Managing Chronic Kidney Disease (CKD)
A Web-Based Training

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Director, NKDEP

Presented by Indian Health Service (IHS)
Division of Diabetes
Treatment and Prevention

U.S. Department of Health and Human Services
National Institute of Health

NIDDK | NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

NKDEP
National Kidney Disease Education Program

Managing Progressive Kidney Disease

Objectives: Following completion of the training the participants will be able to:

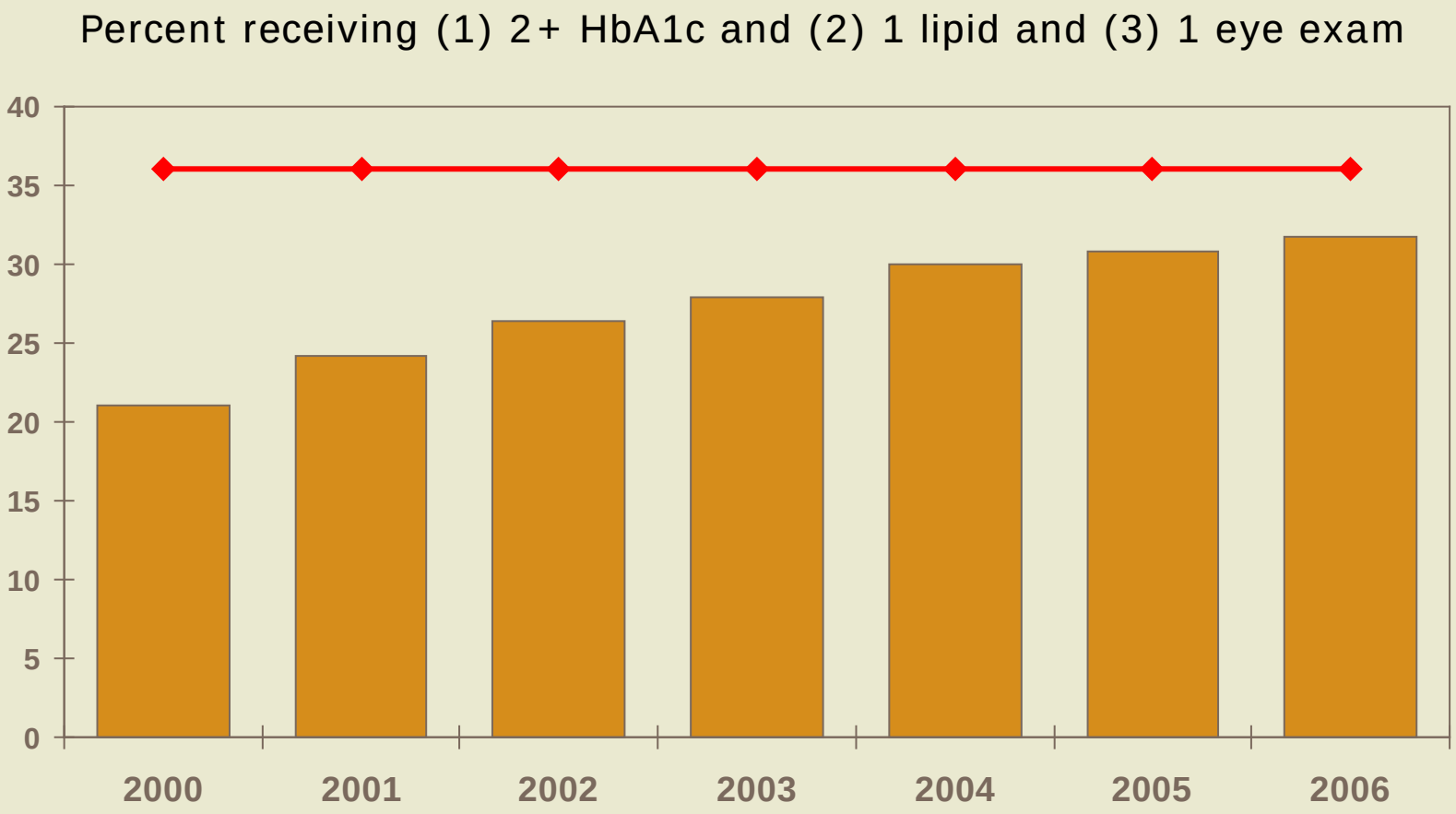
- Discuss the standards of care for patients with CKD
- Describe key tests for identifying and monitoring CKD
- Summarize key prognostic factors in staging CKD
- Develop a strategy for improving CKD outcomes in the primary care setting
- Describe indications for referral to nephrology

Guidelines Reflect International Consensus on Treatment of CKD

- Clinic follow-up where modality education, dietary instruction, and comprehensive clinical management for at least six months prior to initiation
- CVD Risk: exercise, smoking, lipids
- Blood pressure < 130/80
- BMD CKD control of calcium, phosphorus, PTH
- Anemia: Hgb 11-12g
- Hepatitis B immunization
- Nephroprotection: ACEi, ARB
- Assessment for transplant and referral prior to initiation
- Access: functioning fistula or Tenchkoff at initiation

https://www.kdigo.org/nephrology_guideline_database/Compare_guideline_targets.php

HP2010: Increase the Proportion of Persons With Type 1 or Type 2 Diabetes and Chronic Kidney Disease Who Receive Recommended Medical Evaluation. Goal = 36



USRDS 2008 ADR

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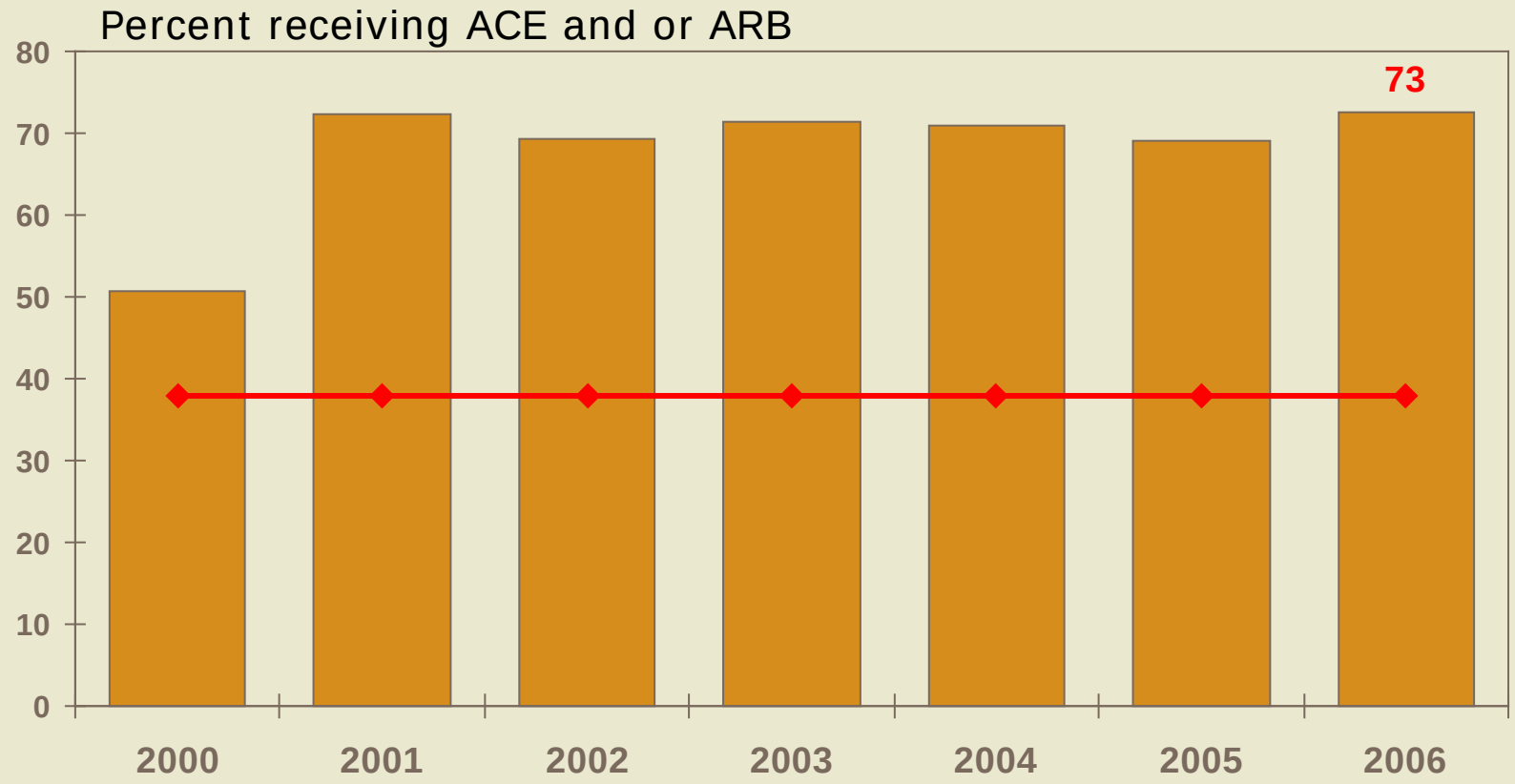
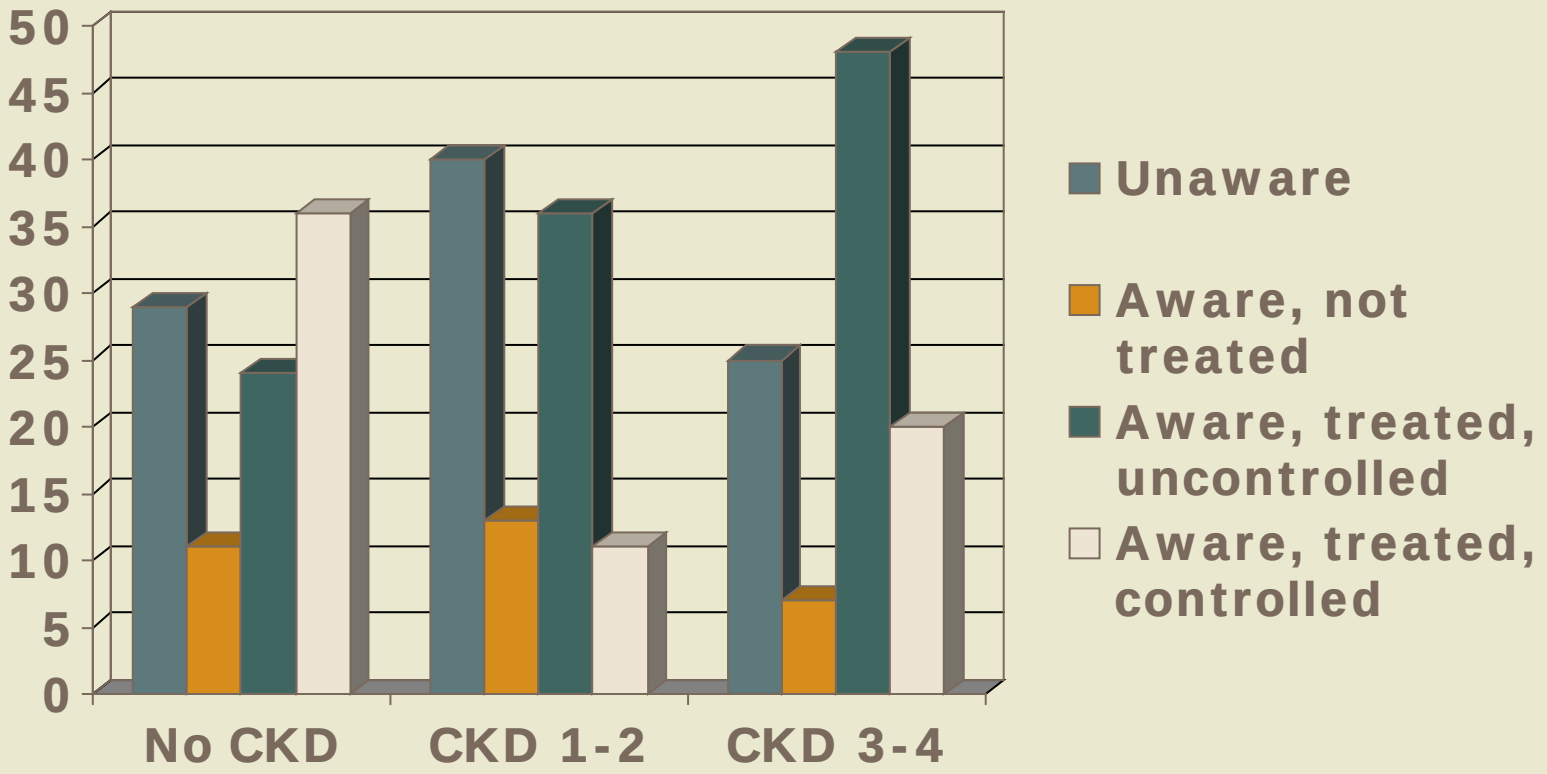


