TMF QIN-QIO Program Campaign for Kidney Health Slide

A Guide to Detecting and Delaying Chronic Kidney Disease

September 6, 2018

This material was prepared by TMF Health Quality Institute, the Medicare Quality Innovation Network Quality Improvement Organization, under contract with the Centers for Medicare & Medicaid Services (CMS), an agency of the U.S. Department of Health and Human Services. The contents do not necessarily reflect CMS policy. 11SOW-QINQIO-CKD-18-45 Published 07/2018

About the TMF QIN-QIO Program

- The TMF Quality Innovation Network Quality Improvement Organization (QIN-QIO) is leading a Chronic Kidney Disease Special Innovation Project, under contract with the Centers for Medicare & Medicaid Services (CMS), to promote the early diagnosis and treatment of chronic kidney disease through an integrated, systemic approach. The goal is to increase timely screening and appropriate treatment among primary care practices and to empower at-risk patients to seek screening for chronic kidney disease.
  - The TMF QIN-QIO has teamed up with national partners to align subject matter experts, resources and tools to support providers, educators and community partners.
  - This project will engage primary care physician practices in Arkansas, Missouri, Oklahoma and Texas, specifically practices in rural areas and medically underserved communities. The TMF QIN-QIO will also involve community stakeholders and at-risk patients.

TMF QIN-QIO LAN Website

- Provides targeted technical assistance and will engage providers and stakeholders in improvement initiatives through numerous Learning and Action Networks (LANs).
- The networks serve as information hubs to monitor data, engage relevant organizations, facilitate learning and sharing of best practices, reduce disparities and elevate the voice of the patient.

Join the TMF QIN-QIO Website

- To join, create a free account at http://www.TMFQIN.org/. Visit the Networks tab for more information.
- As you complete registration, you will be prompted to choose the network(s) you would like to join. You can select any of the TMFQIN networks available.
- For CKD SIP project, select **Health for Life – Everyone with Diabetes Counts,** Campaign for Kidney Health.

Housekeeping Items

- **Conference recordings**
  - A recording of the conference presentation will be available at www.TMFQIN.org in about two weeks and will be located on the Health for Life, Campaign for Kidney Health Network recorded events page.
- **Phone lines**
  - Phone lines are muted during the presentation. You will be instructed on how to ask questions on the phone for the question and answer sessions.
- **Online chat**
  - If you have a question or comment during the presentation, please submit your questions/comments via the chat feature on WebEx. Your questions will be read to the speaker during the Q&A period, time permitting.

Housekeeping Items, 2

- **Conference presentations**
  - All registrants should have received an email with information about today's event, including a link to complete a pre-assessment prior to today's presentation.
  - After today's presentation, you will receive a thank you email, via WebEx, with a link to complete the post-assessment. Upon submission of the post-assessment you will automatically be directed to the CE claims.

Disclosure to Participants

TMF Health Quality Institute

- **Approval Statements**
  - This continuing nursing education activity was approved by the Texas Nurses Association – Approver, an accredited approver with distinction, by the American Nurses Credentialing Center's Commission on Accreditation.
  - TMF Health Quality Institute is accredited by the Texas Medical Association to provide continuing medical education (CME) for physicians.
  - TMF Health Quality Institute designates this live activity for a maximum of 1.5 *AMA PRA Category 1 Credit(s)™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.
  - TMF Health Quality Institute designates this CME activity for a maximum of 1.5 2A credits for Osteopathic physicians (DOs).
  - This CME activity has been designated by TMF Health Quality Institute for a maximum of 1.5 hours of education in medical ethics and/or professional responsibility.

Disclosure to Participants, 2

A Guide to Detecting and Delaying Progress of Chronic Kidney Disease

- **Requirements for Successful Completion**
  - To receive contact hours for this continuing education activity, the participant must:
    - Attend the session in its entirety to be eligible for continuing education credit for that session.
    - Complete the online claims process providing a unique identifier (birth day and month).
    - Complete and submit the online Educational Activity Evaluation Form for each session attended.

  Once successful completion has been verified, a "Certificate of Successful Completion" will be awarded for 1.5 contact hours.

Disclosure to Participants, 3

- **Purpose of Education Activity**
  - The purpose of this education activity is to enhance knowledge of participating registered nurses, physicians and health care providers of the importance of identifying early stage chronic kidney disease (CKD) in the at-risk patient, and understand the screening tools used to identify early CKD and management strategies that help delay CKD progression.

Disclosure to Participants, 4

- **Learning Outcome:**
  - The professional registered nurse, physician and health care provider will have increased knowledge of identifying early stage chronic kidney disease (CKD) in the at-risk patient, knowledge of the screening tools used to identify CKD and recognize management strategies that help delay the progression of CKD.
- **Learning Objectives of this Education Activity**
  - Describe suitable screening tools, such as GFR and ACR, for proper utilization in clinical practice related to the diagnosis and monitoring of CKD.
  - Define and classify CKD, based on GFR and albuminuria categories, in order to guide appropriate treatment approaches.
  - Recognize evidence-based management strategies that will help delay CKD progression in at-risk patients and improve outcomes.

Disclosure to Participants, 5

- **Conflicts of Interest**
  - **Explanation:** A conflict of interest occurs when an individual has an opportunity to affect or impact educational content with which he or she may have a commercial interest or a potentially biasing relationship of a financial nature. All planners and presenters/authors/content reviewers must disclose the presence or absence of a conflict of interest relative to this activity. All potential conflicts are resolved prior to the planning, implementation or evaluation of the continuing education activity. All activity planning committee members and presenters/authors/content reviewers have submitted Conflict of Interest Disclosure forms.

Disclosure to Participants, 6

- **Disclosure of Relevant Financial Relationships**
  - Policies and standards of the Texas Medical Association, the Accreditation Council for Continuing Medical Education, and the American Medical Association require that speakers/authors and planners for continuing medical education activities disclose any relevant financial relationships they may have with commercial interests whose products, devices or services may be discussed in the content of a CME activity.
- **The following planners have no relevant financial relationships to disclose:**
  - Planners - Terri Watson, Brenda Ortiz, Tanya Avila
- **The following speakers have the following to disclose:**
  - Presenter: Michael Choi has reported to receive honorarium from AstraZeneca for Co-chairing the Mid-Atlantic Nephrology Young Investigators Forum – 20 fellows present research on kidney disease at a CME forum.
  - Questions & Answers/Presenter: Joseph Vassalotti, MD has reported that he has a non-speaker role with KPMG, Inc. as International Dialysis Quality Review and a consultant for Merck.

Disclosure to Participants, 7

- Commercial Support
  - TMF Health Quality Institute and National Kidney Foundation have received no commercial support.
- Joint Provider Statement:
  - This CE activity has been jointly provided by TMF Health Quality Institute collaboratively with the National Kidney Foundation.

CE Code

- A CE code will be given only once at the end of the presentation, after the Q&A with our speaker and panelist. If you are wanting to claim CEs, please do not disconnect from the call until this code has been given.
- **Friday, September 21, 2018** is the deadline to retrieve CE credits.

Introduction of Today's Presenter

- Dr. Michael Choi
  - National Kidney Foundation (NKF), President and Chair, NFK Scientific Advisory Board.
  - Associate professor of medicine at Johns Hopkins University School of Medicine.
    - Vital role in developing NKF's courses on chronic kidney disease for primary care clinicians:
      - Early diagnosis, slow progression, treat complications, offer guidance for referral to nephrologists and share renal replacement options including conservative care.

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Guide to Detecting and Delaying Progress of Chronic Kidney Disease

Michael J. Choi, MD

Disclosures:

National Kidney Foundation Board of Directors

AstraZeneca –Honorarium for organizing Nephrology Research Forum

Learning Objectives

- Describe screening tools, eGFR and ACR, for the diagnosis and monitoring of chronic kidney disease (CKD.)
- Define and classify CKD, based on GFR and albuminuria categories, to help guide appropriate treatment approaches.
- Describe how the registered nurse can play an active role in timely intervention and patient education for patients with CKD
- Recognize evidence-based management strategies that will help delay CKD progression and help improve outcomes in at-risk patients.

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Case Question 1

A 55 year-old Caucasian-American man, with a history of type 2 diabetes (15 years), hypertension (3 years) dyslipidemia (5 years) and cardiovascular disease (myocardial infarction 3 years ago). He was recently diagnosed with CKD. His most recent labs reveal an estimated glomerular filtration rate (eGFR) of 45 ml/min/1.73m^2 and a urine albumin to creatinine ratio (ACR) of 38 mg/g. Which of the following should be avoided?

A. ACE and ARB in combination
B. Daily low-dose aspirin
C. NSAIDs
D. Statins
E. A and C

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Case Question 2

All of the following adult patients should be referred for nephrology consultation, EXCEPT?

