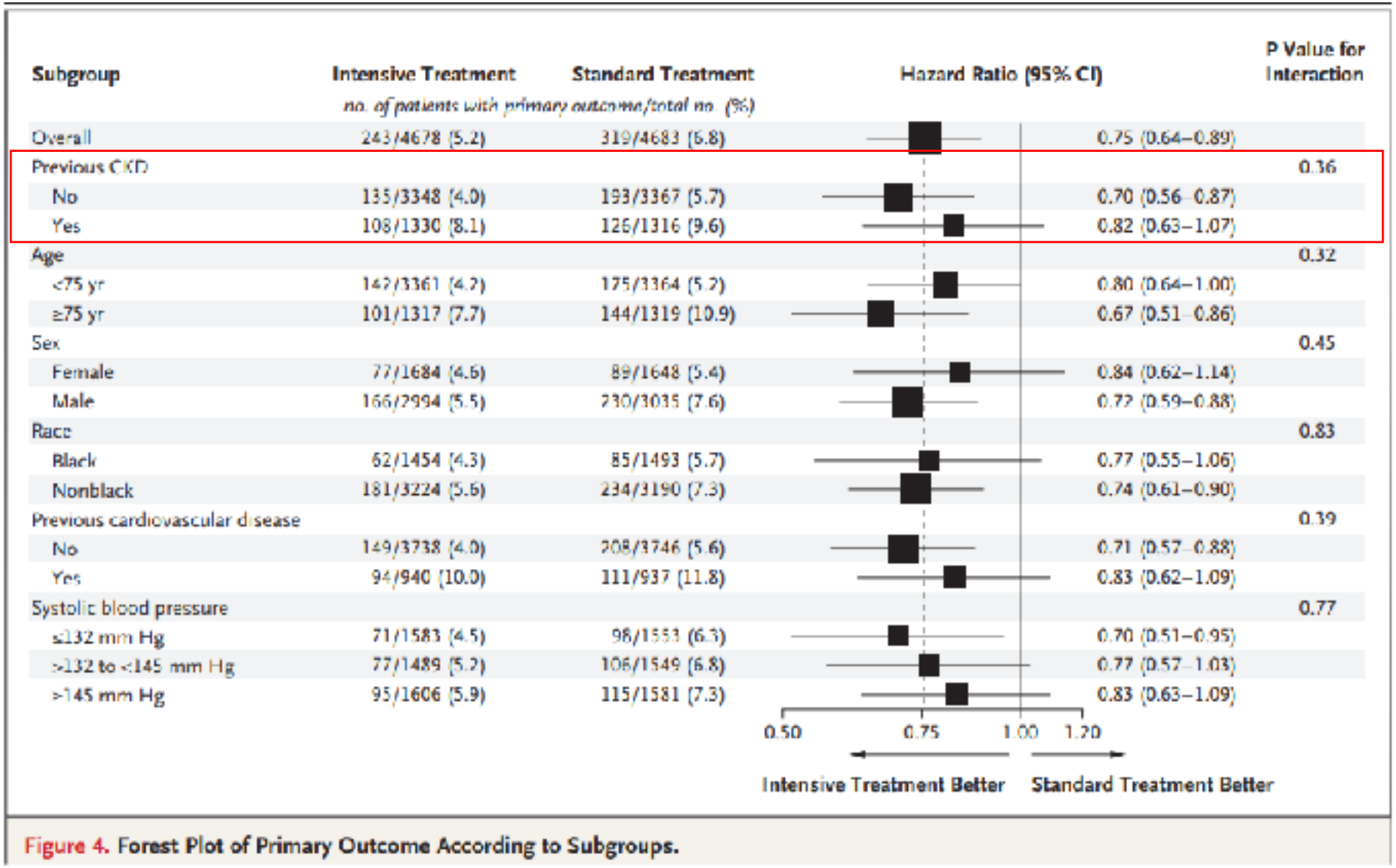
SPRINT TRIAL: Overall substantial reduction of Cardiovascular events