USRDS 2008 ADR

Blood Pressure Control in CKD

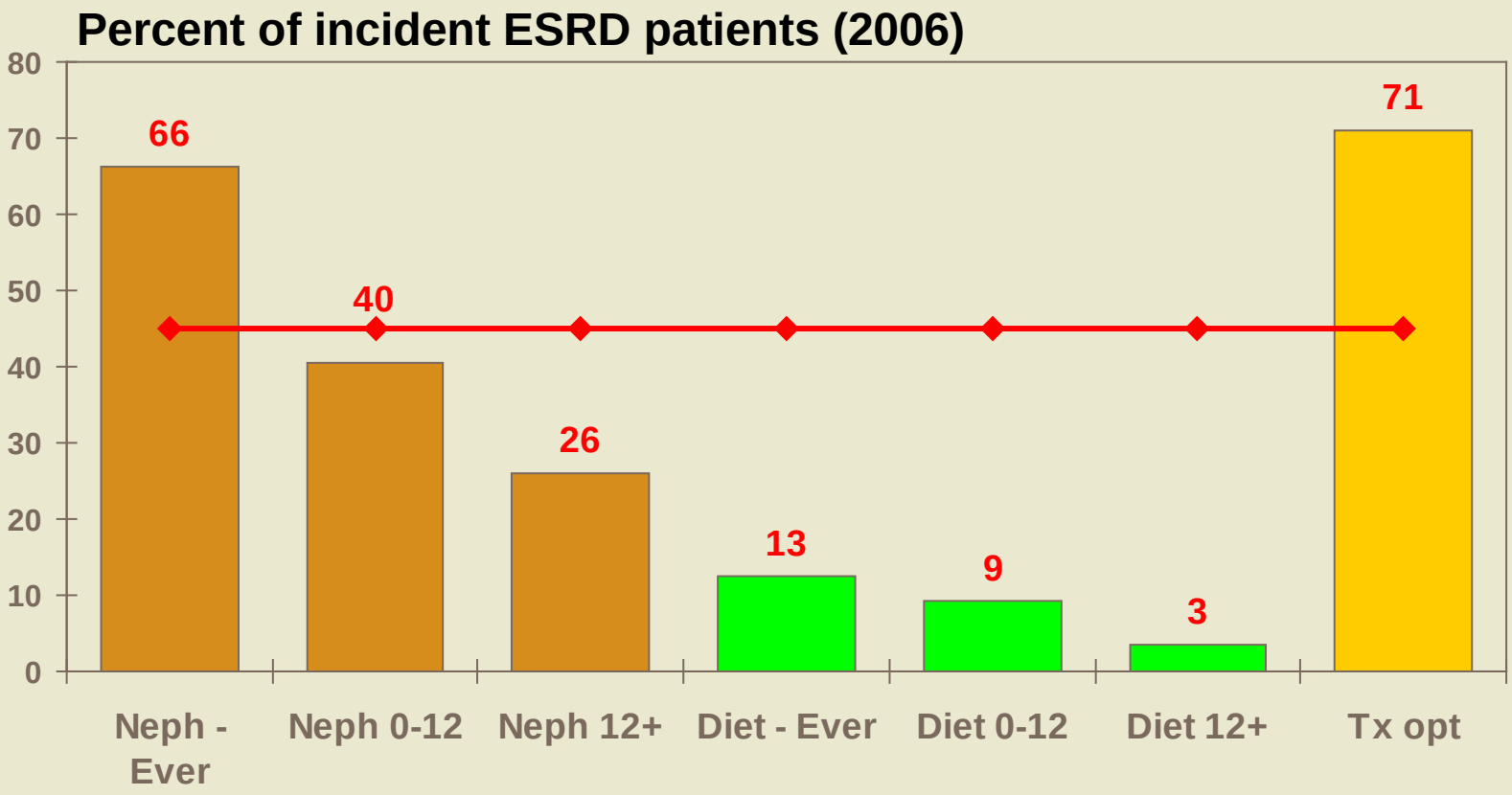
Hypertensive patients in NHANES



https://www.kdigo.org/

USRDS 2008 ADR

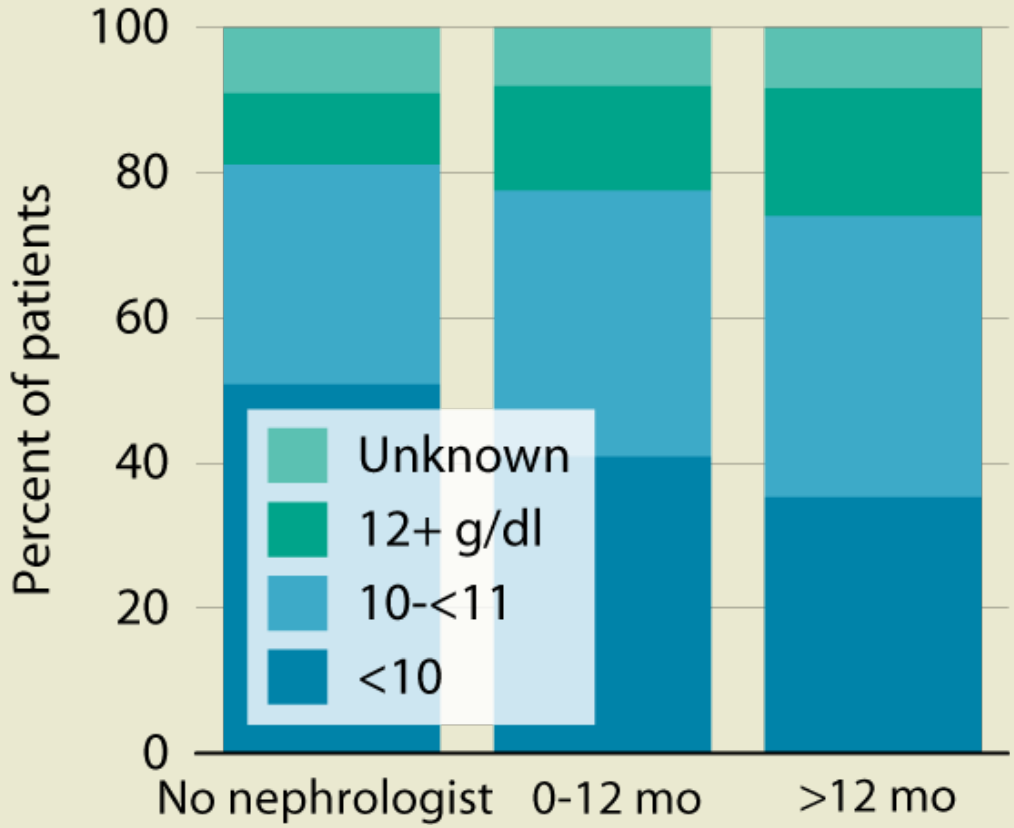
HP2010: Increase the proportion of treated chronic kidney failure patients who have received counseling on nutrition, treatment choices, and cardiovascular care 12 months before the start of renal replacement therapy. Goal = 45%



USRDS 2008 ADR

Preinitiation hemoglobin levels, by nephrologist care, 2006

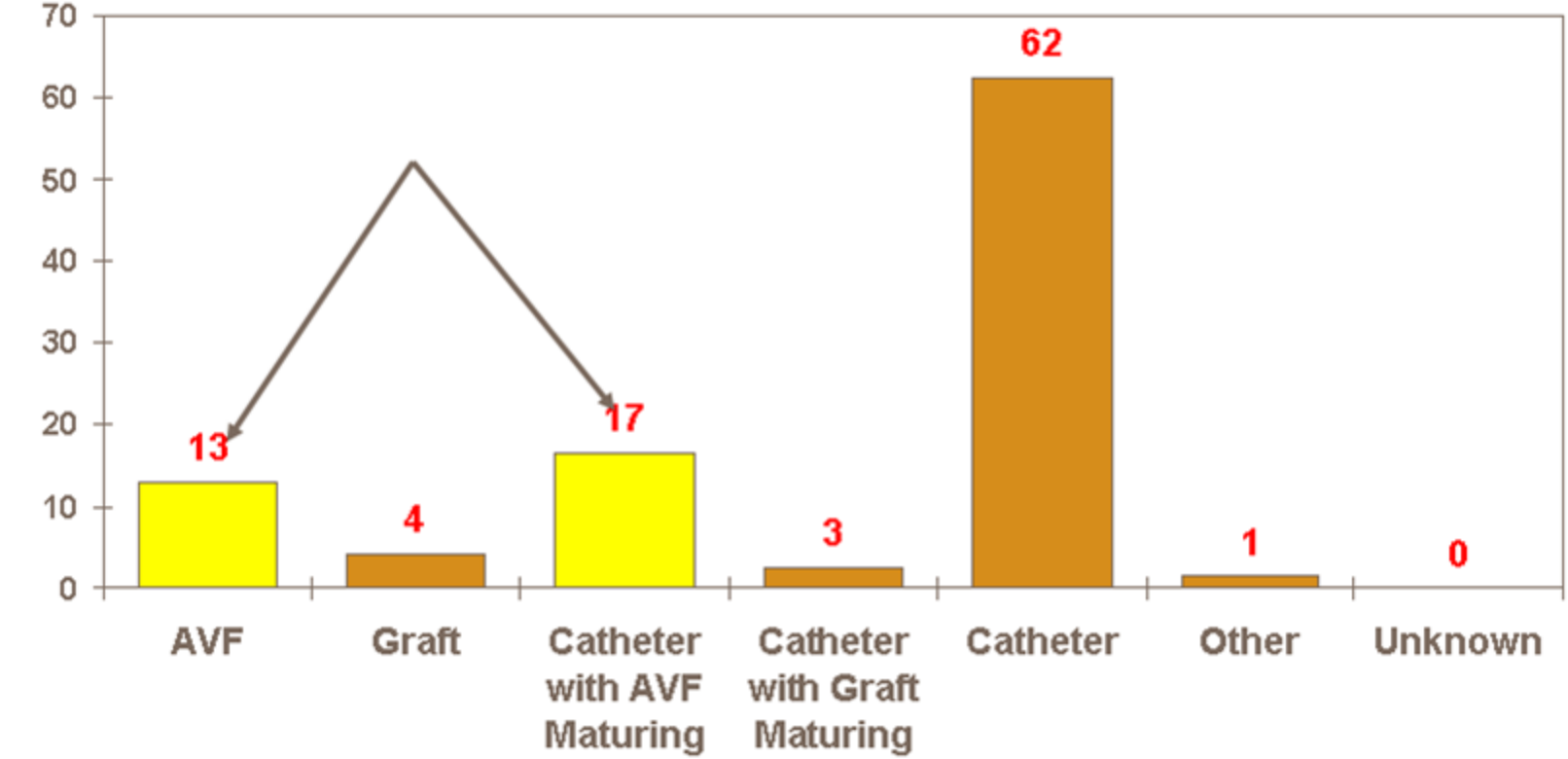
Figure 3.3 (Volume 2)



Incident ESRD patients, 2006, with new (revised edition) Medical Evidence forms.

HP2020: Increase the proportion of incident hemodialysis who use arteriovenous fistulas or have a maturing fistula as the primary mode of vascular access.

Access at incidence–2006



USRDS 2008 ADR

Defining optimal care is not the primary barrier to improved outcomes.

Delivering appropriate care to those who need it is the problem we must overcome.

Lack of Appropriate Care/Late Referral

- More rapid progression
- Worse health status at time of initiation
- Higher mortality after starting RRT
- Decreased access to transplant

Interventions to Improve CKD Outcomes

- Formal CKD education extends time to starting dialysis. Devins et al. AJKD. 2003
- Directed CKD care increases initial fistula utilization. Lee, W. et al. Nephrol. Dial. Transplant. 2006
- Multidisciplinary care improves survival. Hemmerlgarn et al. JASN 2007
- CKD clinics decreased hospitalizations postinitiation. Goldstein et al. AJKD. 2004.

Models of Improving Care

- Private Office
  - RPA *Advanced CKD Patient Management Toolkit*
  - Small studies showing improved outcomes with disease management, multidisciplinary teams, nurse practitioners and physician assistants
- HMO
  - Kaiser of Southern California
- Public Health Setting:
  - Community Health Center
  - Indian Health

Southern California Kaiser Permanente

- 3 million members
- eGFR reporting implemented 2003
- Modified staging by splitting Stage 3 into:
  - High risk: proteinuria, DM, eGFR + 1/2 age <85
  - Low risk: chronic Stage 3
- 67% diabetic
- 10% African American
- Integrated approach

Rutkowski et al. AJKD. 2009

CKD by Stage–KPSC

STAGE	No. of Members	Mean Age
1	4048	50.7
2	7127	61.5
3 modified	55485	69.3
4	5009	71.5
5 future RRT	336	65.6
Total	72005	67.7

Chronic Stage 3

- Not DM
- UACR < 300mg/g
- eGFR + age/2 < 85
- 48,734 members vs. 55,485 Stage 3modified
- 71% > 70 years
- Not targeted for population management

Nephrology Referral

- 60 full-time nephrologists
- No disincentive for primary care to refer early
- Culture of early referral
- 32% CKD patients seen in last 5 years
- 24% CKD patients seen in last 12 months

Nephrology Referral Guidelines

- CKD 4–5 unless aggressive management not indicated
- CKD 1–3, consider referral if:
  - Proteinuria > 1000mg/d
  - Refractory HTN
  - Clarification of diagnosis
  - Unexplained acute decrease in eGFR
- Most CKD 1–3 patients fully integrated with other population care efforts

Nephrology Visits by CKD Stage

CKD Stage	Number	Past 5 Years %	Past 12 Months %
1	4048	16	10
2	7127	23	15
3 modified	55485	29	21
4	5009	87	77
5 future RRT	336	97	89
Total	48734	32	24

Population Care Management System

- 85% of visits by CKD patients are to PCPs
- 79% of these visits coded for CKD
- Patient-specific information and advice provided at time of visit
- EMR includes care management summary sheet and algorithm based reminders
- Decision support through provider education

Quality Indicators: Stages 1–5

Indicator	Number	%
BP>129/79	42466	56.4
No UACR in past 12 months	15765	20.9
DM or Proteinuria No ACEi or ARB	12184	16.2
No LDL in past 12 months	8350	11.1
LDL > 100 mg/dl	26557	39.6

Quality Indicators: Stages 4–5

Indicator	Number	%
No Hgb in past 12 months (CKD 3-5)	8461	13.9
Hgb<11g/dl (CKD 3-5)	6603	12.6
Hospital Days /pt/year	2.5	
No neph. visit in past 12 months	1225	23.0
Not attending RRT Class	3291	61.9

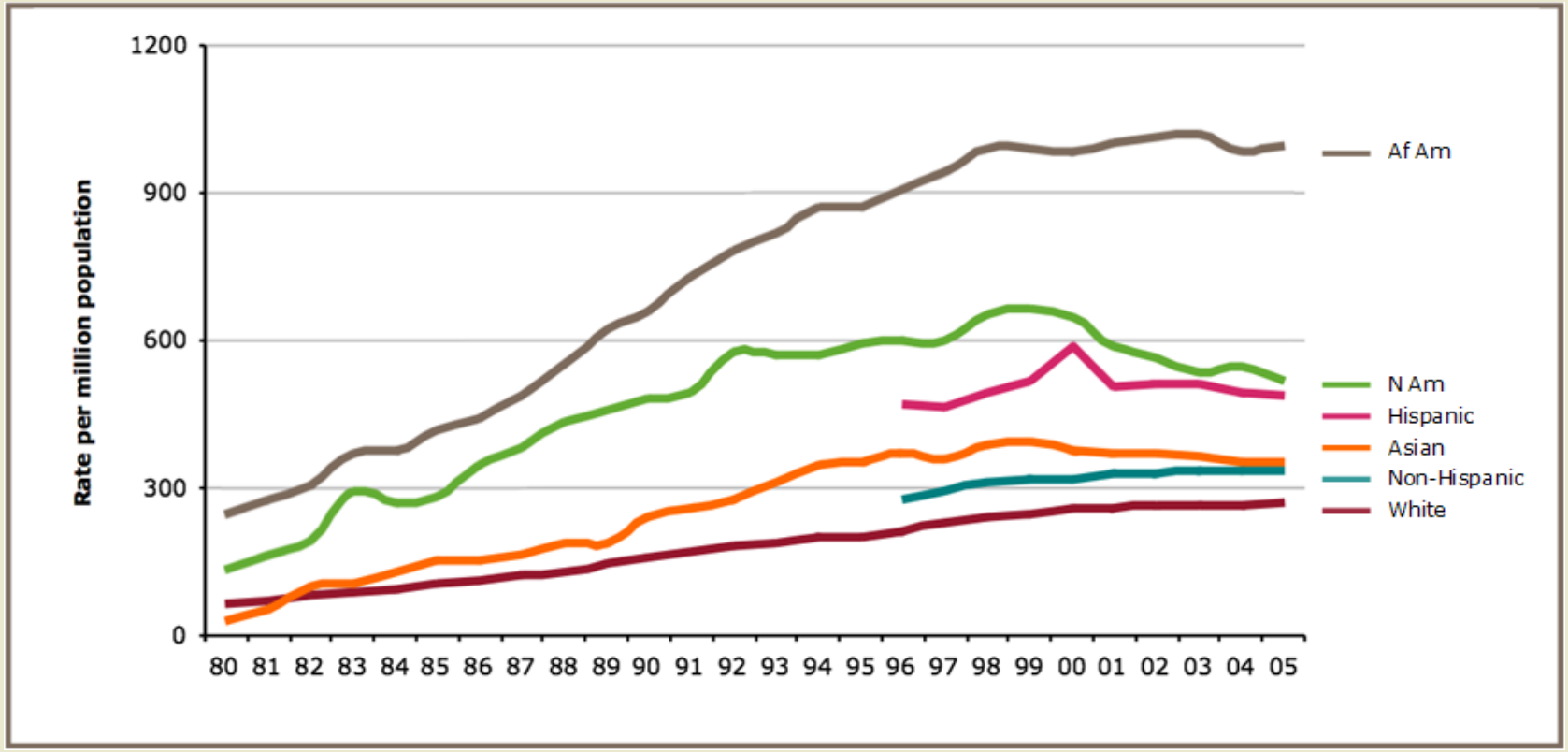
Optimal Start of ESRD Therapy, July–Dec 2007

	Number	%
New ESRD	392	
New PD	46	12
Preemptive Transplants	10	3
AV Fistula 1st HD	140	36
AV Graft 1st HD	21	5
Catheter 1st HD	175	45
Optimal Start	196	54

Defining optimal care is not the primary barrier to improved outcomes.