A. Initial visit: eGFR 26 & 3 months later: eGFR 28 (mL/min/1.73m^2)

B. B. Initial visit: eGFR 55, & 3 months later: eGFR 43 confirmed with repeat eGFR 45 (mL/min/1.73m^2)

C. Initial visit: ACR 450 & 3 months later: ACR 395 (mg/g) on both dates the eGFR >60 mL/min/1.73m^2

D. Initial visit: eGFR >60 & 3 months later: eGFR >60 (mL/min/1.73m^2) with personal history of Autosomal Dominant Polycystic Kidney Disease

E. Initial visit: eGFR 42 & 3 months later: eGFR 44 (mL/min/1.73m^2) on both dates the ACR <30 mg/g

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Steps to CKD Patient Care

1. Does the patient have CKD?
2. Assess GFR, albuminuria.
3. Determine etiology.
4. Assess for evidence of progression.
5. Assess for associated complications.
6. Registered nurse to provide patient education.
7. Assess life expectancy and patient wishes for dialysis/transplantation.

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Definition of Chronic Kidney Disease*

CKD is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health.

Criteria for CKD (either of the following present for >3 months)

Markers of kidney damage (one or more)	Albuminuria (AER ≥30 mg/24 hours; ACR ≥30 mg/g [≥3 mg/mmol]) Urine sediment abnormalities Electrolyte and other abnormalities due to tubular disorders Abnormalities detected by histology Structural abnormalities detected by imaging History of kidney transplantation
Decreased GFR	GFR <60 ml/min/1.73 m^2 (GFR categories G3a-G5)

*Registered nurse to provide patient education on CKD

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Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. *Kidney Int Suppls*. 2013;3:1-150.

Assign Albuminuria Category

Albuminuria Categories in CKD		
Category	ACR (mg/g)	Terms
A1	<30	Normal to mildly increased
A2	30-299	Moderately increased*
A3	≥300	Severely increased**

*Relative to young adult level. ACR 30-300 mg/g for >3 months indicates CKD.
**Including nephrotic syndrome (albumin excretion ACR >2220 mg/g).

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Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. *Kidney Int Suppls*. 2013;3:1-150.

Assign GFR Category

GFR Categories in CKD			
Category	GFR	Terms	Clinical Presentations
G1	≥90	Normal or high	Markers of kidney damage (nephrotic syndrome, nephritic syndrome, tubular syndromes, urinary tract symptoms, asymptomatic urinalysis abnormalities, asymptomatic radiologic abnormalities, hypertension due to kidney disease)
G2	60-89	Mildly decreased*	
G3a	45-59	Mildly to moderately decreased	• Mild to severe complications: o Anemia o Mineral and bone disorder ▪ Elevated parathyroid hormone o Cardiovascular disease ▪ Hypertension ▪ Lipid abnormalities o Low serum albumin
G3b	30-44	Moderately to severely decreased	
G4	15-29	Severely decreased	
G5	<15	Kidney failure	• Includes all of the above • Uremia

GFR = mL/min/1.73m^2

*Relative to young adult level

In the absence of evidence of kidney damage, neither GFR category G1 nor G2 fulfill the criteria for CKD.

Refer to a nephrologist and prepare for kidney replacement therapy when GFR <30 mL/min/1.73m^2.

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Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. *Kidney Int Suppls*. 2013;3:1-150.

Classification of CKD Based on GFR and Albuminuria Categories: "Heat Map"

CKD is classified based on:

- **Cause (C)**
- **GFR (G)**
- **Albuminuria (A)**

GFR catagproes (ml/min/1.73 m^2) 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	1 if CKD	Monitor 1	Refer* 2
	G2	Mildly decreased	60-89	1 if CKD	Monitor 1	Refer* 2
	G3a	Mildly to moderately decreased	45-59	Monitor 1	Monitor 2	Refer 3
	G3b	Moderately to severely decreased	30-44	Monitor 2	Monitor 3	Refer 3
	G4	Severely decreased	15-29	Refer* 3	Refer* 3	Refer 4+
	G5	Kidney failure	<15	Refer 4+	Refer 4+	Refer 4+

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Colors: Represents the risk for progression, morbidity and mortality by color from best to worst. Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk; Orange: high risk; Red, very high risk.
Numbers: Recommendation for number of times per year the patient should be monitored.
Refer: Indicates nephrology referral is recommended.
*Referring clinicians may wish to discuss with nephrology service on local arrangements regarding monitoring or referral.
Adapted from Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. *Kidney Int Suppls*. 2013;3:1-150.

Screening Tools: eGFR

- Considered the best overall index of kidney function.
- Normal GFR varies according to age, sex, and body size, and declines with age.
- The NKF recommends using the CKD-EPI Creatinine Equation (2009) to estimate GFR. Other useful calculators related to kidney disease include MDRD and Cockcroft-Gault.
- For GFR calculators search: GFR calculator – The National Kidney Foundation

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Summary of the MDRD Study and CKD-EPI Estimating Equations:
https://www.kidney.org/sites/default/files/docs/mdrd-study-and-ckd-epi-gfr-estimating-equations-summary-ta.pdf

eGFR, SCr Comparison

Age	Sex	Race	SCr mg/dl	eGFR ml/ min per CKD-EPI
25	M	AA	1.6	68
49	F	Hispanic	1.6	38
67	M	Asian	1.6	44
92	F	Caucasian	1.6	28

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eGFR, SCr Comparison, 2

Age	Sex	Race	SCr mg/dl	eGFR ml/ min per CKD-EPI	Weight in lbs Height in Ft/in	eGFR Adj for BSA
25	M	AA	1.6	68	285 6′	97
49	F	Hispanic	1.6	38	180 5′4″	41
67	M	Asian	1.6	44	155 5′8″	46
92	F	Caucasian	1.6	28	98 5′1″	22

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Average Measured GFR by Age in People Without CKD

Age (Years)	Average Measured GFR ($mL/min/1.73\ m^2$)
20-29	116
30-39	107
40-49	99
50-59	93
60-69	85
70+	75

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Coresh J, et al. *Am J Kidney Dis.* 2003;41(1):1-12.

Use These Equations Cautiously, if at all in….

- Patients who have/are:
  - Poor nutrition/loss of muscle mass
  - Amputation
  - Chronic illness
  - Not African American or Caucasian
  - Changing serum creatinine
  - Obese
  - Very elderly, young

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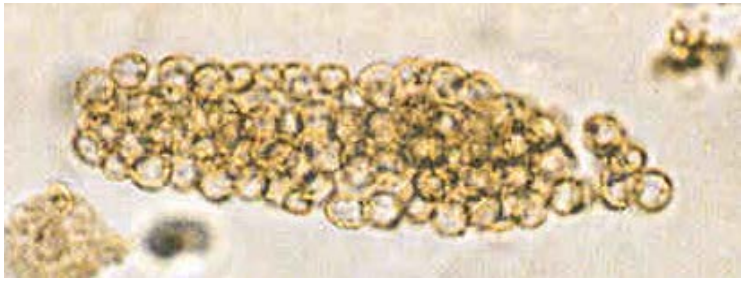
Clinical Evaluation of Patients with CKD

- Blood pressure
- HbA1c
- Serum creatinine
  - Use a GFR estimating equation or clearance measurement; don't rely on serum creatinine concentration alone.
  - Be attentive to changes in creatinine over time--even in "normal" range.
- Spot urine for protein-to-creatinine or albumin-to-creatinine ratio.
- Electrolytes, blood glucose, CBC
- Urinalysis
  - Urine sediment



Red cell cast

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Clinical Evaluation of Patients with CKD, 2

- Depending on CKD stage: albumin, phosphate, calcium, intact parathyroid hormone (iPTH)
- Depending on age and H&P
  - Free light chain assay, serum/urine protein electrophoresis (SPEP, UPEP) for monoclonal gammopathy
  - HIV, HCV, HBV tests
  - Serum complement levels (C3, C4), other serologies—if there is a specific reason
- Renal imaging - Usually ultrasound

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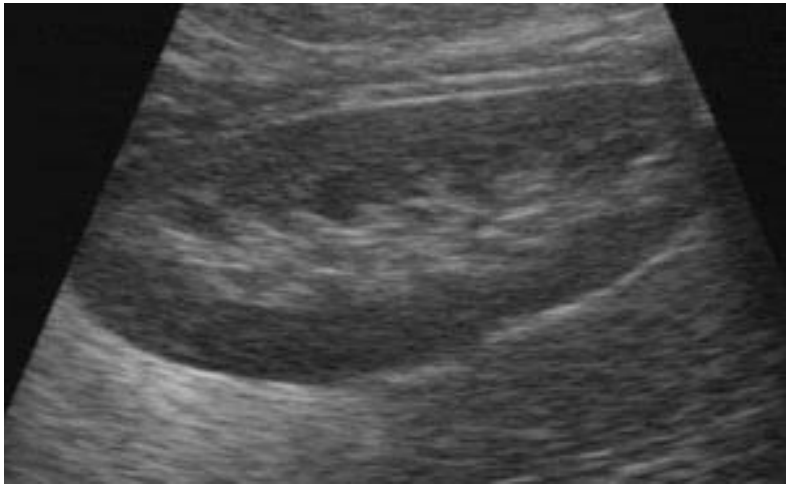
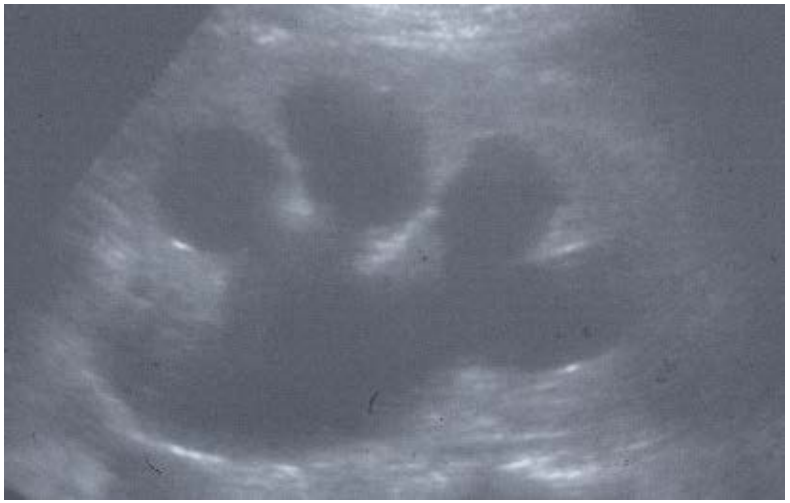
CKD or AKI from urinary obstruction