n engl j med 373;22 November 26, 2015

Primary Outcome in SPRINT

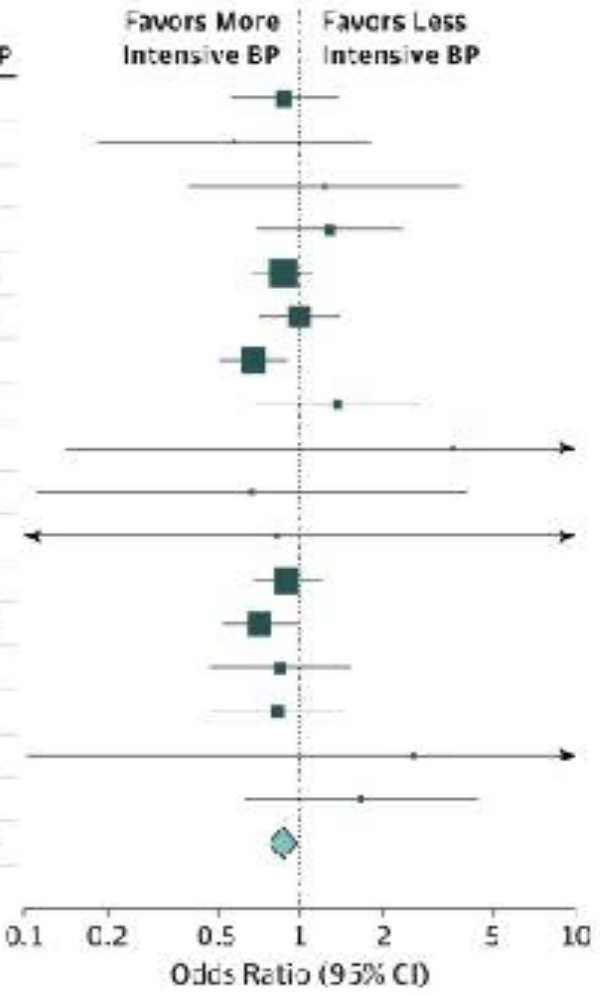


Subgroup	Intensive Treatment	Standard Treatment	Hazard Ratio (95% CI)	P Value for Interaction
	no. of patients with primary outcome/total no. (%)			
Overall	243/4678 (5.2)	319/4683 (6.8)	0.75 (0.64–0.89)	
Previous CKD				0.36
No	135/3348 (4.0)	193/3367 (5.7)	0.70 (0.56–0.87)	
Yes	108/1330 (8.1)	126/1316 (9.6)	0.82 (0.63–1.07)	
Age				0.32
<75 yr	142/3361 (4.2)	175/3364 (5.2)	0.80 (0.64–1.00)	
≥75 yr	101/1317 (7.7)	144/1319 (10.9)	0.67 (0.51–0.86)	
Sex				0.45
Female	77/1684 (4.6)	89/1648 (5.4)	0.84 (0.62–1.14)	
Male	166/2994 (5.5)	230/3035 (7.6)	0.72 (0.59–0.88)	
Race				0.83
Black	62/1454 (4.3)	85/1493 (5.7)	0.77 (0.55–1.06)	
Nonblack	181/3224 (5.6)	234/3190 (7.3)	0.74 (0.61–0.90)	
Previous cardiovascular disease				0.39
No	149/3738 (4.0)	208/3746 (5.6)	0.71 (0.57–0.88)	
Yes	94/940 (10.0)	111/937 (11.8)	0.83 (0.62–1.09)	
Systolic blood pressure				0.77
≤132 mm Hg	71/1583 (4.5)	98/1553 (6.3)	0.70 (0.51–0.95)	
>132 to <145 mm Hg	77/1489 (5.2)	106/1549 (6.8)	0.77 (0.57–1.03)	
≥145 mm Hg	95/1606 (5.9)	115/1581 (7.3)	0.83 (0.63–1.09)	

Figure 4. Forest Plot of Primary Outcome According to Subgroups.