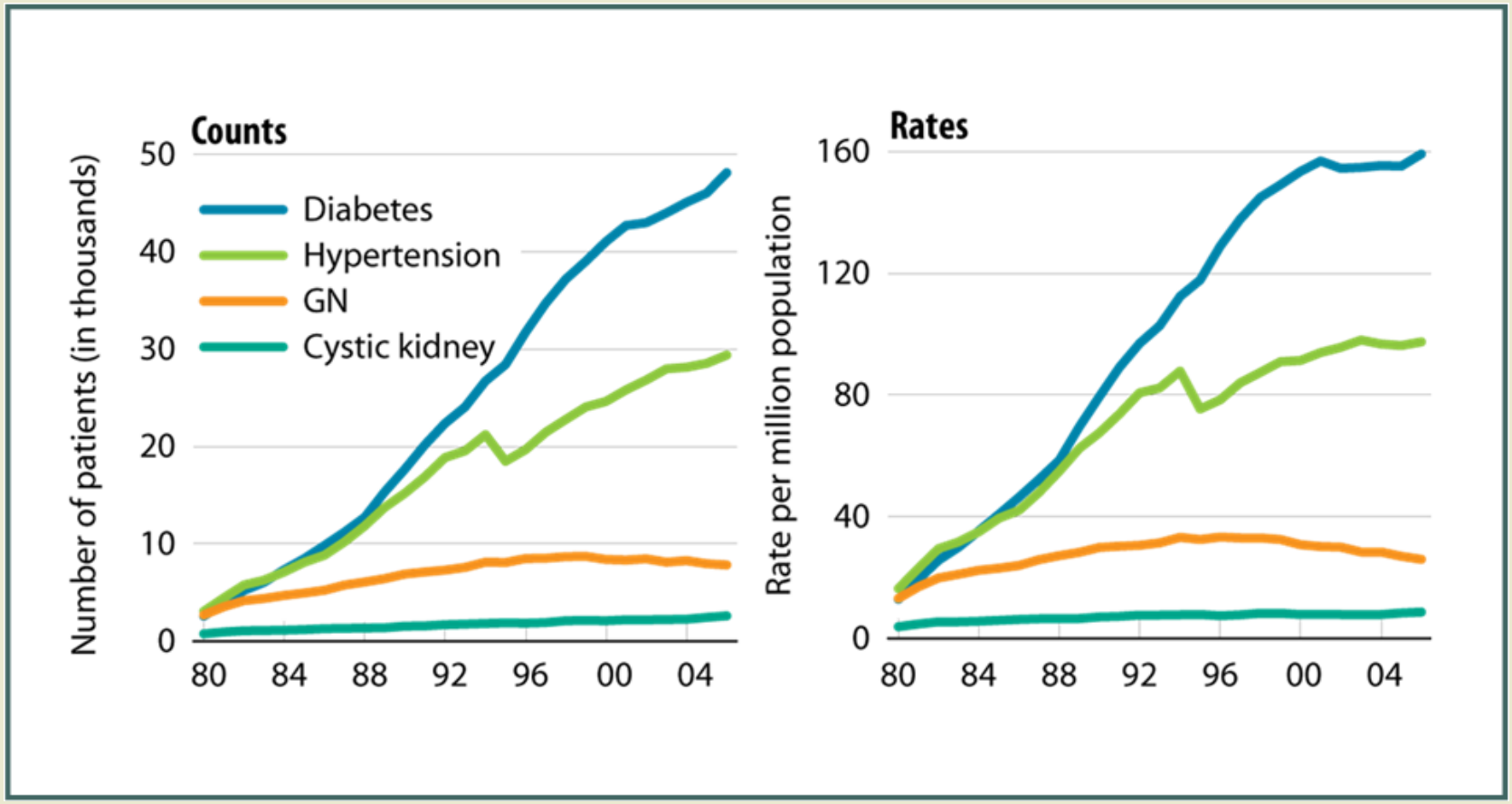
Delivering appropriate care to those who need it is the problem we must overcome.

Health Disparities in CKD Must be Addressed



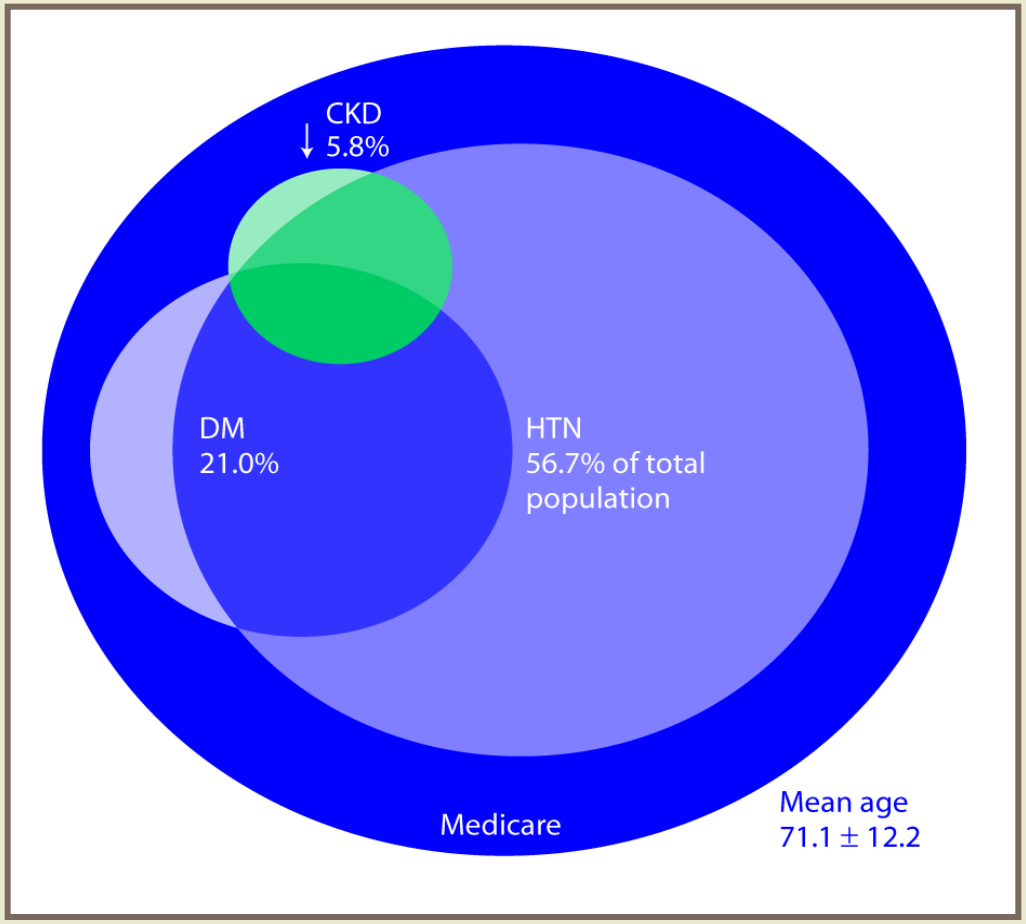
Incident ESRD patients; rates adjusted for age and gender.

The Greatest Opportunity Is in Improving Care of Diabetics



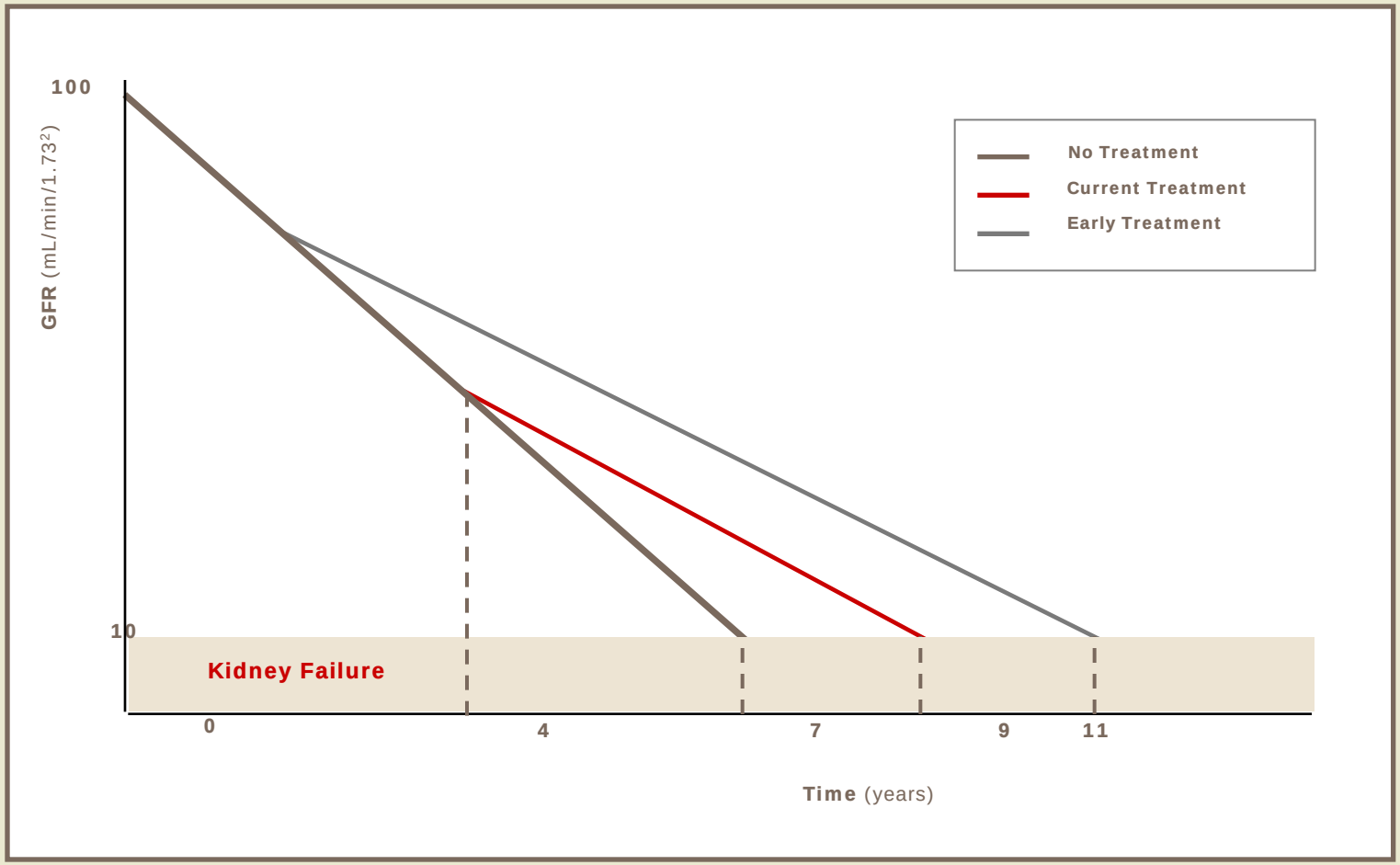
Incident ESRD patients; rates adjusted for age, gender, and race

Diabetes (DM) and Hypertension (HTN) Often Coexist in CKD



Distribution of CKD, HTN, and diabetic patients in Medicare population, 2004.

Even Early Referral Is Too Late to Intervene



Challenges to Improving CKD Care

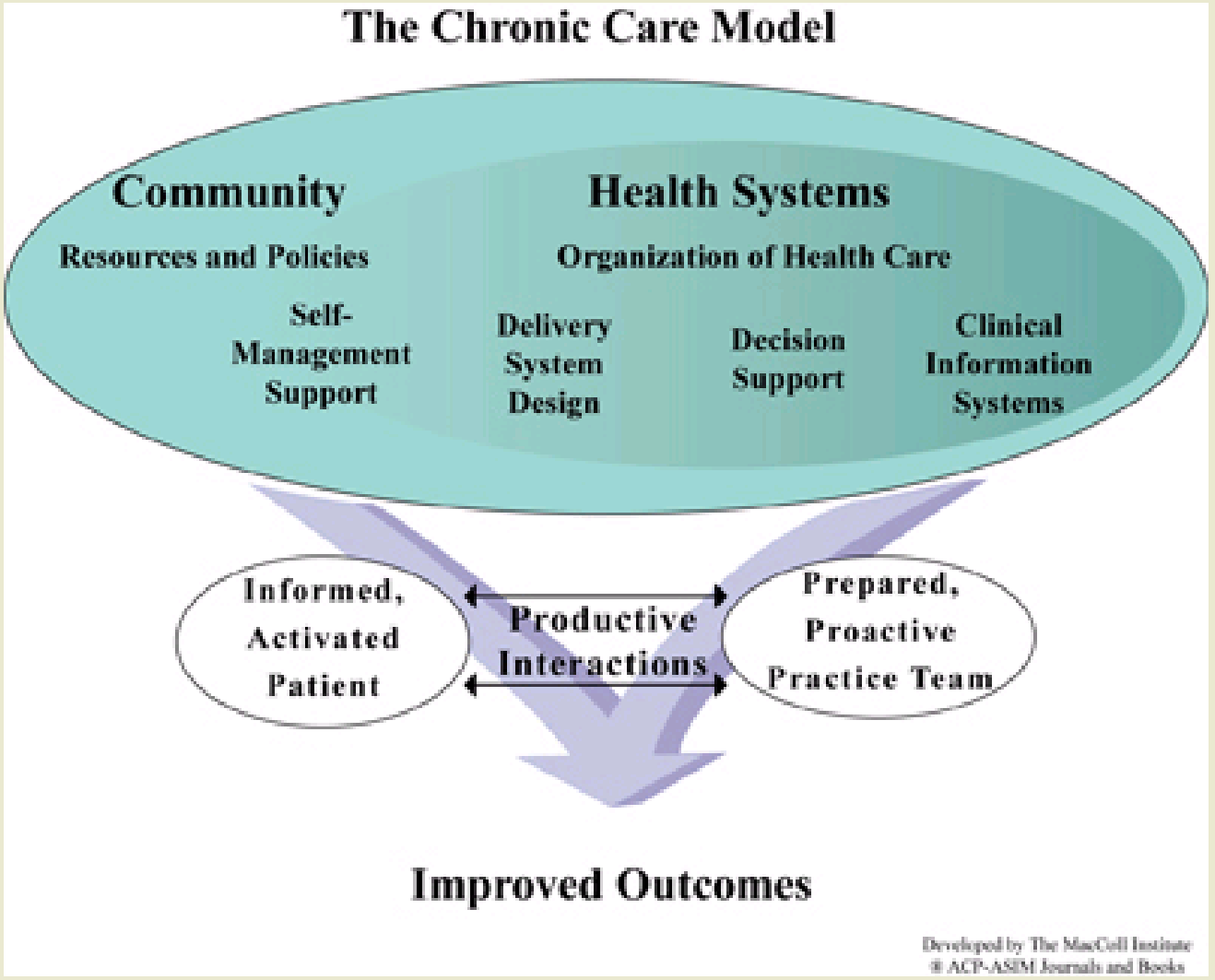
- CKD remains underdiagnosed
- Implementation of recommended care is poor
- Many clinicians feel inadequately educated
  - Uncertain about how to interpret diagnostic tests
  - Unclear about clinical recommendations
  - Low confidence in their ability to successfully manage CKD
  - Indications for, and process of, referral poorly defined

The National Kidney Disease Education Program

The National Kidney Disease Education Program (NKDEP) aims to reduce the morbidity and mortality caused by kidney disease and its complications by:

- Improving early detection of CKD
- Facilitating identification of patients at greatest risk for progression to kidney failure
- Promoting evidence-based interventions to slow progression of kidney disease
- Supporting the coordination of federal responses to CKD

The Chronic Care Model (CCM)



What it Means for CKD

- An approach to reducing health disparities in chronic disease through systems change
- CCM provides a much-needed paradigm for how to improve CKD detection and management
- Offers a systematic way to identify needs and set priorities
  - Makes it clear which elements we need to address including the *primary care/nephrology relationship*

What Can Primary Care Providers Do?