- Voiding symptoms
  - Diabetics, older men
  - anticholinergics, opiates
- Partial obstruction
  - Urine output variable
- Dx: **Ultrasound**
  - Kidney sizes normally 10-12 cm
  - < 10 cm implies CKD
- Rx: foley/nephrostomy tube





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Clinical Evaluation of Patients with CKD, 3

- Standard urine dipsticks detect total protein >30 mg/dL - not sensitive enough for "microalbuminuria" screening, especially with dilute urine.
- Untimed, random "spot" urine for albumin-to-creatinine or protein-to-creatinine ratio (first morning void preferred).

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Definitions: Albuminuria and Proteinuria

- Normal Albuminuria
  - Albumin-to-creatinine ratio <30 mg/g creatinine
- Moderately Increased Albuminuria
  - Albumin-to-creatinine ratio 30-299 mg/g creatinine
  - 24-hour urine albumin 30-300 mg/d
- Severely Increased Albuminuria
  - Albumin-to-creatinine ratio ≥300 mg albumin/g creatinine
  - 24-hour urine albumin >300 mg/d
- Proteinuria
  - (+) urine dipstick at >30 mg/dl
  - ≥200 mg protein/g creatinine
  - 24-hour urine protein >300 mg/d

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Slowing Progression of CKD

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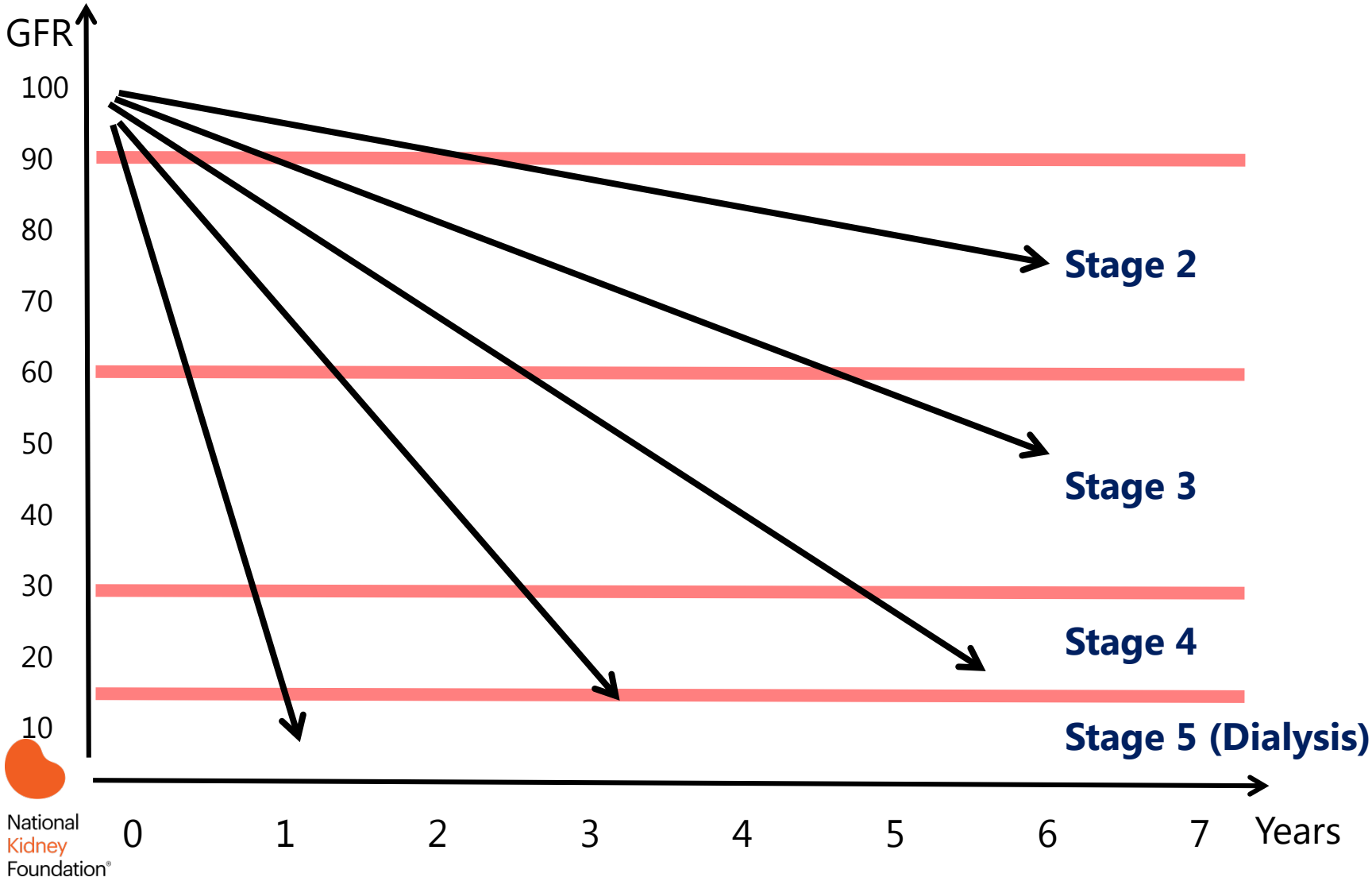
CKD- Progression of Kidney Failure Concept

Variable depending on several factors including (1) type of disease and (2) *how well it is treated*



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Blood Pressure and CKD Progression

- Control of BP more important than exactly which agents are used
  - Avoidance of side-effects is important.
- With albuminuria/proteinuria
  - : ACEi or ARB +/- diuretic
- No albuminuria/proteinuria: no clear drug preference
  - ACEi or ARB ok to use

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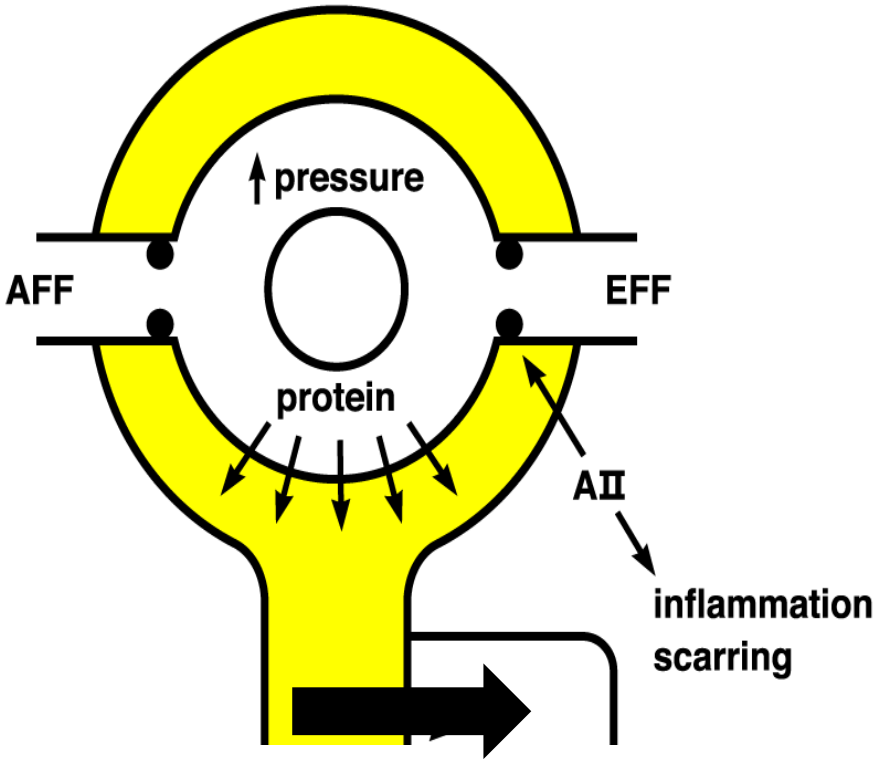
ACE inhibitor in CKD with albuminuria and HTN*