Effect of Intensive BP lowering on Risk of Mortality in CKD

Source	Odds Ratio (95% CI)	Score	No. of Deaths/Total No. More Intensive BP	No. of Deaths/Total No. Less Intensive BP	P Value
Wright et al,[14] 2002	0.874 (0.554-1.380)	-0.578	37/540	43/554	.55
Estacio et al,[24] 2000	0.575 (0.182-1.820)	-0.941	5/62	9/68	.35
Schrier et al,[26] 2002	1.227 (0.398-3.865)	0.349	6/57	7/80	.73
Cushman et al,[31] 2010	1.271 (0.685-2.360)	0.761	26/208	20/198	.45
Heerspink et al,[27] 2010	0.862 (0.662-1.123)	-1.102	117/1010	135/1023	.27
Lonn et al,[37] 2016	0.993 (0.699-1.410)	-0.039	49/1220	97/2389	.97
Beckett et al,[30] 2008	0.676 (0.502-0.911)	-2.570	83/783	121/816	.01
Klahr et al,[13] 1994	1.366 (0.681-2.742)	0.878	20/432	14/408	.38
Mant et al,[34] 2016	3.588 (0.140-91.945)	0.772	1/26	0/30	.44
Ruggenenti et al,[22] 2005	0.667 (0.110-4.042)	-0.441	2/167	3/168	.65
Schrier et al,[45] 2002	0.825 (0.050-13.701)	-0.134	1/41	1/34	.89
SHEP Cooperative Research Group,[28] 1991	0.900 (0.670-1.209)	-0.700	95/879	103/859	.48
Wright et al,[17] 2015	0.714 (0.519-0.982)	-2.072	70/1330	95/1316	.04
Benavente et al,[33] 2013	0.850 (0.468-1.544)	-0.534	24/216	25/195	.59
Staessen et al,[29] 1997	0.826 (0.470-1.451)	-0.665	25/242	29/228	.51
Toto et al,[23] 1995	2.566 (0.101-64.993)	0.572	1/42	0/35	.57
UK Prospective Diabetes Study Group,[35] 1998	1.667 (0.626-4.435)	1.023	20/68	7/35	.31
Overall	0.859 (0.764-0.965)	-2.560	584/7451	709/8473	.01
Heterogeneity: $\tau^2 = 0\%$, $P = .77$; $I^2 = 0\%$					