- Recognize and test at-risk patients: monitor eGFR and UACR
- Screen for anemia (Hgb), malnutrition (albumin), metabolic bone disease (Ca, Phos., PTH)
- Treat cardiovascular risk, especially with smokers and hypercholesterolemia
- Refer to dietitian for nutritional guidance
- *Educate patients about CKD and treatment*

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Performance Measures

- Improve screening of patients with DM
  - eGFR and UACR
- Improve management of CKD
  - BP control
  - ACE inhibitors and ARBs
- Improve screening for complications
  - Anemia, malnutrition, metabolic bone disease, lipid disorders
- Improve CKD education: Four key concepts

AADE Position Statement on Diabetic Kidney Disease

2009

- 1. The diabetes educator is in a unique position to incorporate kidney education while providing continuity of self management skills and education to patients.
- 2. Each person with diabetes and DKD needs a personalized education plan, which incorporates kidney content into the AADE7™ Self-Care Behaviors.
- 3. **Those patients who will require renal replacement therapy will be well served by *early DKD education and discussion about renal replace therapy options*.**

Identifying and Monitoring CKD

- eGFR
- UACR
- Staging

National Kidney Foundation (NKF) Definition of CKD

- Kidney Function. Glomerular filtration rate (GFR) <60 mL/min/ 1.73 m2 for ≥ 3 months with or without kidney damage

  OR

- Kidney damage for ≥ 3 months, with or without decreased GFR, manifested by either:
  - Pathologic abnormalities
  - Markers of kidney damage, i.e., proteinuria

(National Kidney Foundation. Am J Kidney Dis. 2002;39(suppl 1):S1-S266)

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What is Glomerular Filtration Rate (GFR)?

- GFR is equal to the sum of the filtration rates in all of the functioning nephrons
- Estimation of the GFR gives a rough measure of the number of functioning nephrons
- GFR cannot be measured directly

GFR

- Cardiac output = 6 L/min
- X 20% of CO goes to kidneys = 1.2L/min
- X Plasma is 50% blood volume = 600 ml/min
- X Filtration Fraction of 20% = 120 ml/min

eGFR

- Not the GFR. It's an *estimate*
- Population-based
- Like all estimates of kidney function based on creatinine:
  - Cr must be stable
  - Affected by muscle mass
- Creatinine standardization

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Proteinuria: Important in Screening, Diagnosing, and Treating

- **Diagnosis**: Approximately 40% people are identified with CKD based on urine albumin alone. Early marker of kidney damage (ACR >30 mg/g) due to diabetes, glomerular disease, hypertension
- **Prognosis**: Urine albumin is an important prognostic marker (particularly in diabetic kidney disease) and may be used to monitor and guide therapy
- **Marker for cardiovascular disease**. Hypothesized marker of generalized endothelial dysfunction
- **Hypothesized surrogate outcome** for kidney disease progression and CVD risk reduction
- A tool for **patient education** and self-management (like eGFR, eAG)

NKDEP Listserv

- "Recently a wave of emails came through on the American College of Clinical Pharmacy's Nephrology Practice Research Network (PRN) listserv regarding microalbumin testing. **It seems that every institution has a different (and onerous) way to request a urine albumin/creatinine ratio. As a result, oftentimes, the wrong test (albumin, microalbumin only) gets done."**

LOINC Codes for Urine Albumin Tests

12842-1	PROTEIN	MCNC	12H	UR	QN		
21482-5	PROTEIN	MCNC	24H	UR	QN		
26034-9	PROTEIN	MCNC	PT	UR	QN		
26801-1	PROTEIN	MRAT	12H	UR	QN		
2889-4	PROTEIN	MRAT	24H	UR	QN		
13801-6	PROTEIN/CREATININE	MCRTO	24H	UR	QN		
2890-2	PROTEIN/CREATININE	MCRTO	PT	UR	QN		
34366-5	PROTEIN/CREATININE	RATIO	PT	UR	QN		
40662-9	PROTEIN^RESTING	MRAT	12H	UR	QN		
40663-7	PROTEIN^UPRIGHT	MRAT	12H	UR	QN		
18373-1	PROTEIN	MRAT	6H	UR	QN		
20454-5	PROTEIN	ACNC	PT	UR	ORD	TEST STRIP	
27298-9	PROTEIN	ACNC	PT	UR	QN		
2887-8	PROTEIN	ACNC	PT	UR	ORD		
2888-6	PROTEIN	MCNC	PT	UR	QN		
32209-9	PROTEIN	ACNC	24H	UR	ORD	TEST STRIP	
32551-4	PROTEIN	MASS	XXX	UR	QN		
35663-4	PROTEIN	MCNC	XXX	UR	QN		
5804-0	PROTEIN	MCNC	PT	UR	QN	TEST STRIP	
40486-3	PROTEIN/CREATININE	RATIO	24H	UR	QN		
34535-5	MICROALBUMIN/CREATININE RATIO PANEL	-	PT	UR	QN		
14956-7	ALBUMIN	MRAT	24H	UR	QN	DETECTION LIMIT = 20 MG/L	MICROALE
14957-5	ALBUMIN	MCNC	PT	UR	QN	DETECTION LIMIT = 20 MG/L	MICROALE
1753-3	ALBUMIN	ACNC	PT	UR	ORD		
1754-1	ALBUMIN	MCNC	PT	UR	QN		
1755-8	ALBUMIN	MRAT	24H	UR	QN		
21059-1	ALBUMIN	MCNC	24H	UR	QN		
30003-8	ALBUMIN	MCNC	24H	UR	QN	DETECTION LIMIT = 20 MG/L	MICROALE
43605-5	ALBUMIN	MCNC	4H	UR	QN	DETECTION LIMIT = 20 MG/L	
43606-3	ALBUMIN	MRAT	4H	UR	QN	DETECTION LIMIT = 20 MG/L	
43607-1	ALBUMIN	MRAT	12H	UR	QN	DETECTION LIMIT = 20 MG/L	
1757-4	ALBUMIN RENAL CLEARANCE	VRAT	24H	UR	QN		
13705-9	ALBUMIN/CREATININE	MCRTO	24H	UR	QN		PROTEIN..
14585-4	ALBUMIN/CREATININE	SCRTO	PT	UR	QN		PROTEIN..
14958-3	ALBUMIN/CREATININE	MCRTO	24H	UR	QN	DETECTION LIMIT = 20 MG/L	MICROALE
14959-1	ALBUMIN/CREATININE	MCRTO	PT	UR	QN	DETECTION LIMIT = 20 MG/L	MICROALE
30000-4	ALBUMIN/CREATININE	RATIO	PT	UR	QN	DETECTION LIMIT = 20 MG/L	MICROALE
30001-2	ALBUMIN/CREATININE	RATIO	PT	UR	QN	DETECTION LIMIT = 20 MG/L TES	MICROALE
32294-1	ALBUMIN/CREATININE	RATIO	PT	UR	QN		
44292-1	ALBUMIN/CREATININE	MCRTO	12H	UR	QN	DETECTION LIMIT = 20 MG/L	
9318-7	ALBUMIN/CREATININE	MCRTO	PT	UR	QN		

Urine Albumin/Creatinine Ratio (UACR)

The ratio of albumin to creatinine in a spot urine specimen correlates closely, in adults, to total albumin excretion:

$$\frac{\text{Albumin (mg/dl)}}{\text{Creatinine (mg/dl)}} \approx \text{Albumin excretion in grams/24 h}$$

However, generally expressed as mg albumin/g creatinine:

Normoalbuminuruia <30 mg/g

micro-albuminuria 30-300 mg/g

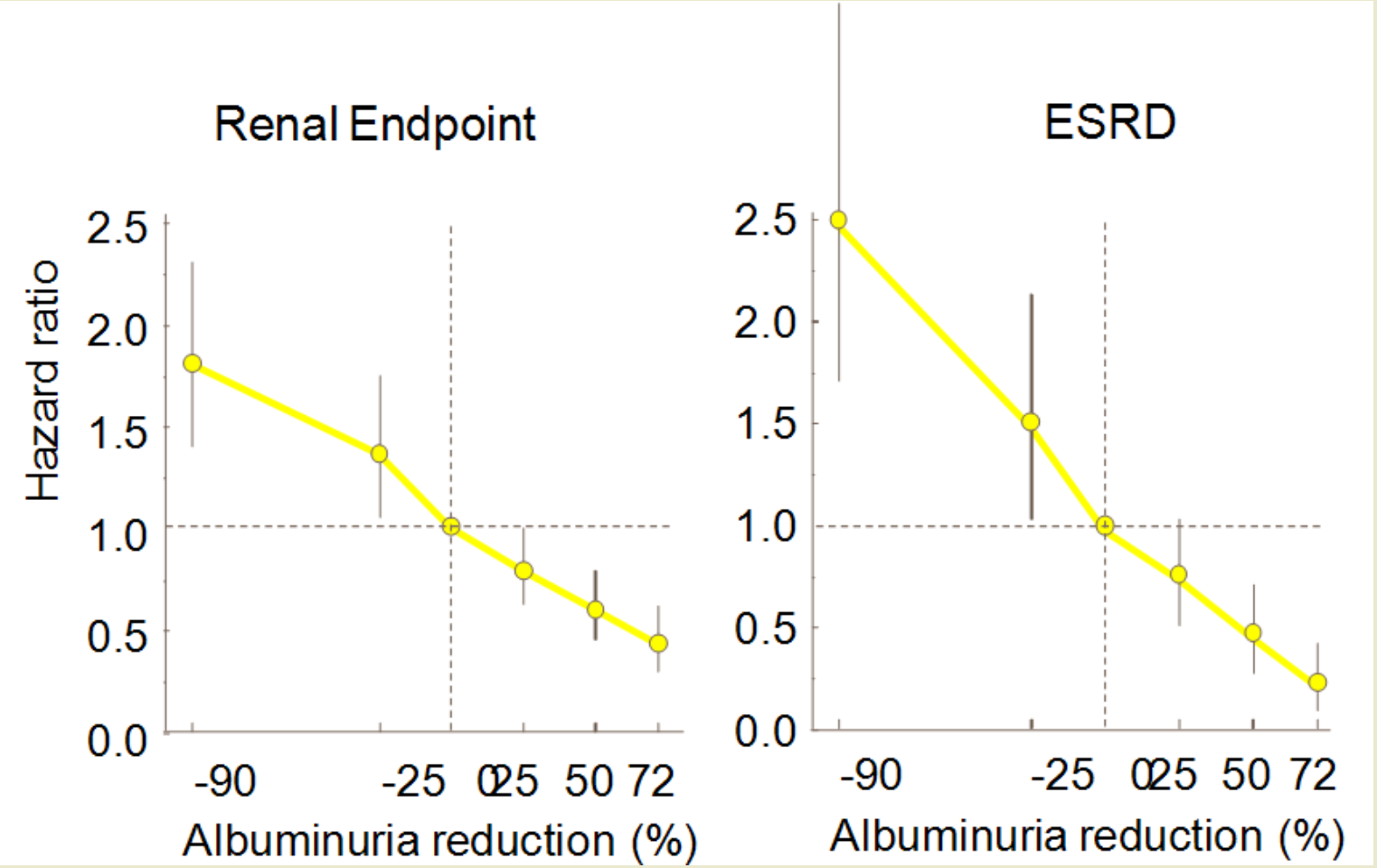
macro-albuminuria >300 mg/g

UACR is a continuous variable and the above terms will be replaced with a single term e.g. urine albumin

Primary Provider Listserv

- **Clinical Issue: Clinical usefulness of quantitative urine protein measurements**
- *Our providers have serious questions about the clinical usefulness of quantitative urine protein measurements for diabetics already identified, and on ACEis, and the time it would take to convince most of our population to do a quantitative urine protein.*

RENAAL; Initial antialbuminuric response predicts renal outcome



De Zeeuw et al; Kidney Int 2004

Urine Albumin Testing–IHS Cost

- In-house UACR $2.30–$9.10
  Mean $3.50

  Siemens Dimension, DCA 2000
  Coulter DxC 600

- Send out UACR $6.31–$10.00
  Mean $8.00

  Quest
  LabCorps
  RML

Bert Tallant, Santa Fe Indian Hospital

ADA 2008 Standards of Care

- Screening
  - Perform an **annual test to assess urine albumin excretion** in Type 1 diabetic patients with diabetes duration of > 5 years and in all Type 2 diabetic patients, starting at diagnosis

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Stages of Chronic Kidney Disease

Stage	Description	GFR (mL/min/1.73 m^2)
1	Kidney Damage with Normal or ↑ GFR	≥ 90
2	Kidney Damage with Mild ↓ GFR	60-89
3	Moderate ↓ GFR	30-59
4	Severe ↓ GFR	15-29
5	Kidney Failure	<15 or Dialysis

DOQI

Caveats to Staging

- eGFR > 60 too inaccurate for clinical use although staging demands accuracy above 60
- “Damage” criteria is usually proteinuria -? Significance when eGFR>60 and no known kidney disease, HTN or DM
- 40% of NHANES-based CKD estimate have eGFR > 60

Age

- Age-related decline makes up much of Stage 3
- Most do not progress to ESRD
- Still a CVD risk factor but what implications for 75-year-old with eGFR 59

eGFR

GFR is probably too narrow a basis on which to make diagnosis and prognosis (stage)

Suggestions

- Eliminate Stages 1 and 2.
- Use of numbered stages promises more than it delivers. Instead use descriptive terms: moderate, severe, kidney failure.
- Use age as a modifier.
- Don’t use measures which are not proven to associated with risk to inflate burden of CKD.
- DM, Urine Albumin, BP, eGFR.