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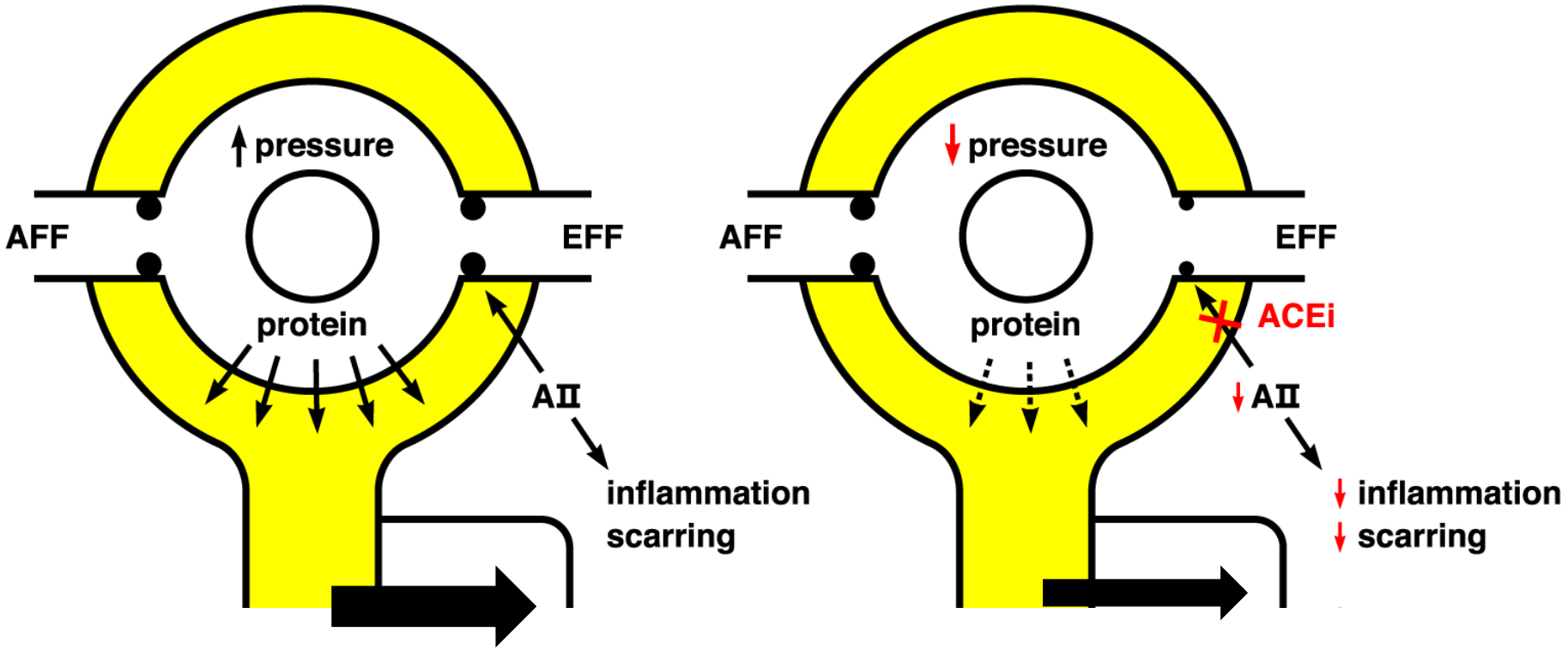
ACE inhibitor in CKD with albuminuria and HTN*, 2



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Slowing CKD Progression: ACEi/ARB

- Check labs after initiation.
  - If less than 25% SCr increase, continue and monitor.
  - If more than 25% SCr increase, stop ACEi and evaluate for renal artery stenosis (RAS).
- Continue until contraindication arises, no absolute eGFR cutoff.
- Better proteinuria suppression with low Na diet and diuretics.
- Avoid volume depletion.

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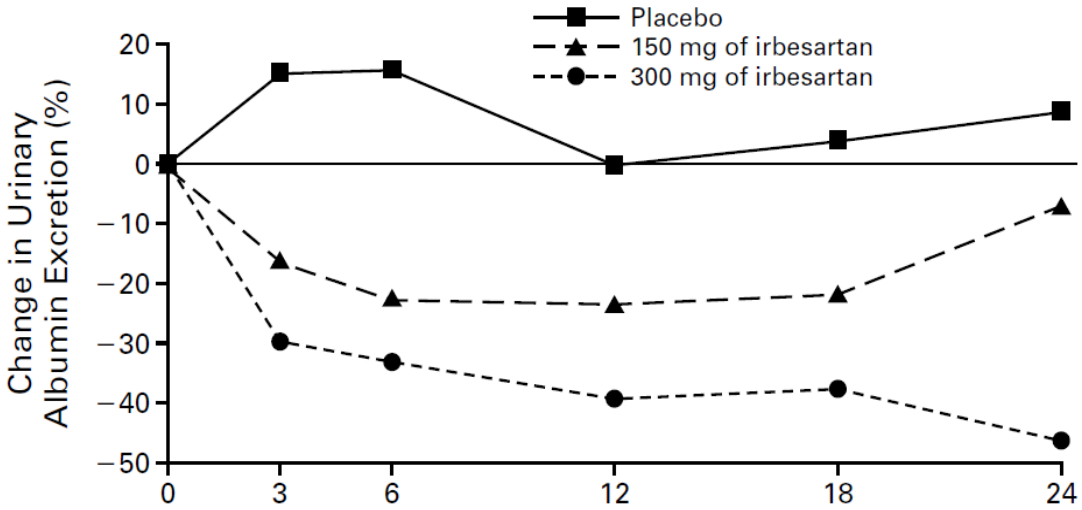
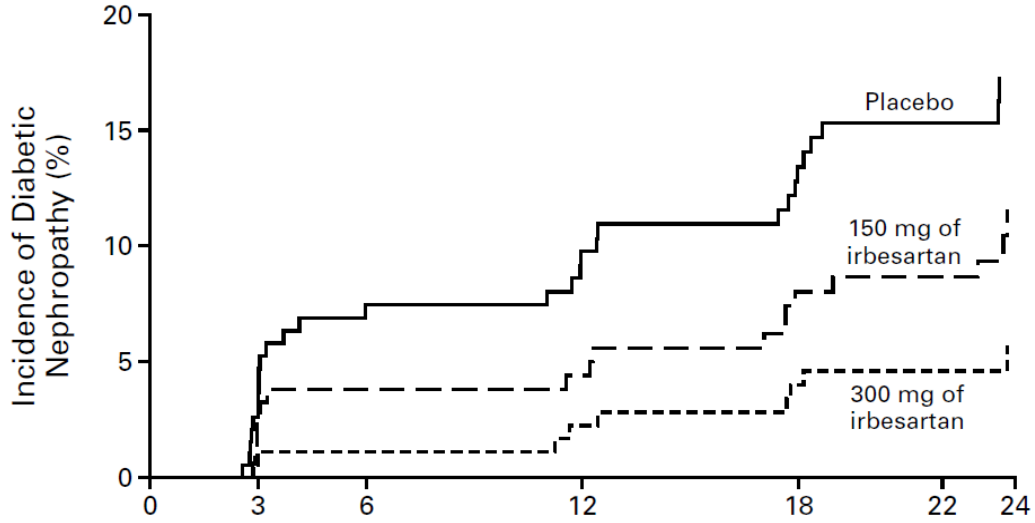
ARBs and Diabetic Nephropathy

ARB and ACEi equivalent for moderate proteinuria reduction





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Goals for Renoprotection

- Target blood pressure in non-dialysis CKD.[1]
  - Any ACR: ≤130/80 mm Hg.
  - Consider individualizing targets and agents.
- Avoid ACEi and ARB in combination.[3,4]
  - Risk of adverse events (impaired kidney function, hyperkalemia).

*Reasonable to select a goal of 140/90 mm Hg, especially for moderate albuminuria (ACR 30-300 mg/g).[2]

1) Whelton PK et al. JACC 2018:71; e127-248.
2) KDOQI Commentary on KDIGO Blood Pressure Guidelines. *Am J Kidney Dis*. 2013;62:201-213.
3) Kunz R, et al. *Ann Intern Med*. 2008;148:30-48.
4) Mann J, et al. ONTARGET study. *Lancet*. 2008;372:547-553.