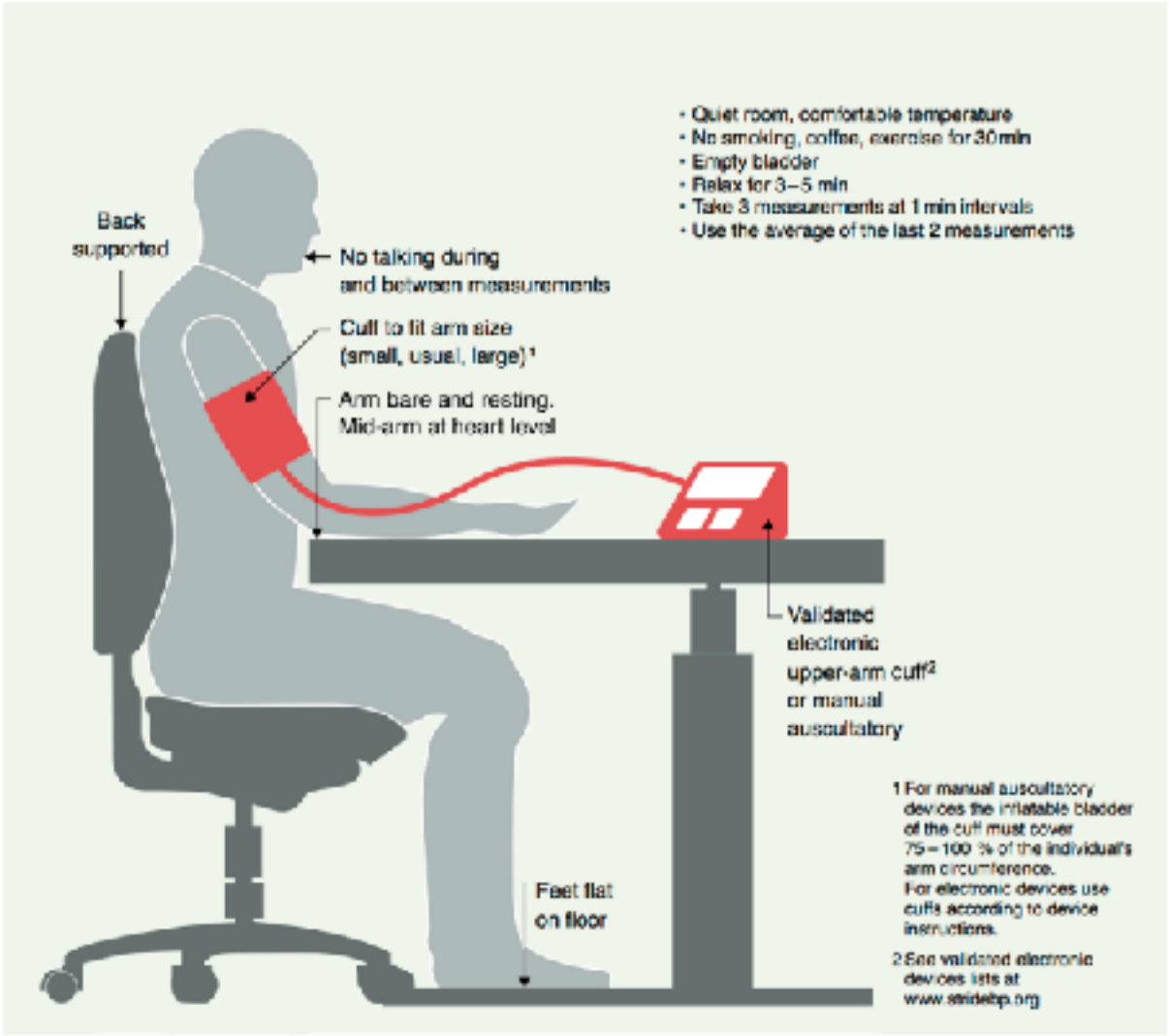


JAMA Intern Med. 2017 Oct; 177

Hazard ratio 0.86

Critical to take BP measurements by AHA protocol

- Rest for 5 minutes
- Feet on the floor
- Appropriate cuff size
- Arm at heart level
- 3 measurements at 1-minute intervals



kidney INTERNATIONAL

VOL 99 | ISSUE 3S | MARCH 2021

KDIGO 2021 Clinical Practice Guideline for the Management of Blood Pressure in Chronic Kidney Disease

Kidney Disease: Improving Global Outcomes (KDIGO) Blood Pressure Work Group OPEN

Recommendation 1.1: We recommend standardized office BP measurement in preference to routine office BP measurement for the management of high BP in adults *(1B)*.

Recommendation 1.2: We suggest that out-of-office BP measurements with ambulatory BP monitoring (ABPM) or home BP monitoring (HBPM) be used to complement standardized office BP readings for the management of high BP *(2B)*.

Recommendation 3.1.1: We suggest that adults with high BP and CKD be treated with a target systolic blood pressure (SBP) of <120 mm Hg, when tolerated, using standardized office BP measurement (*2B*).

KDIGO recommendations for CKD management – Summary

1. BP and RAAS blockade - *first line in CKD , CV benefits outweighs eGFR decrease. Standardized BP is key.*
2. CKD and AKI risk – *mindful of medication and dose adjustments*
3. Protein intake – *0.8mg/ kg/day reduced protein intake, eGFR <30*
4. Glycemic control – *Target A1c <7, SGLT2 inhibitors , GLP-1 RA*

5. Salt intake – *2g sodium restriction / day*

6. Hyperuricemia – *insufficient evidence to make recommendation to treat*

7. Lifestyle –*physical activity goal 30mins or more 5 times a week*

8. Additional dietary advice – *phosphate, potassium restriction if indicated*

9. Medication management in CKD – *take eGFR into account when prescribing.*

Referral for Specialist Kidney care

- AKI or abrupt sustained fall in GFR
- GFR <30 ml/min/1.73 m2 (GFR categories G4-G5)
- Significant albuminuria (ACR >300 mg/g or approximately equivalent to PCR >500 mg/g
- Progression of CKD
- Urinary red cell casts, RBC >20 per high power field sustained and not readily explained
- CKD and hypertension refractory to treatment with 4 or more antihypertensive agents
- Persistent abnormalities of serum potassium; recurrent or extensive nephrolithiasis; hereditary kidney disease

Thank you

Questions?