Proteinuria—as important as eGFR, Maybe more

- Community-based cohort study of 920,000 pts
- Risks of mortality, MI, progression to kidney failure associated with a given level of eGFR are independently elevated with higher levels of proteinuria
- Example: who's at higher risk?
  - pt with eGFR >60 and UACR 400 mg/g= Stage 1
  - pt with eGFR of 50 and UACR <30mg/g=Stage 3
  - The first pt has 2-10x higher risk than the second!

JAMA 2010;303(5):423-429

Quick Reference on UACR and GFR

NKDEP National Kidney Disease Education Program

Urine Albumin-to-Creatinine Ratio (UACR)

In Evaluating Patients with Diabetes for Kidney Disease

The two key markers for chronic kidney disease (CKD) are urine albumin and estimated glomerular filtration rate (eGFR).

Assess urine albumin excretion yearly to diagnose *and* monitor kidney damage in patients with type 1 diabetes for five years or more or with type 2 diabetes.

- More frequent monitoring may be indicated in patients with changing clinical status or after therapeutic interventions.
- Use a spot urine albumin-to-creatinine ratio (UACR). UACR estimates 24-hour urine albumin excretion. Twenty-four-hour collection and timed specimens are not necessary.

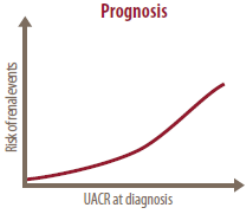
$$\frac{\text{Urine albumin (mg/dL)}}{\text{Urine creatinine (g/dL)}} = \text{UACR in mg/g} \approx \text{Albumin excretion in mg/day}$$

UACR is a ratio between two measured substances. Unlike a dipstick test for albumin, UACR is unaffected by variation in urine concentration.

Albuminuria[1] is present when UACR is greater than 30 mg/g and is a marker for CKD.

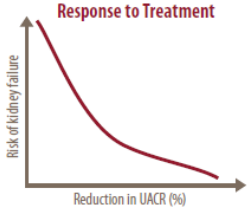
Albuminuria is used to diagnose and monitor kidney disease. Change in albuminuria may reflect response to therapy and risk for progression. A decrease in urine albumin may be associated with improved renal and cardiovascular outcomes.

Prognosis



In a large cohort of CKD patients, a higher UACR at time of diagnosis was associated with increased risk for renal events—loss of half of eGFR, dialysis, or death. (Chronic Renal Insufficiency Cohort study)

Response to Treatment



A randomized trial of diabetes patients with CKD found that the greater the reduction of UACR in response to treatment (with ARBs), the lower the risk of progression to kidney failure. (De Zeeuw D, et al. *Kidney International*, 2004:65:2309-2320)

[1]Albuminuria is a term that describes all levels of urine albumin. *Microalbuminuria* is a term used to describe urine albumin levels not detected by a dipstick test, i.e., 30 mg/g—300 mg/g. *Macroalbuminuria* is sometimes used to describe albumin levels more than 300mg/g.

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Estimated Glomerular Filtration Rate (eGFR)

In Evaluating Patients with Diabetes for Kidney Disease

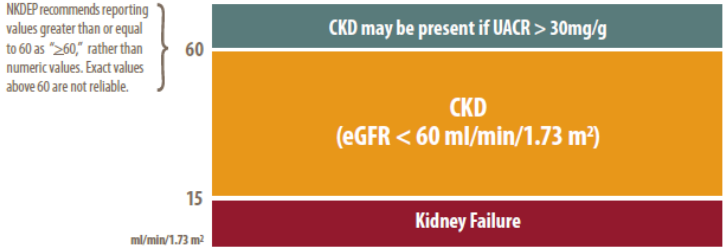
The two key markers for chronic kidney disease (CKD) are estimated glomerular filtration rate (eGFR) and urine albumin.

Calculate eGFR from stable serum creatinine levels at least once a year in all patients with diabetes.

- eGFR is more accurate than serum creatinine alone. Serum creatinine is affected by muscle mass, and related factors of age, sex, and race.
- eGFR is not reliable for patients with rapidly changing creatinine levels, extremes in muscle mass and body size, or altered diet patterns.

See if your lab reports eGFR routinely. If it does not, ask your lab to do so. You can also calculate an eGFR yourself by using GFR calculators available on NKDEP's website at *www.nkdep.nih.gov/professionals/gfr_calculators*.

Interpreting eGFR Results



If CKD is detected, it should be addressed as part of a comprehensive approach to the treatment of diabetes.

For more information on UACR, eGFR, and kidney disease, go to *www.nkdep.nih.gov*.

The National Kidney Disease Education Program (NKDEP) of the National Institutes of Health aims to improve early detection of kidney disease, help identify patients at risk for progression to kidney failure, and promote interventions to slow progression of kidney disease.

U.S. Department of Health and Human Services
National Institutes of Health

NIH Publication No. 10-6286 • March 2010

Materials

GFR UA Tear Pad

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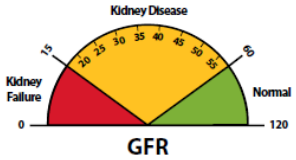
How well are your kidneys working?

Explaining Your Kidney Test Results

Your GFR result on _____ **was** _____.
Date

- ☐ A GFR of *60 or higher* is in the normal range.
- ☐ A GFR *below 60* may mean kidney disease.
- ☐ A GFR of *15 or lower* may mean kidney failure.



What is GFR?

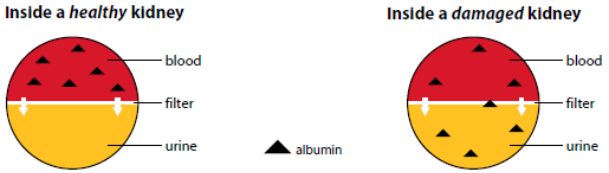
GFR stands for glomerular filtration rate. GFR is a measure of how well your kidneys filter blood.

Your urine albumin result on _____ **was** _____.
Date

- ☐ A urine albumin result *below 30* is normal.
- ☐ A urine albumin result *above 30* may mean kidney disease.

What is urine albumin?

Albumin is a protein found in the blood. A healthy kidney does not let albumin pass into the urine. A damaged kidney lets some albumin pass into the urine. The less albumin in your urine, the better.



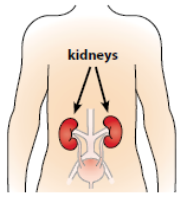
Your blood pressure result on _____ **was** _____.
Date

Keeping your blood pressure below 130/80 may help to protect your kidneys.

1

What your kidneys do

You have two kidneys. Their main job is to filter waste and extra water out of your blood and make urine.



How your kidneys are checked

Two tests are used to check for kidney disease.

- A blood test checks your GFR, which tells how well your kidneys are filtering.
- A urine test checks for albumin in your urine, a sign of kidney damage.

Why your kidneys are being checked

You need to have your kidneys checked because you can't feel kidney disease. Kidney tests are very important for people who have diabetes, high blood pressure, or heart disease. These conditions can hurt your kidneys.

What happens if you have kidney disease

Kidney disease can be treated. The sooner you know you have kidney disease, the sooner you can get treatment to help delay or prevent kidney failure. Treating kidney disease may also help prevent heart disease.

Treatment goals are to:

- Keep your GFR from going down
- Lower your urine albumin

No matter what your results are:

- Keep your blood pressure below 130/80.
- Keep your blood glucose and blood cholesterol in your target range.
- Eat foods that are healthy for your heart and cut back on salt.
- Be physically active.
- Stop smoking.
- Take medicines the way your provider tells you to.

Notes: _____

For more information, visit *www.nkdep.nih.gov* or call 1-866-4 KIDNEY (1-866-454-3639). The National Kidney Disease Education Program (NKDEP) is an initiative of the National Institutes of Health (NIH).

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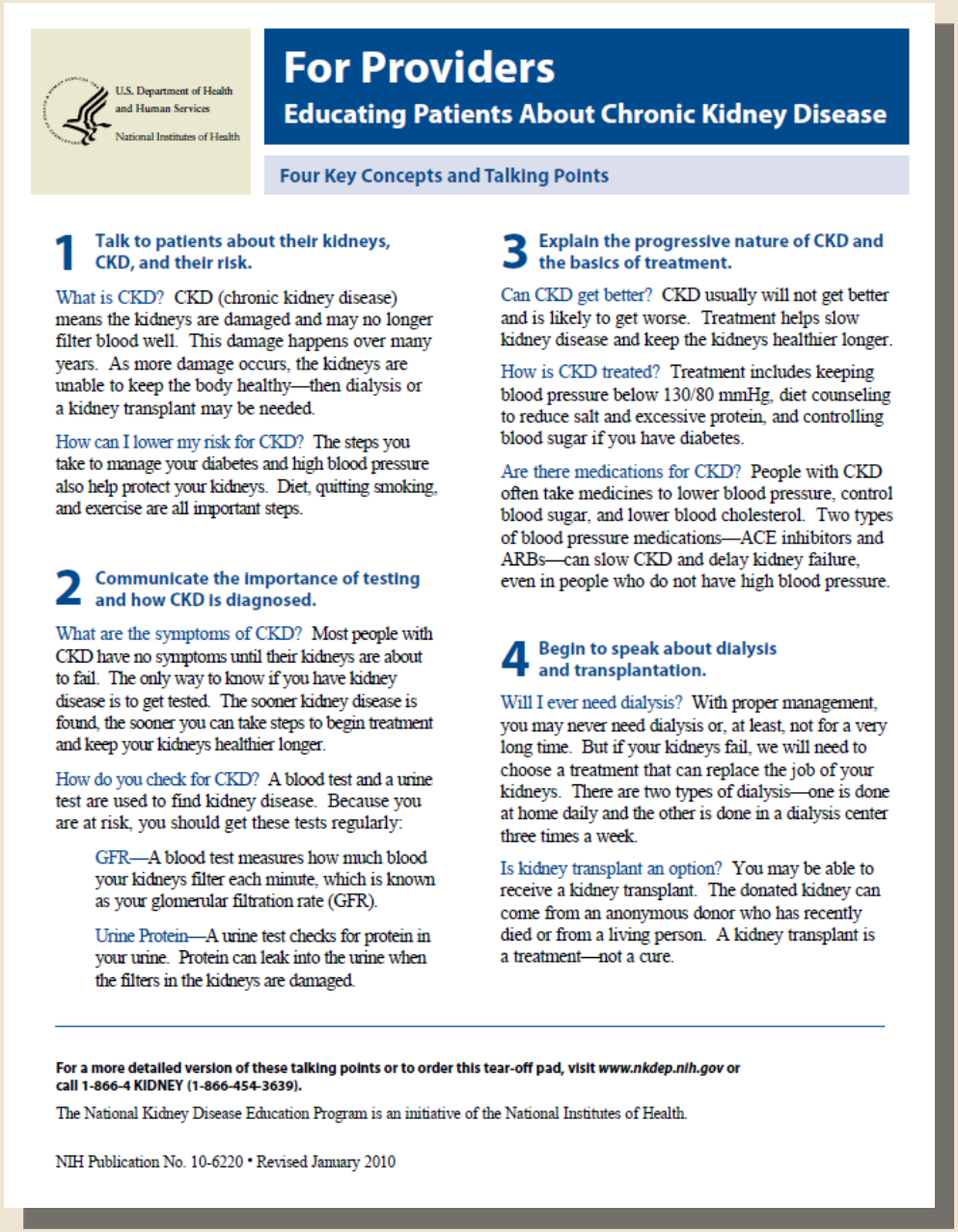
2

GFR Pad – Provider reference (back)



U.S. Department of Health and Human Services
National Institutes of Health

For Providers
Educating Patients About Chronic Kidney Disease

Four Key Concepts and Talking Points

1 Talk to patients about their kidneys, CKD, and their risk.

What is CKD? CKD (chronic kidney disease) means the kidneys are damaged and may no longer filter blood well. This damage happens over many years. As more damage occurs, the kidneys are unable to keep the body healthy—then dialysis or a kidney transplant may be needed.

How can I lower my risk for CKD? The steps you take to manage your diabetes and high blood pressure also help protect your kidneys. Diet, quitting smoking, and exercise are all important steps.

2 Communicate the importance of testing and how CKD is diagnosed.

What are the symptoms of CKD? Most people with CKD have no symptoms until their kidneys are about to fail. The only way to know if you have kidney disease is to get tested. The sooner kidney disease is found, the sooner you can take steps to begin treatment and keep your kidneys healthier longer.

How do you check for CKD? A blood test and a urine test are used to find kidney disease. Because you are at risk, you should get these tests regularly:

- GFR—A blood test measures how much blood your kidneys filter each minute, which is known as your glomerular filtration rate (GFR).
- Urine Protein—A urine test checks for protein in your urine. Protein can leak into the urine when the filters in the kidneys are damaged.

3 Explain the progressive nature of CKD and the basics of treatment.

Can CKD get better? CKD usually will not get better and is likely to get worse. Treatment helps slow kidney disease and keep the kidneys healthier longer.

How is CKD treated? Treatment includes keeping blood pressure below 130/80 mmHg, diet counseling to reduce salt and excessive protein, and controlling blood sugar if you have diabetes.

Are there medications for CKD? People with CKD often take medicines to lower blood pressure, control blood sugar, and lower blood cholesterol. Two types of blood pressure medications—ACE inhibitors and ARBs—can slow CKD and delay kidney failure, even in people who do not have high blood pressure.

4 Begin to speak about dialysis and transplantation.

Will I ever need dialysis? With proper management, you may never need dialysis or, at least, not for a very long time. But if your kidneys fail, we will need to choose a treatment that can replace the job of your kidneys. There are two types of dialysis—one is done at home daily and the other is done in a dialysis center three times a week.

Is kidney transplant an option? You may be able to receive a kidney transplant. The donated kidney can come from an anonymous donor who has recently died or from a living person. A kidney transplant is a treatment—not a cure.

For a more detailed version of these talking points or to order this tear-off pad, visit *www.nkdep.nih.gov* or call 1-866-4 KIDNEY (1-866-454-3639).