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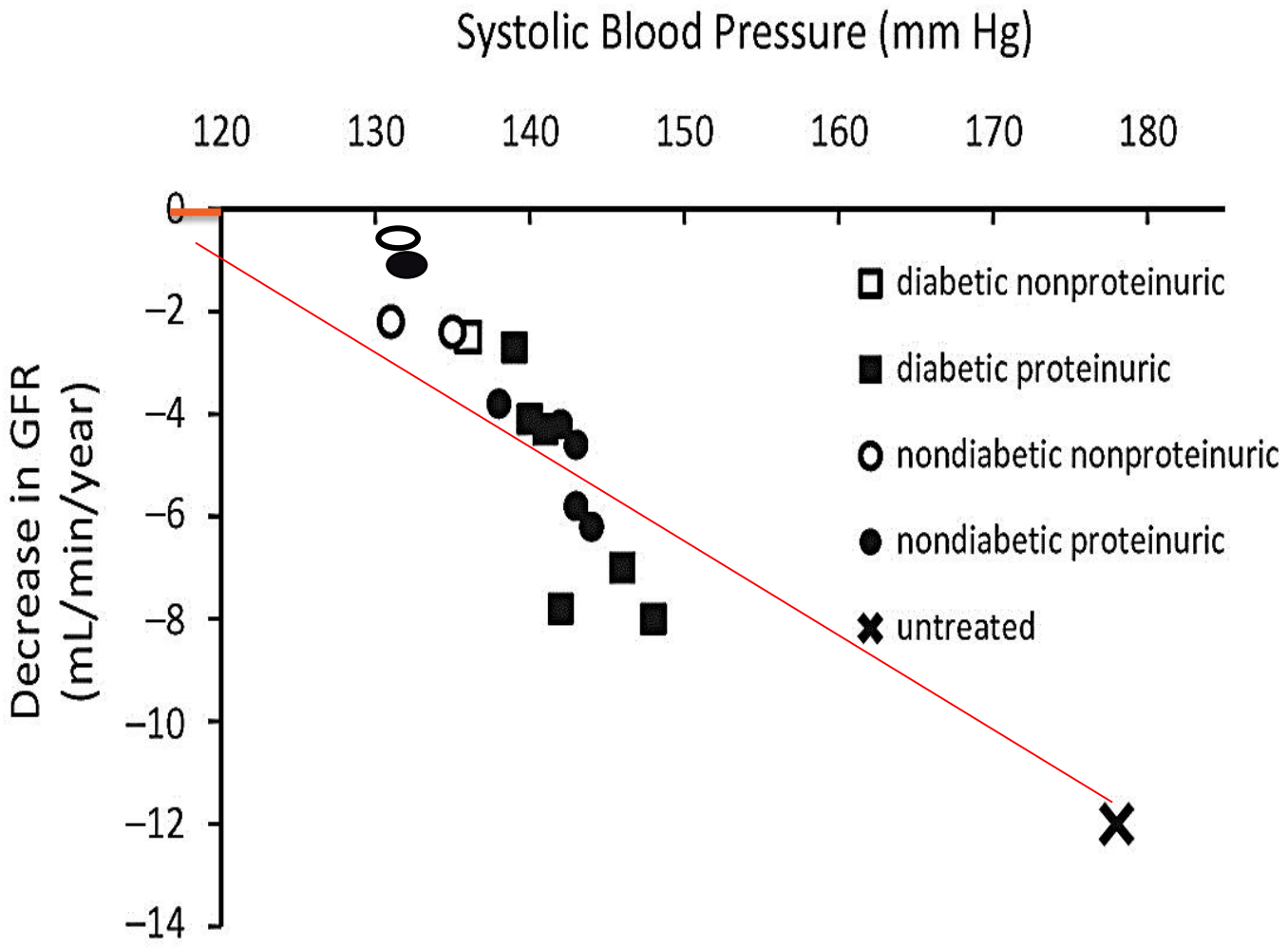
Relationship Between Achieved BP and Decline in Kidney Function from Primary Renal Endpoint Trials

Nondiabetes

MDRD. *N Engl J Med.* 1993
AIPRI. *N Engl J Med.* 1996
REIN. *Lancet.* 1997
AASK. *JAMA.* 2002
Hou FF, et al. *N Engl J Med.* 2006
Parsa A et.al. NEJM 2013

Diabetes

Captopril Trial. *N Engl J Med.* 1993
Hannadouche T, et al. *BMJ.* 1994
Bakris G, et al. *Kidney Int.* 1996
Bakris G, et al. *Hypertension.* 1997
IDNT. *NEJM.* 2001
RENAAL. *NEJM.* 2001
ABCD. *Diabetes Care (Suppl).* 2000



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Update from Kalaitzidis R and Bakris GL In: *Handbook of Chronic Kidney Disease*. Daugirdas J (Ed.) 2011.

Managing Hyperglycemia

- Hyperglycemia is a fundamental cause of vascular complications, including CKD.
- Poor glycemic control has been associated with albuminuria in type 2 diabetes.
- Risk of hypoglycemia increases as kidney function becomes impaired.
- Declining kidney function may necessitate changes to diabetes medications and renally cleared drugs.
- Target HbA1c ~7.0%.
  - Can be extended above 7.0% with comorbidities or limited life expectancy, and risk of hypoglycemia.

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NKF KDOQI. Diabetes and CKD: 2012 Update. *Am J Kidney Dis*. 2012;60:850-856.

Other Goals of CKD Management

- NSAID avoidance
- Limit sodium intake to <90 mmol (2 gm sodium; or 5 gm sodium chloride or salt) per day with HTN and/or proteinuria.
- CVD management: lipids, ASA (secondary prevention), etc.

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Lipid Disorders in CKD

- Use statin alone or statin + ezetimibe in adults ≥50 yrs with CKD 3-5(ND).
- Use statin alone in adults ≥50 yrs with CKD 1-2.
- In adults <50 yrs use statin alone if history of known CAD, MI, DM, stroke.
- Consider a "fire and forget" rather than "treat to target" strategy.
  - Consider treating CKD patients (Non dialysis) with statins or Statin/ ezetimibe combinations without the need for follow up blood tests.

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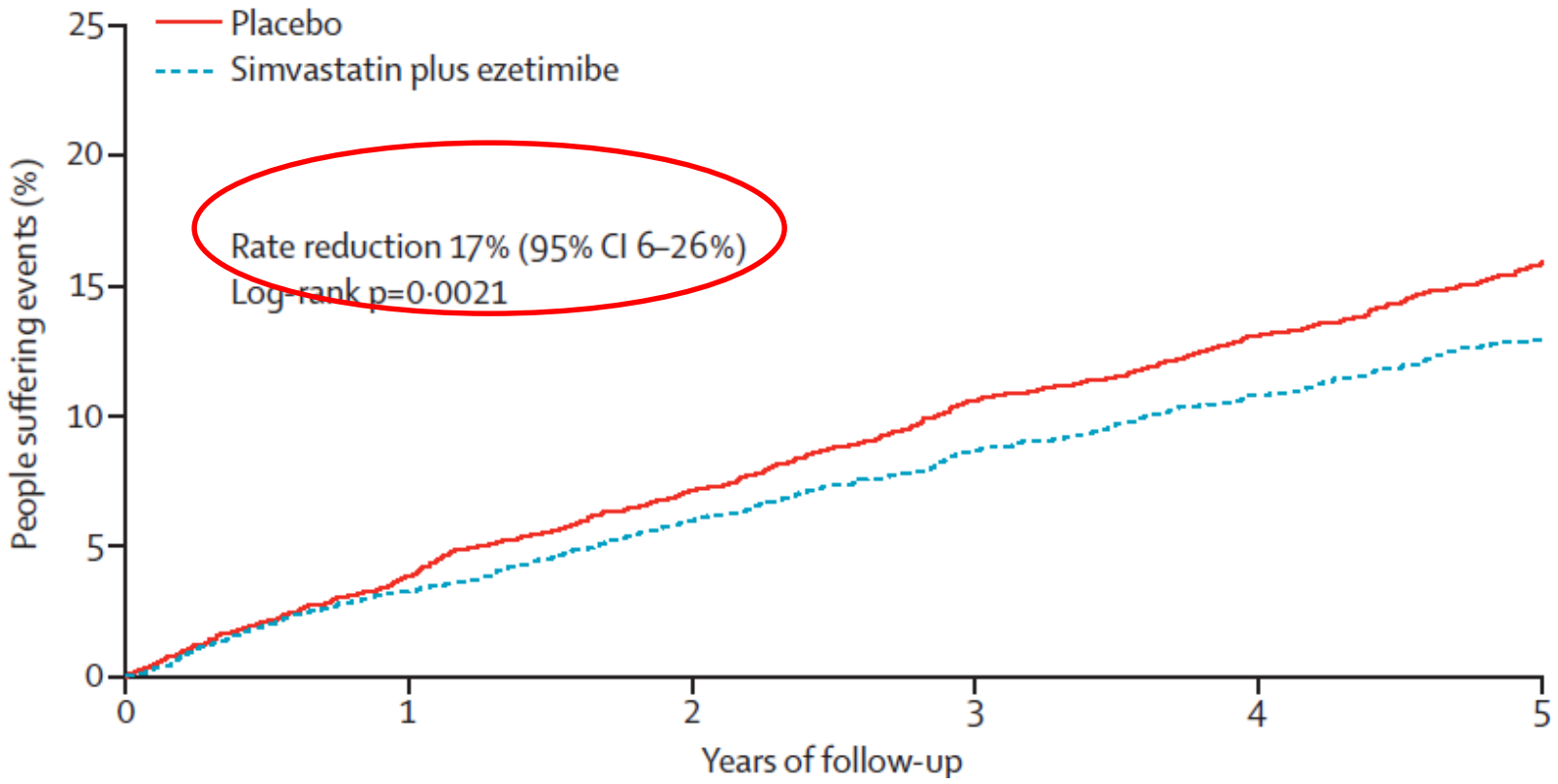
Kidney Disease: Improving Global Outcomes (KDIGO) Lipid Work Group. *Kidney Int Suppl.* 2013;3:259-305.
http://kdigo.org/home/2013/11/04/kdigo-announces-publication-of-guideline-on-lipid-management/

Lipid Disorders in CKD, 2



A 32% reduction in LDL→17% reduction in primary outcome (nonfatal MI, coronary death, nonhemorrhagic stroke, arterial revascularization).