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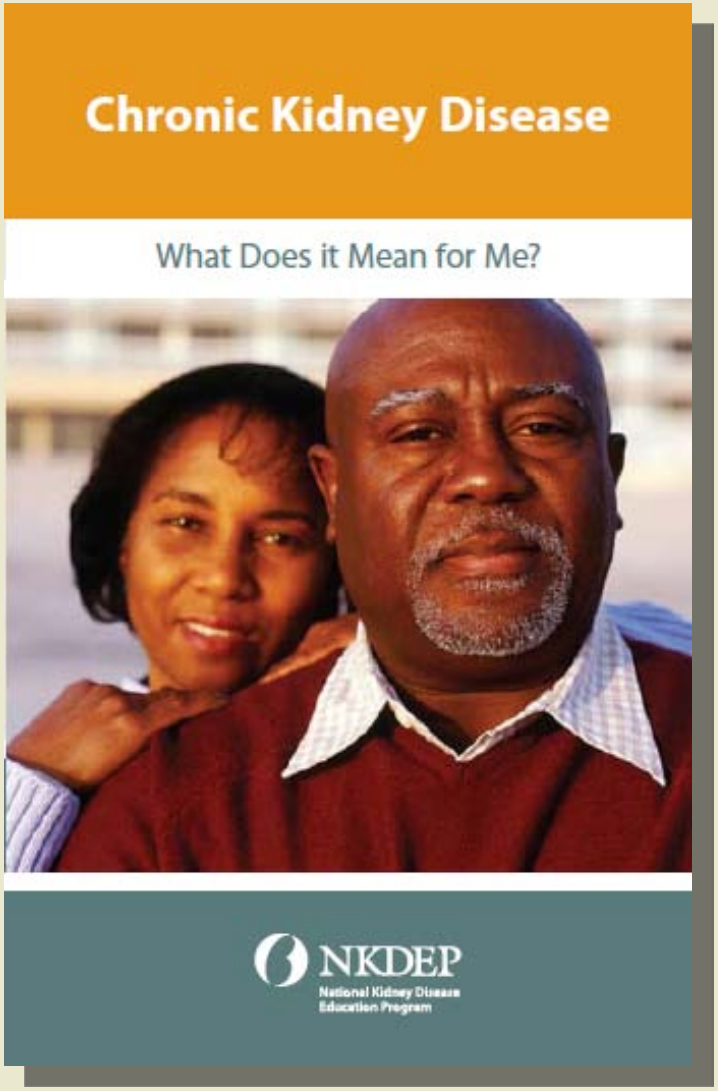
New Materials

CKD Brochure



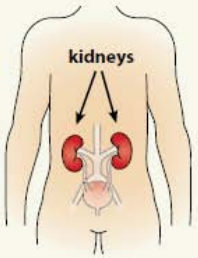
New Materials

CKD Brochure

Chronic Kidney Disease: The Basics

You've been told that you have chronic kidney disease (CKD). What does that mean? And what does it mean for your health and your life? This booklet will help answer some of the questions you might have.

You have two kidneys, each about the size of your fist. Their main job is to filter wastes and excess water out of your blood to make urine. They also keep the body's chemical balance, help control blood pressure, and make hormones.



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CKD means that your kidneys are damaged and can't filter blood like they should. This damage can cause wastes to build up in your body. It can also cause other problems that can harm your health.

CKD is often a "progressive" disease, which means it can get worse over time. CKD may lead to kidney failure. The only treatment options for kidney failure are dialysis or a kidney transplant.

You can take steps to keep your kidneys healthier longer:

- Choose foods with less salt (sodium).
- Keep your blood pressure below 130/80.
- Keep your blood glucose in the target range, if you have diabetes.

New Materials

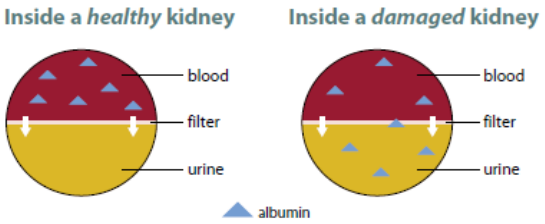
CKD Brochure

CKD and My Health

How does my health care provider know I have CKD?

Chances are, you feel normal and were surprised to hear that you have CKD. It is called a "silent" disease, because many people don't have any symptoms until their kidneys are about to fail. The only way to know is to get your kidneys checked with blood and urine tests.

1. A blood test checks your GFR, which tells how well your kidneys are filtering. GFR stands for glomerular filtration rate.
2. A urine test checks for albumin. Albumin is a protein that can pass into the urine when the kidneys are damaged. See picture below.



These two tests are used to monitor CKD and make sure that treatment is working. See pages 9 and 10 to learn more about these tests and track your results.

What causes CKD?

Diabetes and high blood pressure are the most common causes of CKD. There are other causes, too.

Your provider will look at your health history and may do other tests. You need to know why you have CKD, so your treatment can also address the cause of the CKD.

What medicines are used to treat CKD?

People with CKD often take medicines to lower blood pressure, control blood glucose, and lower blood cholesterol. Two types of blood pressure medicines—ACE inhibitors and ARBs—may slow CKD and delay kidney failure, even in people who don't have high blood pressure. Many people need to take two or more medicines for their blood pressure. They also may need to take a diuretic (water pill). The goal is to keep your blood pressure below 130/80.

Do I need to change my medicines?

Some medicines are not safe for people with CKD. Other medicines need to be taken in smaller doses. Tell your provider about all the medicines you take, including over-the-counter medicines (those you get without a prescription), vitamins, and supplements.

New Materials

CKD Brochure

Can CKD affect my health in other ways?

People with CKD often have high blood pressure. They can also develop anemia (low number of red blood cells), bone disease, malnutrition, and heart and blood vessel diseases.

What tests will help track my CKD?

The blood and urine tests used to check for CKD are also used to monitor CKD. You need to keep track of your test results to see how you're doing.

5

Track your blood pressure. In most cases, you should keep it below 130/80.

If you have diabetes, monitor your blood glucose and keep it in your target range. Like high blood pressure, high blood glucose can be harmful to your kidneys.

See page 9 of this booklet for more information on tracking your test results.

Will I have to go on dialysis?

Some people live with CKD for years without going on dialysis. Others progress quickly to kidney failure. You may delay dialysis if you follow your provider's advice on medicine, diet, and lifestyle changes.

If your kidneys fail, you will need dialysis or a kidney transplant. Most people with kidney failure are treated with dialysis.

Will I be able to get a kidney transplant instead of going on dialysis?

Some people with kidney failure may be able to receive a kidney transplant. The donated kidney can come from someone you don't know who has recently died, or from a living person—a relative, spouse, or friend. A kidney transplant isn't for everyone. You may have a condition that makes the transplant surgery dangerous or not likely to succeed.

6

CKD and My Lifestyle

People with CKD can and should continue to live their lives in a normal way: working, enjoying friends and family, and staying active. They also need to make some changes as explained here.

Do I need to change what I eat?

What you eat may help to slow down CKD and keep your body healthier. Some points to keep in mind:

	Choose and prepare foods with less salt (sodium). Use less salt at the table.
	Select the right kinds and smaller amounts of protein.
	Choose foods that are healthy for your heart, like lean cuts of meat, skinless chicken, fish, fruits, vegetables, and beans.
	Read the Nutrition Facts Label, especially for sodium, to help you pick the right foods and drinks.

Your provider may refer you to a dietitian. Your dietitian will teach you how to choose foods that are easier on your kidneys. You will also learn about the nutrients that matter for CKD.

Do I need to change what I drink?

- Water —You don't need to drink more water unless you have kidney stones. Drink as much water as you normally do.
- Soda and other drinks — If you are told to limit phosphorus, choose light-colored soda (or pop), like lemon-lime, and homemade iced tea and lemonade. Dark-colored sodas, fruit punch, and some bottled and canned iced teas can have a lot of phosphorus.
- Juice — If you are told to limit potassium, drink apple, grape, or cranberry juice instead of orange juice.
- Alcohol — You may be able to drink small amounts of alcohol. Drinking too much can damage the liver, heart, and brain and cause serious health problems.

Is smoking cigarettes bad for my kidneys?

Take steps to quit smoking as soon as you can. Cigarette smoking can make kidney damage worse.

New Materials

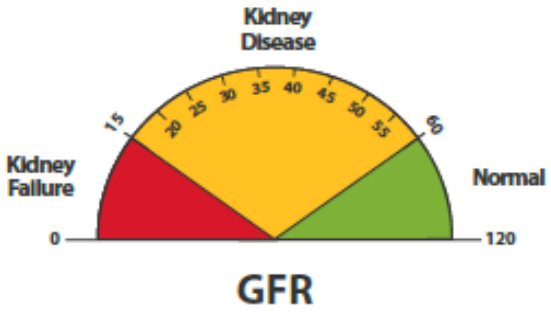
CKD Brochure

CKD: Tracking My Test Results

You are the most important person on your health care team. Know your test results and track them over time to see how your kidneys are doing. Bring this card to your health care visits and ask your provider to complete it.

Blood pressure — The most important thing you can do to slow down CKD is keep your blood pressure below 130/80. This can delay or prevent kidney failure.

GFR — The GFR tells you how well your kidneys are filtering blood. You can't raise your GFR. The goal is to keep your GFR from going down to prevent or delay kidney failure. See the dial picture below.



9

Urine albumin — Albumin is a protein in your blood that can pass into the urine when kidneys are damaged. You can't undo kidney damage, but you may be able to lower the amount of albumin in your urine with treatment. Lowering your urine albumin is good for your kidneys.

A1C — A1C test is a lab test that shows your average blood glucose level over the last 3 months. The goal is less than 7 for most people with diabetes. Lowering your A1C can help you to stay healthy. (For people with diabetes only.)

10

New Materials

CKD Brochure

Where can I get more information?

National Kidney Disease Education Program
www.nkdep.nih.gov
1-866-4 KIDNEY (1-866-454-3639)

National Kidney and Urologic Disease Information Clearinghouse
www.kidney.niddk.nih.gov • 1-800-891-5390

American Association of Kidney Patients
www.aakp.org • 1-800-749-2257

American Kidney Fund
www.kidneyfund.org • 1-800-638-8299

National Kidney Foundation
www.kidney.org • 1-800-622-9010

Participants in clinical trials can play a more active role in their own health care, gain access to new research treatments before they are widely available, and help others by contributing to medical research. For more information, visit *www.clinicaltrials.gov*.

U.S. Department of Health and Human Services
National Institutes of Health
NIDDK
NKDEP National Kidney Disease Education Program

The National Kidney Disease Education Program (NKDEP) encourages people to get tested for kidney disease and educates those with kidney disease and their health care providers about treatments that can help delay or prevent kidney failure. NKDEP is a program of the National Institutes of Health (NIH).

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National Kidney Disease Education Program
www.nkdep.nih.gov
1-866-454-3639 (1-866-4 KIDNEY)

Tips for People with CKD

- Choose foods with less salt
- Keep your blood pressure below 130/80
- Track your tests results
- Keep your blood glucose in the target range—if you have diabetes

My Test Results

NKDEP National Kidney Disease Education Program

Test	Result/Date	Result/Date	Result/Date	Result/Date
Blood pressure *Goal: Less than 130/80*				
GFR *Goal: Keep from going down*				
Urine albumin *Goal: The lower the better*				
A1C (for people with diabetes) *Goal: Less than 7*				

New Materials

Diet Report Card

Your Kidney Test Results

NKDEP National Kidney Disease Education Program

Name: _____ Date: _____

Chronic Kidney Disease (CKD) Tests	Results	Why It Is Important
Glomerular Filtration Rate (GFR)	CKD is less than 60 **Your Result:**	GFR estimates how well your kidneys are filtering blood. Your goal is to keep your GFR from going down.
Urine Albumin-to-Creatinine Ratio (UACR)	CKD is more than 30 **Your Result:**	Urine albumin checks for kidney damage. The lower the result, the better.

Other Important Tests	Results	Why It Is Important
Blood Pressure	Goal: Below 130/80 **Your Result:**	High blood pressure makes the heart work harder and can damage blood vessels in the kidneys.
Serum Albumin	Normal: 3.4 to 5.0* **Your Result:**	Albumin is a protein that helps measure how well you are eating.
Bicarbonate	Normal: More than 22 **Your Result:**	Bicarbonate measures the acid level in your blood.
Blood Urea Nitrogen (BUN)	Normal: Less than 20 **Your Result:**	BUN checks how much urea, a waste product, is in your blood.
Potassium	Normal: 3.5 to 5.0* **Your Result:**	Potassium affects how your nerves and muscles are working. High or low levels can be dangerous.
Calcium	Normal: 8.5 to 10.2* **Your Result:**	Calcium keeps your bones strong and your heart rhythm steady. CKD can lower the amount of calcium in your bones.
Phosphorus	Normal: 2.7 to 4.6* **Your Result:**	Phosphorus is important for strong bones and healthy blood vessels. High levels may cause soft bones, hard blood vessels and itchy skin.
Parathyroid Hormone (PTH)	Normal: Less than 65 **Your Result:**	PTH controls the calcium and phosphorus levels in your blood. It is needed to keep bones and blood vessels healthy.
Vitamin D	Normal: More than 30 **Your Result:**	Vitamin D is important for bones and heart health.

*Normal ranges may vary.

1

Your Kidney Test Results

Other Important Tests, continued	Results	Why It Is Important
A1C (for patients with diabetes)	Goal: Less than 7 **Your Result:**	A1C measures average blood sugar levels over 2 – 3 months.
Total Cholesterol	Normal: Less than 200 **Your Result:**	Cholesterol measures the amount of fat in your blood. Too much cholesterol can clog blood vessels or arteries in the heart and kidneys.
HDL Cholesterol	Normal: More than 40 **Your Result:**	HDL is the good cholesterol and clears bad fats out of your arteries.
LDL Cholesterol	Normal: Less than 100 **Your Result:**	LDL is the bad cholesterol and can clog your arteries.
Triglycerides	Normal: Less than 150 **Your Result:**	Triglyceride is a type of fat in the blood.
Hemoglobin (Hgb)	Normal: 11 to 12* **Your Result:**	Low hemoglobin is a sign of anemia. Anemia occurs when you don't have enough red blood cells and feel tired.

*Normal ranges may vary.

Notes: _____

For more information, visit *www.nkdep.nih.gov* or call 1-866-4 KIDNEY (1-866-454-3639).

The National Kidney Disease Education Program (NKDEP) encourages people to get tested for kidney disease and educates those with kidney disease and their providers about treatments that can help delay or prevent kidney failure. NKDEP is a program of the National Institutes of Health.

U.S. Department of Health and Human Services, National Institutes of Health

NIDDK National Institute of Diabetes and Digestive and Kidney Diseases

NKDEP National Kidney Disease Education Program

NIH Publication No. 10-7407 • April 2010

2

NKDEP
National Kidney Disease Education Program

Chronic Kidney Disease (CKD) and Diet: Assessment, Management, and Treatment

Treating CKD Patients Who Are Not on Dialysis
An Overview Guide for Dietitians

National Kidney Disease Education Program
National Institutes of Health

NKDEP
National Kidney Disease Education Program

This document, developed by the National Kidney Disease Education Program (NKDEP), is intended to help registered dietitians (RDs) provide effective medical nutrition therapy (MNT) to CKD patients who are not on dialysis.

I. About CKD

The kidneys regulate the composition and volume of blood, remove metabolic wastes in the urine, and help control the acid/base balance in the body. They activate vitamin D needed for calcium absorption, and produce erythropoietin needed for red-blood-cell synthesis.

CKD is typically a progressive disease. It is defined as

- reduction of kidney function—defined as an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m^2; and/or
- evidence of kidney damage, including persistent albuminuria—defined as ≥30 mg of urine albumin per gram of urine creatinine

Kidney failure is typically defined as an eGFR <15 mL/min/1.73 m^2.