No reduction in CKD progression, overall or CAD mortality, other individual CAD end-points.

Baigent C, et al. Study of Heart and Renal Protection (SHARP). *Lancet*. 2011;11:60739-60743.

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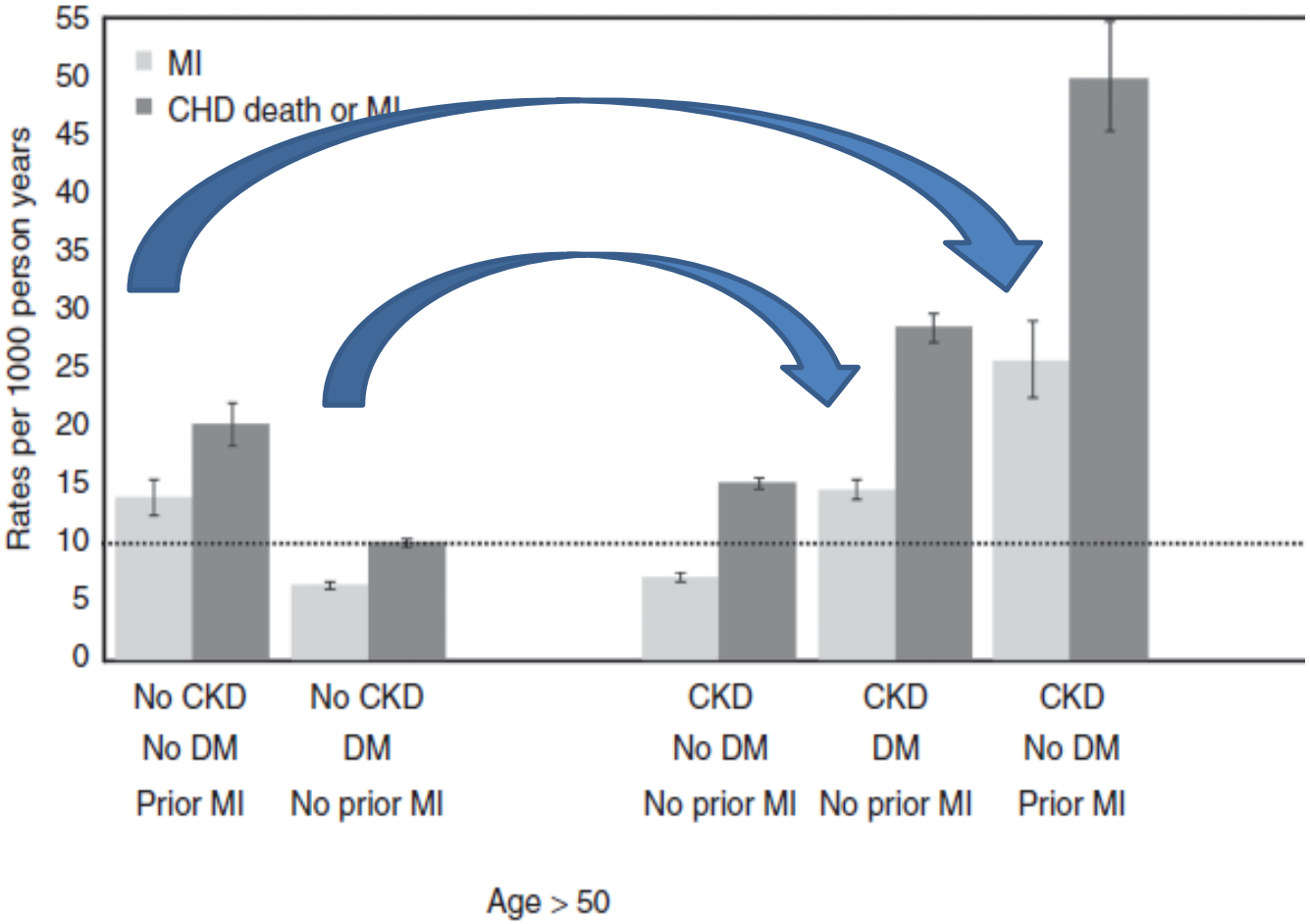
10-Year Coronary Risk Based on Age and Other Patient Characteristics

Future 10-year coronary risk based on patient characteristics. Unadjusted rates from 1,268,029 participants.[1,2]



CABG, coronary artery bypass grafting; **CHD**, coronary heart disease; **CKD**, chronic kidney disease; **CVA**, cerebrovascular accident; **DM**, diabetes mellitus; **MI**, myocardial infarction; **PTCA**, percutaneous transluminal coronary angioplasty; **TIA**, transient ischemic attack.

1) Kidney Disease: Improving Global Outcomes (KDIGO) Lipid Work Group. *Kidney Int Suppl.* 2013;3:259-305.
2) Hemmelgarn BR, et al. Overview of the alberta kidney disease network. *BMC Nephrol.* 2009:30:10.

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Overview of Managing CKD Complications

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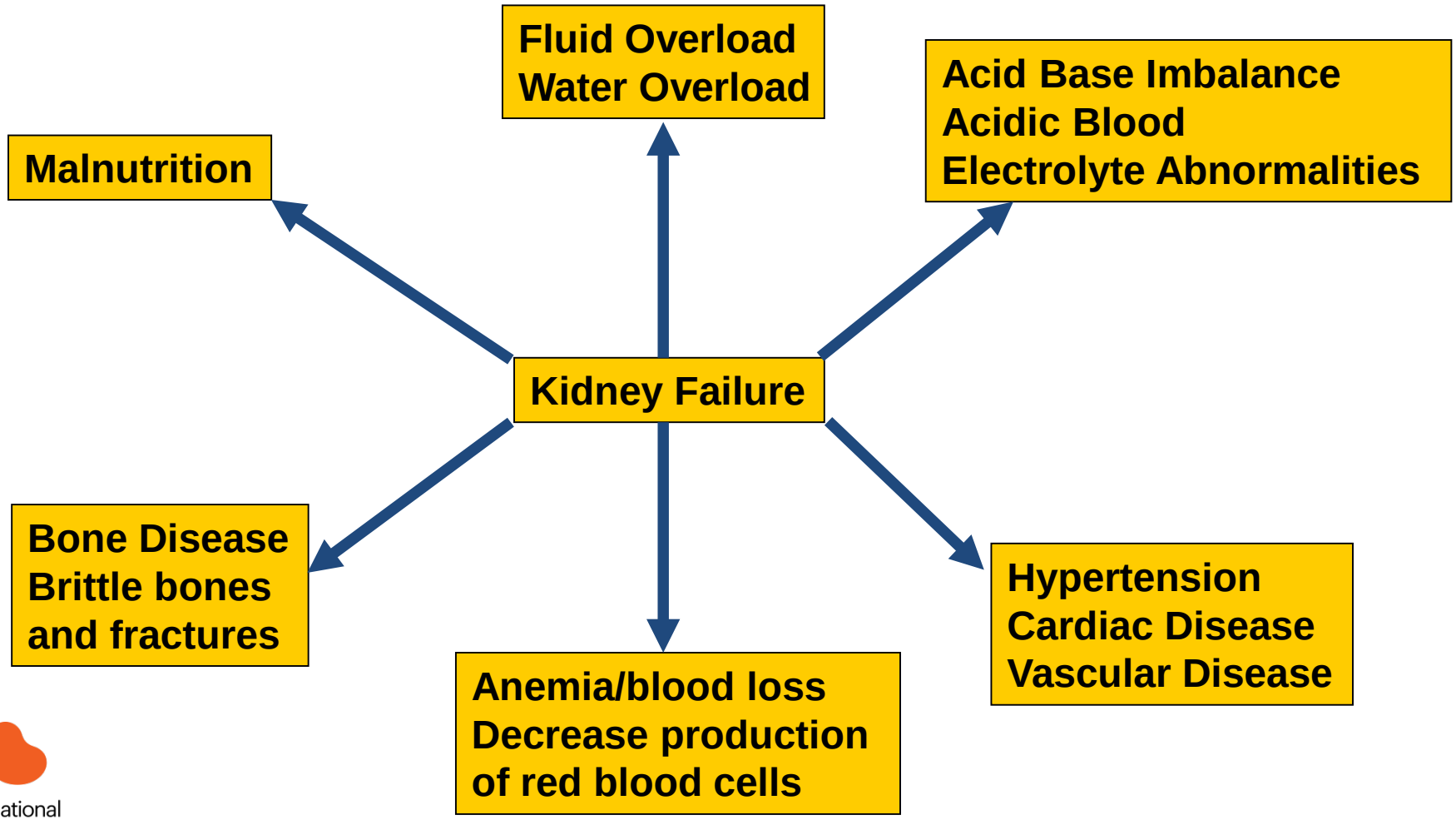
Complications of Kidney Failure Start in Stage 3 and Progress



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Anemia in CKD

- Initiate iron therapy if TSAT ≤30% and ferritin ≤500 ng/mL (IV iron for dialysis, oral for non-dialysis CKD).
- Individualize erythropoiesis stimulating agents (ESA) therapy – Start ESA if Hb <10 g/dl, and maintain Hb <11.5 g/dl. Ensure adequate Fe stores.
  - Appropriate iron supplementation is needed for ESA to be effective.
- ESA usually not required for CKD related anemia until stage 4/5.
- Diagnostic workup of anemia is particularly important if severity of anemia is disproportionate to CKD staging.
- Important to avoid transfusion in transplant candidates.
  - If transfused use leukocyte filter to reduce HLA sensitization.

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CKD-Mineral Bone Disorder (MBD) Testing

CKD Stage	Calcium, Phosphorus	PTH	25(OH)D
Stage 3	Every 6-12 months	Once then based on CKD progression	Once, then based on level and treatments
Stage 4	Every 3-6 months	Every 6-12 months	
Stage 5	Every 1-3 months	Every 3-6 months	

Use CKD progression, presence or absence of abnormalities, treatment response, and side effects to guide testing frequency.

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CKD-MBD: Chronic Kidney Disease – Mineral and Bone Disorder

CKD-MBD

- Treat with D3 as indicated to achieve normal serum levels.
- 2000 IU D3 po qd is cheaper and better absorbed than 50,000 IU of D2 monthly dose.
- Limit phosphorus in diet, with emphasis on decreasing packaged products - Refer to renal RD.
- May need phosphate binders.
- DEXA doesn't predict fracture risk in CKD 3-5.

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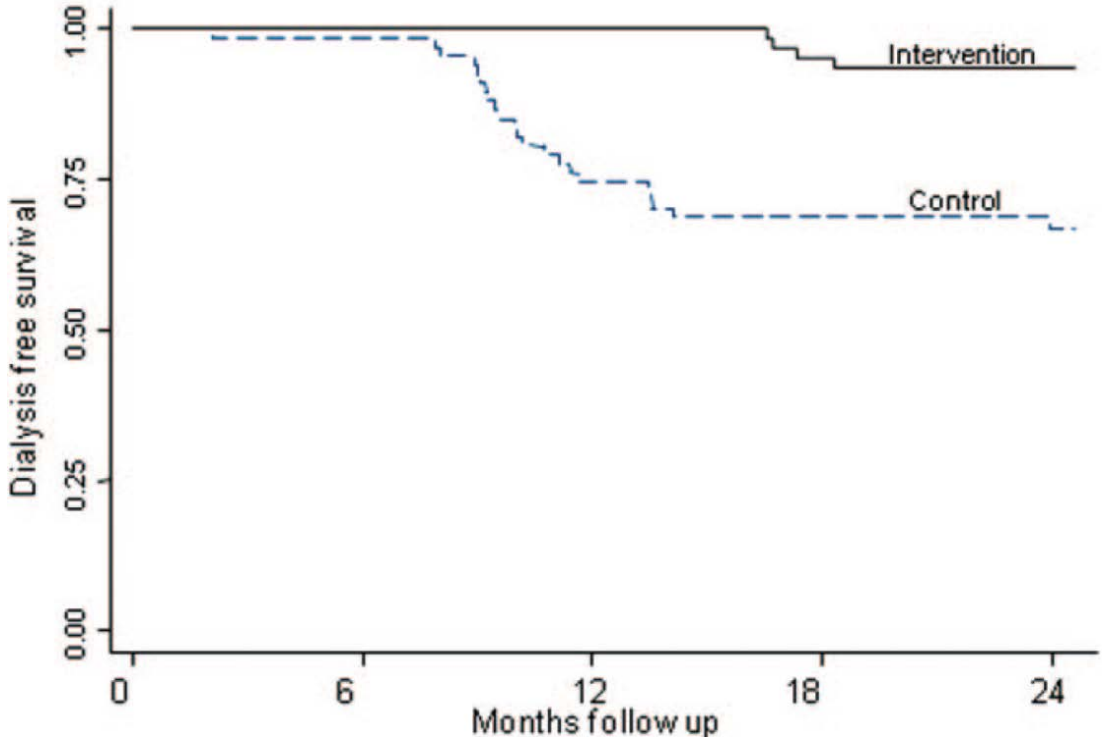
Metabolic Acidosis

- Often becomes apparent at GFR <25-30 ml/min/1.73m^2.
  - More severe with higher protein intake.
- May contribute to bone disease, protein catabolism, and progression of CKD.
- Correction of metabolic acidosis may slow CKD progression and improve patients functional status.[1,2]

eGFR 15-30 ml/min/1.73m^2 Serum bicarbonate 16-20 mmol/L; treated with sodium bicarbonate for 2 years.[2]



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1) Mahajan, et al. *Kidney Int*. 2010;78:303-309.
2) de Brito-Ashurst I, et al. *J Am Soc Nephrol*. 2009;20:2075-2084

Metabolic Acidosis, 2

- Maintain serum bicarbonate ≥ 22 mmol/L.
  - Start with 0.5-1 mEq/kg per day.
  - Sodium bicarbonate tablets:
    - 325mg, 625 mg tablets; 1 g = 12 mEq.
  - Sodium citrate solution:
    - 1 mEq/ml.
    - Avoid if on aluminum phosphate binders.
  - Baking soda:
    - 54 mmol/level tsp.

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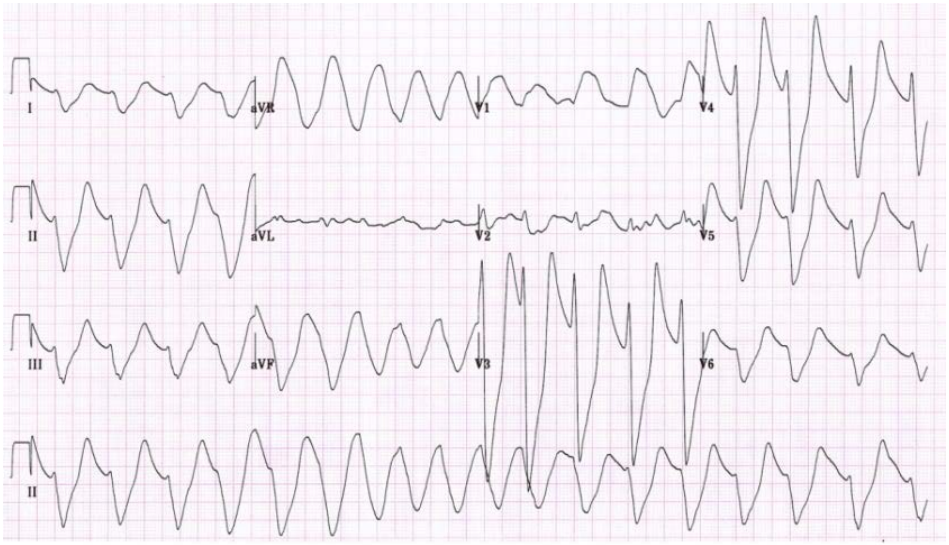
Hyperkalemia



- Reduce dietary potassium.
- Stop NSAIDs, COX-2 inhibitors.
- Stop potassium sparing diuretics.
  - Aldactone
- Stop or reduce beta blockers.
- Avoid salt substitutes that contain potassium.
- Stop or reduce ACEi/ARBs.

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Acute Management of Hyperkalemia

Treatment	Expected serum K+ ↓	Peak effect	Duration	Mechanism
IV Calcium chloride	None	Instant	Transient	Stabilize myocardium
Insulin + dextrose	0.5-1 mEq/L	30-60 mins	4-6 hrs	Cellular shift
B2-adrenergic agonists	0.5-1 mEq/L	30 mins	2 hrs	Cellular shift
Sodium bicarbonate	Variable depending on acidosis	4h		Cellular shift
Loop/ thiazide diuretics		Hours		↑ renal K+ excretion

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Kamel KS, Wei C. *Nephrol Dial Transplant.* 2003;18:2215-2218.

Chronic Management of Hyperkalemia

- Loop or thiazide diuretics.
- Laxatives:
  - As effective as cation exchange resins in sorbitol.
  - Those that induce secretory diarrhea may be more effective (e.g. bisacodyl).
  - Diphenolic laxatives may stimulate colonic K+ secretion.
- Cation exchange resins:
  - Sodium polystyrene sulfonate
  - Mechanism:
    - Theoretical: Bound Na+ exchanged for K+ in colonic/ rectal lumen.
    - Likely: Accompanying sorbitol induces diarrhea.
  - Usually requires multiple doses.
  - Risk of bowel necrosis or perforation.

Risk Factors for Infection in People with CKD

- Advanced age
- High burden of coexisting illnesses (e.g., diabetes)
- Hypoalbuminuria
- Immunosuppressive therapy
- Nephrotic syndrome
- Uremia
- Anemia and malnutrition
- High prevalence of functional disabilities

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Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. *Kidney Int Suppls*. 2013;3:1-150.

Vaccination in CKD

- Annual influenza vaccine for all adults with CKD, unless contraindicated.
- Polyvalent pneumococcal vaccine when eGFR <30 ml/min/1.73m^2 and at high risk of pneumococcal infection (e.g., nephrotic syndrome, diabetes, receiving immunosuppression), unless contraindicated. Offer revaccination within 5 years.
- Hepatitis B immunization when GFR <30 ml/min/1.73m^2. Confirm response with appropriate serological testing.
- Use of a live vaccine should consider the patient's immune status (e.g., immunosuppression).