CKD is detected and monitored by two tests:

- Estimated glomerular filtration rate (eGFR) and
- Urine albumin-to-creatinine ratio (UACR)

The purpose of diet therapy for CKD is to maintain good nutritional status, slow progression, and to treat complications. The key diet components to slowing progression of CKD are

- controlling blood pressure by reducing sodium intake
- reducing protein intake, if excessive
- managing diabetes

CKD RISK FACTORS

Diabetes
Hypertension
Family history of kidney failure
Cardiovascular disease
Recurrent urinary tract infections
HIV infection
Immunological diseases

As eGFR declines, complications occur more commonly and are more severe. These may include

- malnutrition
- metabolic acidosis due to reduced acid (hydrogen ion) excretion
- hyperkalemia
- mineral imbalance and bone disorder (calcium, phosphorus, and vitamin D)
- anemia due to impaired erythropoiesis and low iron stores
- cardiovascular disease (CVD) (dyslipidemia)

II. Assess Kidney Function and Damage

Test and Its Relevance	Results	Assessment
Estimated Glomerular Filtration Rate (eGFR) eGFR estimates kidney function. As eGFR declines, complications are more likely and more severe.	eGFR (mL/min/1.73m^2) Normal >60 CKD 15-60 Kidney failure <15	• Evaluate eGFR to assess kidney function; track over time to monitor effectiveness of diet therapy. • Stable eGFR may indicate therapy is working. • Decline of eGFR reflects progression of CKD. **Additional Information** Each filtering unit of the kidney, or nephron, filters a tiny amount of plasma each minute. eGFR reflects the total filtration of all two million nephrons. As nephrons are damaged or destroyed, eGFR declines. The quantity or volume of urine may not change significantly as eGFR declines. However, what is excreted into the urine does change. Rapidly declining eGFR may warrant appropriate discussion of renal replacement therapies. In adults, the best equation for estimating eGFR from serum creatinine is the Modification of Diet in Renal Disease (MDRD) Study equation (Levey, 1999). NKDEP offers calculators online and as downloadable applications for estimating GFR. Serum creatinine level, age, gender, and race are needed. Many laboratories routinely report eGFR with all serum creatinine determinations.
Urine Albumin-to-Creatinine Ratio (UACR) UACR is the preferred measure for screening, assessing, and monitoring kidney damage. UACR estimates 24-hour urine albumin excretion. Unlike a dipstick test for urine albumin, UACR is unaffected by variation in urine concentration.	UACR (mg/g) Normal 0-29 Albuminuria >30	• Evaluate UACR over time to assess response to therapy and monitor progression of CKD. • Change in albuminuria may reflect response to therapy and risk for progression. • A decrease in urine albumin may be associated with improved renal and cardiovascular outcomes. **Additional Information** Normally, functioning kidneys excrete very small amounts of albumin into the urine. Albuminuria usually reflects damage to the glomerulus—the "filter" of the nephron. Albuminuria is an independent risk factor for CKD progression (Hemmelgarn, 2010) and is considered a marker for CVD and mortality in hypertension. Reducing urine albumin to normal or near-normal levels may improve cardiovascular prognoses.

III. Slow Progression

Therapeutic Goal and Its Relevance	Ranges/Goals	Dietary Intervention
Control Blood Pressure Blood pressure control slows progression of CKD and lowers CVD risk. Sodium plays a large role in blood pressure control in CKD as a result of alterations in sodium excretion by the kidneys.	Goal <130/80mm Hg	• Limit sodium intake to 2,300mg a day or less (Sacks, 2001). • Weight reduction may be beneficial. • Monitor serum potassium in patients on renin angiotensin system (RAS) antagonists; limit dietary potassium intake when serum potassium >5mEq/L. **Additional Information** For patients with hypertension, reduction of dietary sodium has been associated with improved blood pressure control in clinical trials and epidemiological studies. Multiple medications may be required to control blood pressure. RAS antagonists, such as angiotensin-converting enzyme inhibitors (ACEi) or angiotensin receptor blockers (ARBs), are often used to control blood pressure, delay progression, reduce albuminuria, and protect against heart disease. Diuretics are prescribed to treat fluid overload and high blood pressure, and may help control serum potassium levels.
Reduce Albuminuria Decreased albuminuria is associated with slower progression of CKD, particularly in diabetics. Limiting dietary protein may reduce albuminuria and improve blood glucose control, hyperlipidemia, blood pressure, renal bone disease, and metabolic acidosis.	Reduce or stabilize the amount of albumin lost in the urine (see UACR above on page 2).	Limit excessive dietary protein as follows: • Nondiabetic: 0.8g protein/kg/day • Diabetic: 0.8-1.0g protein/kg/day **Additional Information** Limiting excessive protein may activate adaptive responses that decrease albuminuria and increase serum albumin, without increasing risk for protein malnutrition.

Page 3

CKD and Diet: Assessment, Management, and Treatment

New Materials

Provider Resource

Therapeutic Goal and Its Relevance	Ranges/Goals	Dietary Intervention
Manage Diabetes Blood glucose control may help slow progression of CKD (DCCT,1993; UKPDS,1998)	A1C ≤7%	• Consider less-stringent control for patients with histories of hypoglycemia, the elderly, and patients with multiple co-morbid conditions. • Instruct patients to treat hypoglycemia with cranberry juice cocktail, grape or apple juice, glucose tablets, or 10 jelly beans to prevent hyperkalemia. **Additional Information** As eGFR declines, renal metabolism of insulin and certain oral diabetes medications are reduced, potentially causing hypoglycemia in diabetes (Snyder, 2004). Unexplained improvement in glucose control may reflect progression of CKD. Low-protein diets have been associated with improved insulin sensitivity and fasting serum insulin levels, lower insulin requirements and blood glucose levels; and a decrease in endogenous glucose production in patients with diabetes.

IV. Prevent, Monitor, and Treat Complications

Data is limited for CKD. Many of the recommendations for CKD are extrapolated from renal replacement therapies literature.

Complication and Its Relevance	Ranges/Goals*	Dietary Intervention
Malnutrition Malnutrition is common in CKD; as eGFR declines, so may appetite. Malnutrition in CKD patients is associated with increased morbidity and mortality.	Albumin >4g/dL Normal range: 3.4-5.0g/dL Serum albumin <4g/dL, prior to initiation of dialysis, may predict morbidity and mortality (Lowrie, 1990). Blood urea nitrogen (BUN) <20mg/dL	• Manage with adequate calories and nutrients. • Water-soluble vitamin supplementation may be indicated due to the restricted protein intake. Vitamin C is typically not supplemented above the Dietary Reference Intake, as it may cause oxalosis. Vitamins A, E, and K can accumulate more rapidly in CKD and are not recommended for supplementation. Specific renal vitamin formulas are available for dialysis patients. **Additional Information** Serum albumin is used to monitor nutritional status. Hypoalbuminemia may result from reduced protein and/or calorie intake, uremia, metabolic acidosis, albuminuria, inflammation, or infection. Although not used to indicate nutritional status, elevated BUN may be associated with aversion to certain high-biological-value protein foods. Appetite may improve in renal failure with adequate renal replacement therapy (i.e., dialysis treatment or kidney transplantation).
Metabolic Acidosis Patients with CKD are at risk for metabolic acidosis as a result of reduced excretion of acid load.	Bicarbonate (CO_2) >22mEq/L Normal range: 21-28mEq/L	• Dietary protein is a source of metabolic acid. Serum bicarbonate levels may increase with dietary protein restriction. • Sodium bicarbonate supplementation may be prescribed to improve nutritional parameters and slow rate of CKD progression (de Brito-Ashurst, 2009). Monitor blood pressure closely when this medication is used, as some patients may experience elevated blood pressure associated with increased sodium load. **Additional Information** Metabolic acidosis is thought to result in loss of bone and muscle mass, negative nitrogen balance, increased protein catabolism, and decreased protein synthesis (ibid).

Complication and Its Relevance	Ranges/Goals*	Dietary Intervention
Hyperkalemia Patients with CKD are at risk for hyperkalemia as a result of reduced potassium excretion, intake of high-potassium foods, metabolic acidosis, and medications that inhibit potassium excretion, such as RAS antagonists for blood pressure control.	Potassium 3.5–5.0 MEq/L Hyperkalemia is usually not seen until CKD is advanced, but may be seen at a higher eGFR in diabetics.	• Counsel patients to restrict dietary potassium when serum level is 5mEq/L or higher. • Caution patients to avoid potassium-containing salt substitutes. • Instruct patients with diabetes to treat hypoglycemia with cranberry juice cocktail, grape or apple juice, glucose tablets, or 10 jelly beans to prevent hyperkalemia. • Counsel patients to adhere to sodium bicarbonate, if prescribed. Correction of acidosis may lower potassium. **Additional Information** The potassium content of most vegetables can be decreased through a process of leaching. Leaching entails slicing and soaking the vegetable overnight in water, then draining and boiling the vegetable in new water. A recent study, however, shows that white potatoes do not need to be soaked overnight (Bethke & Jansky, 2008). The potassium content of other tuberous root vegetables commonly eaten in the Caribbean and South America has been shown to be reduced somewhat by double-cooking, however, most still remained higher than 200mg per serving (Burrowes & Ramer, 2006).

Complication and Its Relevance	Ranges*/Goals	Dietary Intervention
CKD Mineral and Bone Disorder (CKD-MBD) CKD-MBD is renal bone disease that occurs when the kidneys fail to maintain serum calcium and phosphorus levels.	See sections on calcium, phosphorus, parathyroid hormone (PTH), and vitamin D.	Existing guidelines on management of CKD-MBD reflect consensus rather than high-grade evidence. Early intervention may help prevent vascular calcification and secondary hyperparathyroidism. The kidneys maintain calcium and phosphorus levels and activate vitamin D. As kidney function declines, complex interactions occur that affect calcium, phosphorus, vitamin D, and the parathyroid gland. Abnormal levels of PTH (measured as intact or iPTH) may be seen. Mineral and bone disorders may result from these interactions. See the specific sections that follow. **Additional Information** Depending on the type of renal bone disease, calcium, phosphorus, and iPTH may be normal, decreased, or elevated. • **Secondary hyperparathyroidism** is associated with high bone turnover, and elevated levels of calcium, phosphorus, iPTH, and alkaline phosphatase. • **Osteomalacia** results in low bone turnover with elevated serum calcium levels and normal-to-decreased serum phosphorus, iPTH, and alkaline phosphatase. • **Adynamic bone disease** results in low bone turnover and may be characterized by normal-to-low iPTH and alkaline phosphatase. Serum calcium and phosphorus may be normal to elevated. • **Mixed bone disease,** as the name implies, has features of both low and high bone turnover.
Calcium Control of calcium and phosphorus levels helps control PTH.	Calcium 8.5-10.2mg/dL Maintain within normal range. Use formula to correct calcium with hypoalbuminemia: Corrected calcium (mg/dL) = total calcium (mg/dL) + 0.8 x [4-serum albumin (g/dL)]	• Dietary calcium recommendations for CKD have yet to be established. • Calcium-based phosphate-binding medications can increase total daily intake and elevate calcium. • Supplementation with active vitamin D increases the risk for hypercalcemia.

Complication and Its Relevance	Ranges*/Goals	Dietary Intervention
Phosphorus Control of phosphorus and calcium levels helps control PTH.	Phosphorus 2.7-4.6mg/dL Maintain within normal range. Serum phosphorus levels may be "normal" until CKD is advanced.	• If serum phosphorus is elevated, dietary phosphorus restriction may be indicated. The recommended level of restriction has yet to be determined in CKD. • Dietary protein restriction decreases phosphorus intake. If further restriction is needed, counsel patients to reduce intake of foods with added phosphorus. (Uribarri, 2007) • Counsel patients to read ingredient lists for "phos" to identify foods with phosphate additives, as the additives may be absorbed more efficiently than food sources. • Limiting whole grains may help if further reduction is needed. • Phosphorus binders may be prescribed to lower phosphorus levels. Counsel patients to take binders with meals to help limit absorption of phosphorus from food and beverages. **Additional Information** Calcium acetate and calcium carbonate are common calcium-containing phosphate binders. Calcium citrate is not recommended as a phosphate binder for CKD patients, because it may increase aluminum absorption. Other binders, used more often in renal replacement therapy, are typically composed of resins (sevelamer carbonate) and earth metals (lanthanum carbonate).
Parathyroid hormone (PTH) Secondary hyperparathyroidism (elevated PTH) is associated with the most common cause of bone disease in CKD.	Normal PTH <65pg/mL Measured as iPTH PTH varies by level of kidney function and type of bone disease.	Dietary phosphorus restriction and use of active vitamin D or its analogs may help control PTH levels in CKD. Calcium supplementation may help as well. **Additional Information** PTH is the hormone that regulates serum calcium levels. Low levels of $1,25(OH)_2D$, hypocalcemia and hyperphosphatemia stimulate PTH secretion. Its metabolic actions include mobilizing calcium and phosphorus from bone; increasing intestinal absorption and renal tubular reabsorption of calcium; and decreasing renal tubular reabsorption of phosphorus. PTH enhances conversion of 25(OH)D to $1,25(OH)_2D$. Consensus guidelines endorse higher PTH therapeutic goal at lower levels of eGFR.

Page 8 CKD and Diet: Assessment, Management, and Treatment

Complication and Its Relevance	Ranges*/Goals	Dietary Intervention
Vitamin D The kidneys activate 25(OH)D (calcidiol) to 1,25(OH)$_2$D (calcitriol or active vitamin D). Reduction of kidney function results in decreased production and conversion of calcidiol to calcitriol. There may be corresponding imbalances of calcium, phosphorus, and PTH.	Vitamin D >30nmol/L Measured as 25(OH)D Maintain within normal range (Holick, 2007).	• Supplementation may be indicated. Specific requirements in CKD have yet to be determined. • Ergocalciferol (vitamin D$_2$) or cholecalciferol (vitamin D$_3$) may be used in early CKD to replete Vitamin D. • Active vitamin D (calcitriol) or its analogs (doxercalciferol, paricalcitol, or alfacalcidol) may be used as eGFR declines (ibid). Monitor for hypercalcemia and/or hyperphosphatemia when using supplements. Active vitamin D increases calcium and phosphorus absorption.
Anemia Anemia may develop early during the course of CKD due to inadequate synthesis of erythropoietin by the kidneys.	Hemoglobin 11-12g/dL *Without CKD* Women: 12-16 Men: 14-17 Transferrin Saturation (TSAT) >20% Ferritin >100ng/mL *Without CKD* Women: 18-160 Men: 18-270	Both iron supplementation and injectable erythropoiesis-stimulating agents (ESAs) have been used to correct anemia. The risks and benefits of these treatments in CKD are not yet defined. **Additional Information** Hemoglobin is used to assess anemia in CKD. Uncomplicated anemia of CKD is usually normocytic and normochromic. TSAT is a measure of iron saturation. Transferrin transports iron absorbed by the intestines. Ferritin levels reflect iron stores.

Page 9

CKD and Diet: Assessment, Management, and Treatment

Complication and Its Relevance	Ranges/Goals*	Dietary Intervention
Cardiovascular Disease (CVD) Patients with CKD are at high risk for developing CVD; the risk increases as eGFR declines. CVD is the leading cause of mortality in CKD.	Total cholesterol <200mg/dL LDL cholesterol <100mg/dL HDL cholesterol >40mg/dL Triglycerides <150mg/dL	Decreasing intake of saturated and trans fats (substituting for monounsaturated and polyunsaturated fats), along with physical activity, can help control hyperlipidemia and reduce inflammation. **Additional Information** Controlling dyslipidemia may reduce the rate of decline in eGFR. To further decrease risk of developing CVD, pharmacological therapy may be necessary (Fried, 2001).