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Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. *Kidney Int Suppls*. 2013;3:1-150.

Malnutrition and CKD

- Malnutrition or protein energy wasting (PEW) is common in CKD, and is associated with poor patient outcomes.
- Malnutrition in CKD begins as early as stages 3 and 4. Risk increases with progression of the disease.
- Preventing PEW or malnutrition may require clinical interventions to assess nutritional status, individualize strategies for prevention and treatment, provide patient instruction and promote patient adherence.
- A specialty-trained registered dietitian can help address the nutritional aspects so that protein wasting can be diminished.

NKF KDOQI. *Am J Kidney Dis.* 2000;35(suppl 2):S1-S3.
NKF KDOQI. *Am J Kidney Dis*. 2007;49(suppl 2):S1-S179.

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A Balanced Approach to Nutrition in CKD: Macronutrient Composition and Mineral Content*

Nutrient	Stage of CKD		
	1-2	1-4	3-4
Sodium (g/d)		<2.3	
Total fat* (% of calories)		<30	
Saturated fat (% of calories)		<10	
Cholesterol (mg/d)		<200	
Carbohydrate (% of calories)		50-60	
Protein (g/kg/d, % of calories)			
No diabetes	1.4 (~18)		0.6-0.8 (~8-10)
Diabetes	0.8 (~10)		0.6-0.8 (~8-10)
Phosphorus (g/d)	1.7		0.8-1.0
Potassium (g/d)	>4		2.4

Adapted from DASH (dietary approaches to stop hypertension) diet.
*Adjust so total calories from protein, fat, and carbohydrate are 100%. Emphasize such whole-food sources as fresh vegetables, whole grains, nuts, legumes, low-fat or nonfat dairy products, canola oil, olive oil, cold-water fish, and poultry.
*(CKD Stages 1-4)
NKF KDOQI. *Am J Kidney Dis.* 2007;49(suppl 2):S1-S179.

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Education and Counseling

- Ethical, psychological and social care (e.g., social bereavement, depression, anxiety).
- Dietary counseling and education on other lifestyle modifications (e.g., exercise, smoking cessation).
- The registered nurse's role in providing education:
  - Involve the patient, family and children if possible.
  - Offer literature in both traditional and interactive formats.
  - Use educational materials written in the patient's language.
  - Assess the need for low-level reading materials.
  - Use internet resources and smartphone apps as appropriate.
  - Use visual aids such as handouts, drawings, CDs, and DVDs.
  - Involve other health care professionals in educating patients/families.
  - Be consistent in the information provided.

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Mental Health Counseling

- Psychiatric illnesses like depression are associated with many chronic diseases.
- Depression is linked to early CKD, progressive CKD, kidney failure, hospitalization and increased mortality. [1-4]
- Patients with GFR <60 mL/min/1.73m^2 should undergo regular assessment for impairment of functioning and well-being.[5]

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1) Palmer S, et al. *Am J Kidney Dis*. 2013;62:493-505.
2) Hedayati S, et al. *Am J Kidney Dis*. 2009;54(3):424-32.
3) Kimmel P, et al. *Kidney Int*. 2000;57:2093-2098.
4) Tsai Y, et al. *Am J Kidney Dis*. 2012;60:54-61.
5) NKF KDOQI. *Am J Kidney Dis*. 2002;39(2 Suppl 1):S1-266.

CKD Care Among Special Populations

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Considerations for CKD Management in Older Adults

- More than 36 million adults are now over the age of 65 and 50% have two or more chronic diseases.[1]
- Management requires an individualized approach, with attention to unique considerations for older adults.
- Treatment of hypertension in older adults has been shown to reduce CV morbidity and mortality. However, older frail adults should be monitored for risk of hypotension.[2,3]
- Less stringent glycemic goals can be appropriate for older adults with other comorbidities, or those at higher risk for hypoglycemia.[4]
- Exercise can have multiple benefits. A weight control program should be individually tailored to preserve body cell mass and function, while losing fat mass.[5,6]

1.U.S. Census Bureau. Population by age and gender 2008. www.census.gov.
2.Katz P, Gilbert J. *Geriatrics and Aging*. 2008;11:509-514.
3.Aronow W. *Clin Geriatr Med.* 2008; 11(8):457-463.
4.NKF KDOQI. *Am J Kidney Dis*. 2012 60:850-856.
5.Hornick T, Aron D. *Clev Clin J Med*. 2008;75:70-78.
6.NHLBI. ww.nhlbi.nih.gov.

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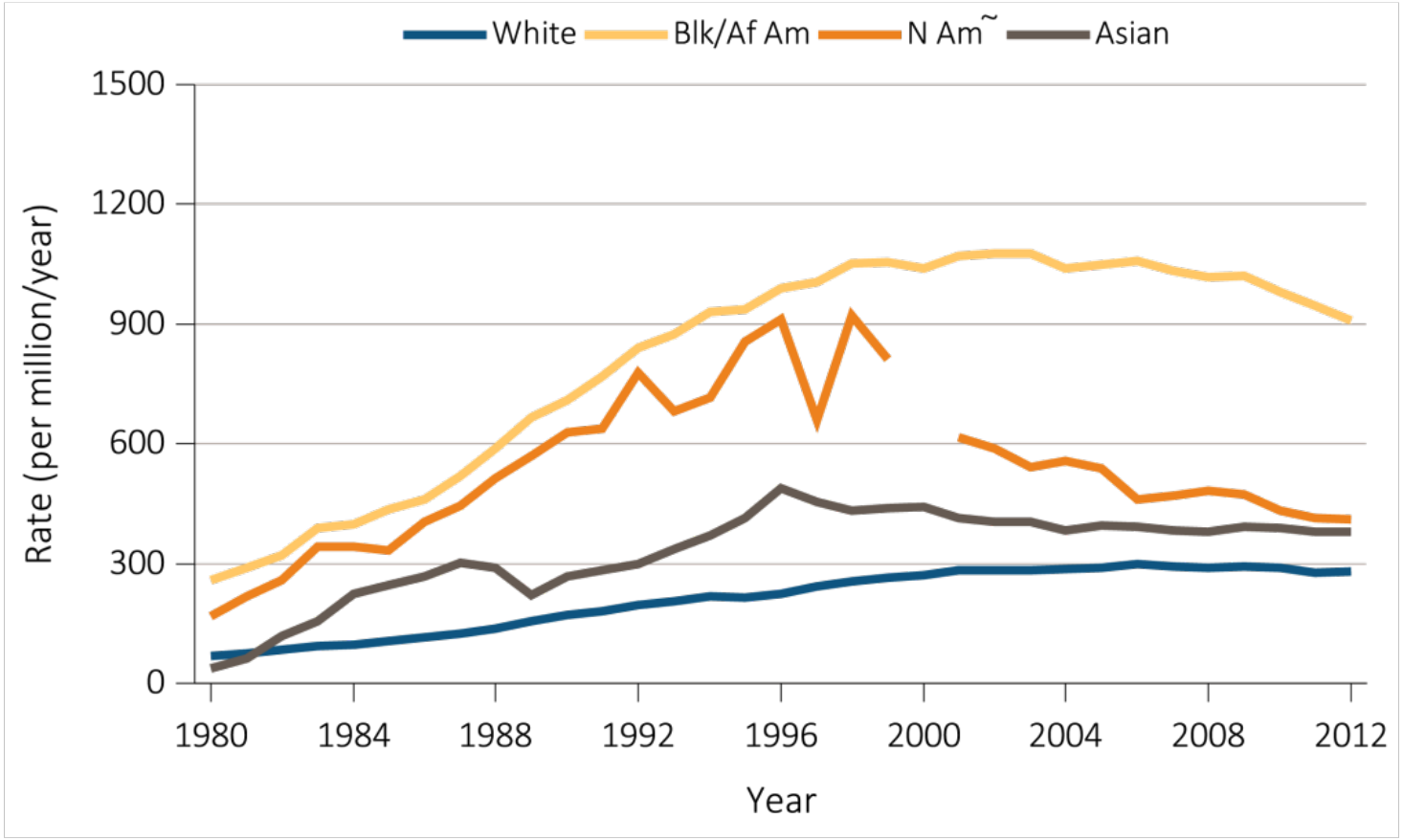
Incidence of ESRD Varies Widely by Race and Ethnicity

Adjusted* ESRD incidence rate, per million/year, by race, in the U.S. population, 1980-2012.



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*Adjusted for age and sex; the standard population was the U.S. population in 2011. Panel b: ~Estimate shown is imprecise due to small sample size and may be unstable over time. The line for Native Americans has a discontinuity because of unreliable data for that year. Abbreviations: Af Am, African American; ESRD, end-stage renal disease; N Am, Native American. USRDS ADR 2014.

Additional Online Resources for CKD Learning

- National Kidney Foundation: www.kidney.org
- United States Renal Data Service: www.usrds.org
- CDC's CKD Surveillance Project: http://nccd.cdc.gov/ckd
- National Kidney Foundation: www.kidney.org
- United States Renal Data Service: www.usrds.org
- National Kidney Disease Education Program (NKDEP): http://nkdep.nih.gov

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