*Normal ranges may vary.

What does it mean if my child's urine albumin is too high?

It may mean your child has kidney disease. Your health care provider may do another test for kidney disease called GFR or glomerular filtration rate. This blood test checks how well your child's kidneys are filtering the blood.

What can we do if the tests show kidney disease?

If your child has kidney disease, it can often be treated. Your health care provider may give your child medicines to help keep his or her kidneys healthy and lower the amount of albumin in the urine.

For more information

About kidney disease in children:
Visit the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) website at www.kidney.niddk.nih.gov/kudiseases/topics/children.asp

About kidney disease:
Call the National Kidney Disease Education Program (NKDEP) toll free at 1-866-4-KIDNEY (1-866-454-3639), or go online at www.nkdep.nih.gov

U.S. Department of Health and Human Services
National Institutes of Health

NIDDK | National Institute of Diabetes and Digestive and Kidney Diseases

NKDEP National Kidney Disease Education Program

The National Kidney Disease Education Program (NKDEP) encourages people to get tested for kidney disease and educates those with kidney disease and their providers about treatments that can help delay or prevent kidney failure. NKDEP is a program of the National Institutes of Health.

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Draft

Does Your Child Need a Urine Test?

NKDEP
National Kidney Disease Education Program

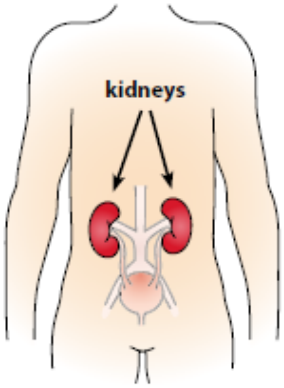
NKDEP
National Kidney Disease Education Program

Draft

Your child needs a urine test if he or she is at risk for kidney disease. Kidney disease has no early symptoms, so testing can help identify problems early, when treatment can do the most good. This brochure will help you find out if your child needs a urine test, what the test looks for, and what happens if kidney disease is found.

What do the kidneys do?

Your child has two kidneys. Their main job is to filter waste and extra water from the blood. Waste and water pass through the kidneys and leave the body as urine.



How do I know if my child needs a urine test?

Your child should have a urine test if he or she has certain diseases or conditions that increase risk for kidney disease. These include:

- Polycystic kidney disease, Alport syndrome, heart disease, or other conditions that run in families
- A "birth defect" of the urinary tract
- Diabetes, rickets (caused by too little vitamin D), a growth disorder, or other diseases that affect the whole body
- Overweight or obesity
- High blood pressure
- Certain infectious diseases

In addition, your child's urine should be checked if he or she complains about or you observe any of the following:

- Symptoms of a urinary tract infection
  - burning feeling while urinating
  - frequent need to urinate
  - back or lower belly pain
  - cloudy, dark, bloody, or odd-smelling urine
  - fever or chills
- Symptoms of a kidney stone (pain in the back or side)
- Bladder control problems or making more urine than usual
- Swelling of the feet, ankles, or legs
- Swollen eyelids in the morning
- Unexplained fever or illness
- Frequent dehydration

What does the urine test look for?

The test checks for albumin, which your child can't see or feel in the urine. Albumin is a protein in your child's blood that it is too big to pass through healthy kidneys. If your child's kidneys are damaged, small amounts of albumin can pass into the urine through the kidneys. In general, the more albumin in the urine, the more damaged the kidneys.

What does my child need to do?

Your child will need to urinate in a cup so that his or her urine can be tested.

NKDEP
National Kidney Disease Education Program

Draft A

Protecting Your Kid's Kidneys

Does your child need a urine test?

Children who are at risk for kidney disease need a urine test to find kidney damage early.

Who is at risk for kidney disease?

Children who have certain conditions that affect the whole body, such as:

- Diabetes
- Rickets (soft bones caused by too little vitamin D)
- A growth disorder
- Other conditions that run in families, such as polycystic kidney disease, Alport Syndrome or heart disease.

Children who:

- Are overweight
- Have high blood pressure
- Have pain in their back, side or lower belly
- Complain of pain when urinating, have changes in their urine, or often wet their pants
- Have unexplained fever
- Have swelling in their feet, ankles, or legs
- Wake up with swollen eyelids
- Become dehydrated often
- Have a family member with kidney disease

If your child is at risk for kidney disease, ask your pediatrician about getting your child's urine tested today.

NIDDK

NKDEP

Performance Measures

- Improve screening of patients with DM
  - eGFR and UACR
- Improve management of CKD
  - BP control
  - ACE inhibitors and ARBs
- Improve screening for complications
  - Anemia, malnutrition, metabolic bone disease, lipid disorders
- Improve CKD education: Four key concepts

Nephrology Referral

- To assist with diagnostic challenge (e.g. decision to biopsy)
- To assist with therapeutic challenge (e.g. blood pressure)
- Rapid progression
- Most primary kidney diseases, (e.g. glomerulonephridites)
- Preparation for renal replacement therapy

Guidelines on Referral

- CARI (Australia) GFR < 30
- CSN (Canada) GFR < 30
- EBPG (Europe) GFR < 30
- KDOQI GFR < 30

https://www.kdigo.org/

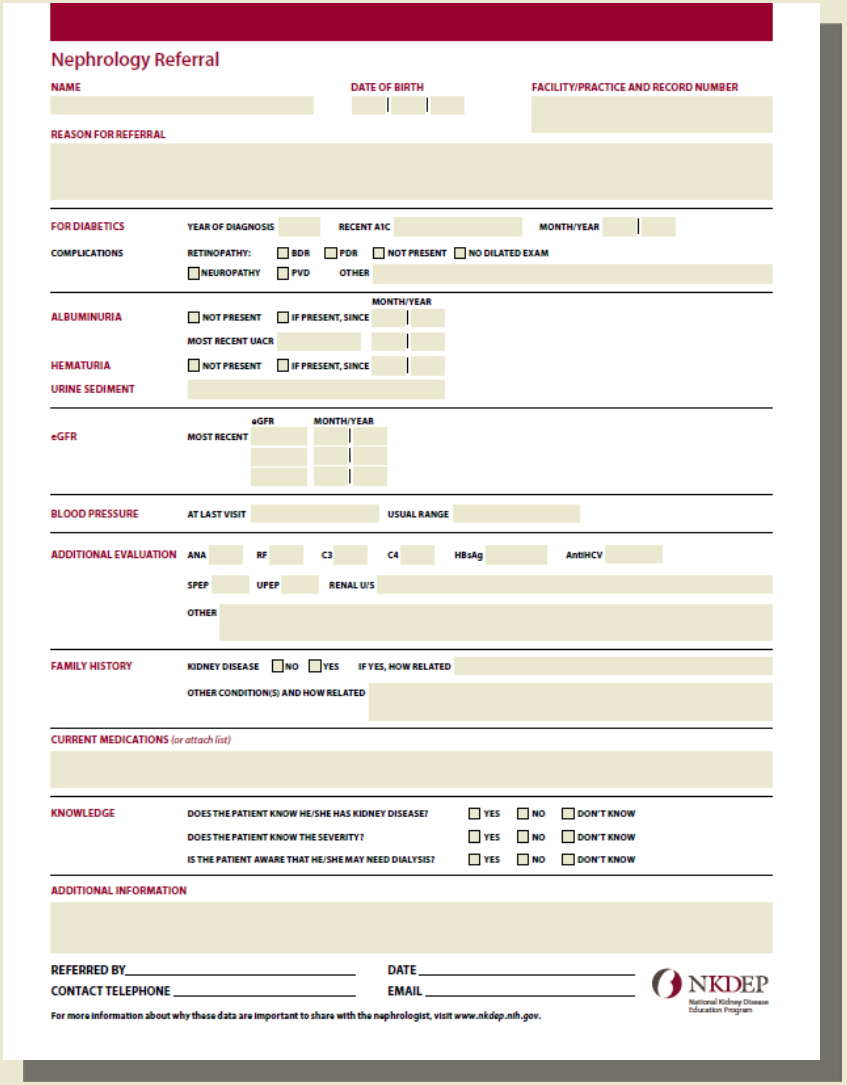
Does Early Intervention = Early Referral?

- ...how much of what nephrologists do could be done just as safely and effectively in primary care, and how much of an overlap is there between nephrology, diabetes, cardiology and the care of older people? (NICE, 2008)

www.nice.org.uk/cg073

Nephrology Referral

- Regardless of when you refer, consider:
  - Obtaining preliminary evaluation (e.g. ultrasound, screening serologies)
  - Providing consultant with patient history including serial measures of renal function
- Like all successful relationships, this requires work and good communication. Be explicit about what you want out of this relationship. Help your referring nephrologist be the consultant you need him/her to be.



Nephrology Referral

NAME

DATE OF BIRTH

FACILITY/PRACTICE AND RECORD NUMBER

REASON FOR REFERRAL

FOR DIABETICS YEAR OF DIAGNOSIS RECENT A1C MONTH/YEAR

COMPLICATIONS RETINOPATHY: ☐ BDR ☐ PDR ☐ NOT PRESENT ☐ NO DILATED EXAM

☐ NEUROPATHY ☐ PVD OTHER

ALBUMINURIA ☐ NOT PRESENT ☐ IF PRESENT, SINCE MONTH/YEAR

MOST RECENT UACR

HEMATURIA ☐ NOT PRESENT ☐ IF PRESENT, SINCE

URINE SEDIMENT

eGFR MOST RECENT eGFR MONTH/YEAR

BLOOD PRESSURE AT LAST VISIT USUAL RANGE

ADDITIONAL EVALUATION ANA RF C3 C4 HBsAg AntiHCV

SPEP UPEP RENAL U/S

OTHER

FAMILY HISTORY KIDNEY DISEASE ☐ NO ☐ YES IF YES, HOW RELATED

OTHER CONDITION(S) AND HOW RELATED

CURRENT MEDICATIONS *(or attach list)*

KNOWLEDGE DOES THE PATIENT KNOW HE/SHE HAS KIDNEY DISEASE? ☐ YES ☐ NO ☐ DON'T KNOW

DOES THE PATIENT KNOW THE SEVERITY? ☐ YES ☐ NO ☐ DON'T KNOW

IS THE PATIENT AWARE THAT HE/SHE MAY NEED DIALYSIS? ☐ YES ☐ NO ☐ DON'T KNOW

ADDITIONAL INFORMATION

REFERRED BY_____ DATE _____

CONTACT TELEPHONE _____ EMAIL _____

NKDEP National Kidney Disease Education Program

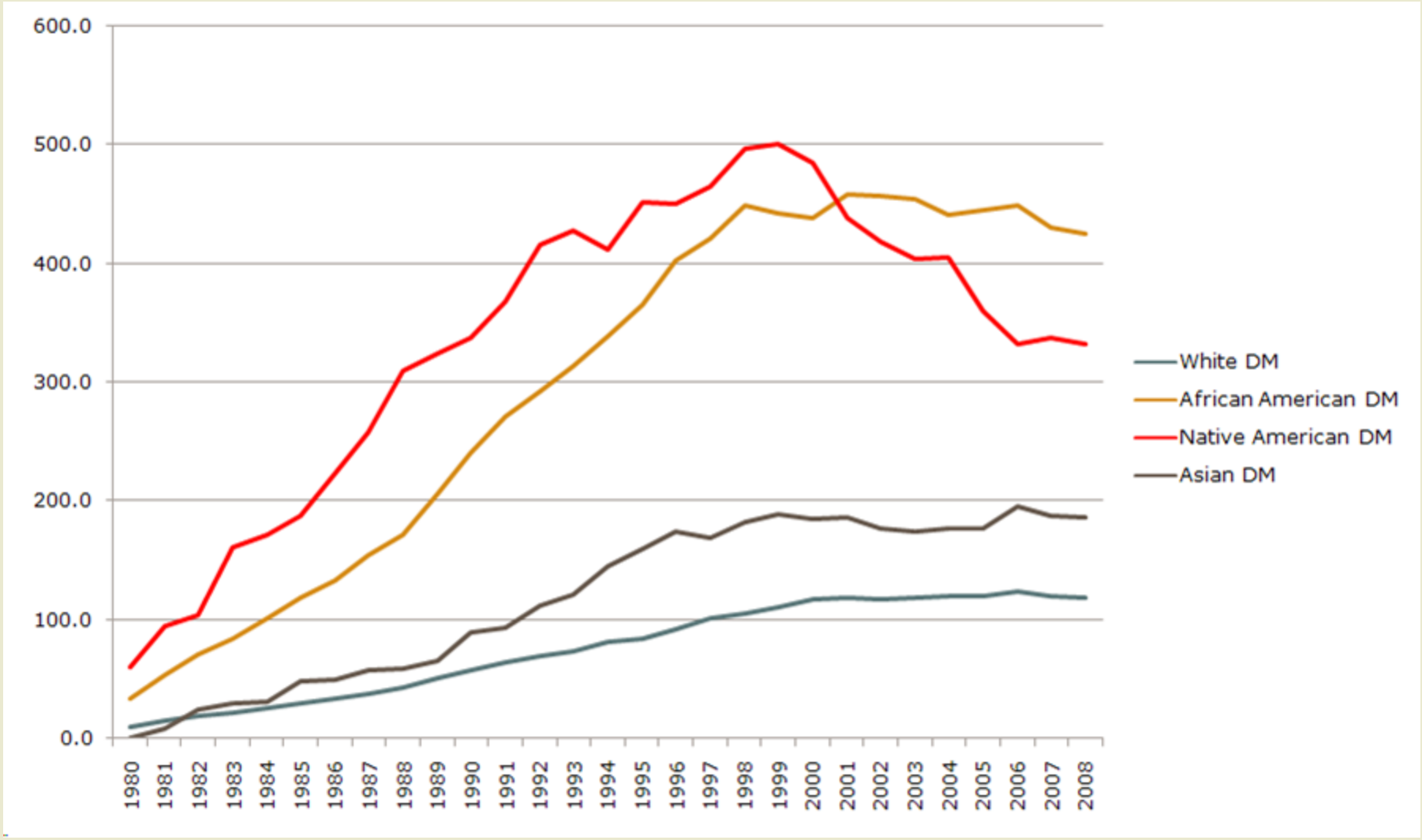
For more information about why these data are important to share with the nephrologist, visit www.nkdep.nih.gov.

Lessons Learned From IHS

- CKD is part of primary care
- Changing patterns of care requires changing “the system” (CCM)
- Improvement in care results from changes implemented by physicians and nonphysician health professionals
- Implemented through diabetes care delivery system; not specialty clinic based
- Surveillance and prevention are part of multisystem chronic disease control
- Emphasis on ensuring that patient received care from competent and interested individual, not referral

Incident Rates of ESRD due to Diabetes 1980-2008

per million population, by age, gender, race, and ethnicity



Improving CKD Care

- Improving the care of people with CKD requires changing clinical practice in settings where high risk populations are served
- Providers change their practice based on scientific evidence and the expectations of their patients
- Improving care of patients *prior* to referral to subspecialty care is necessary to provide better subspecialty care
- Achievement of this goal includes facilitating a redefinition of the primary care/nephrology relationship

Improving CKD/Bottom line

- Follow eGFR and UACR
- Control blood pressure
- Talk to the patient about CKD

Questions and Comments: andrew.narva@nih.gov