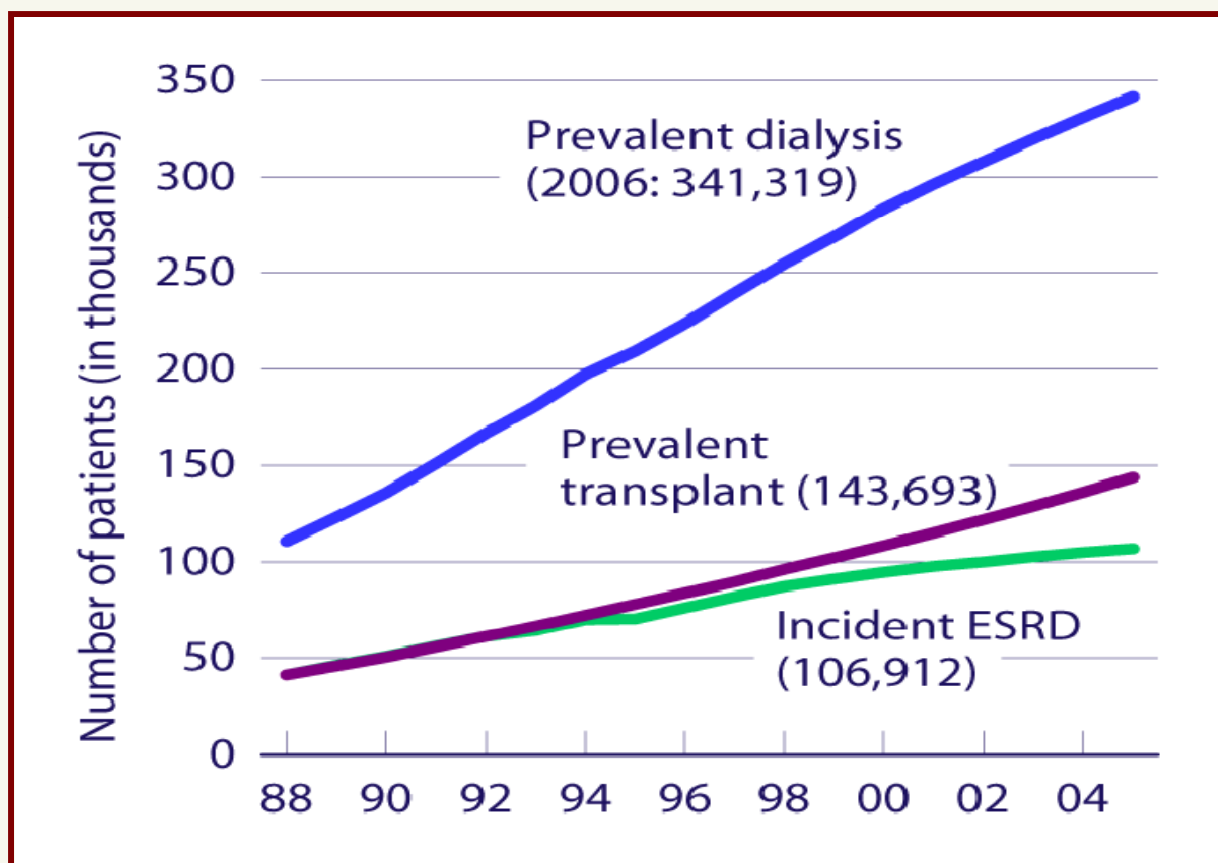


Chronic Kidney Disease

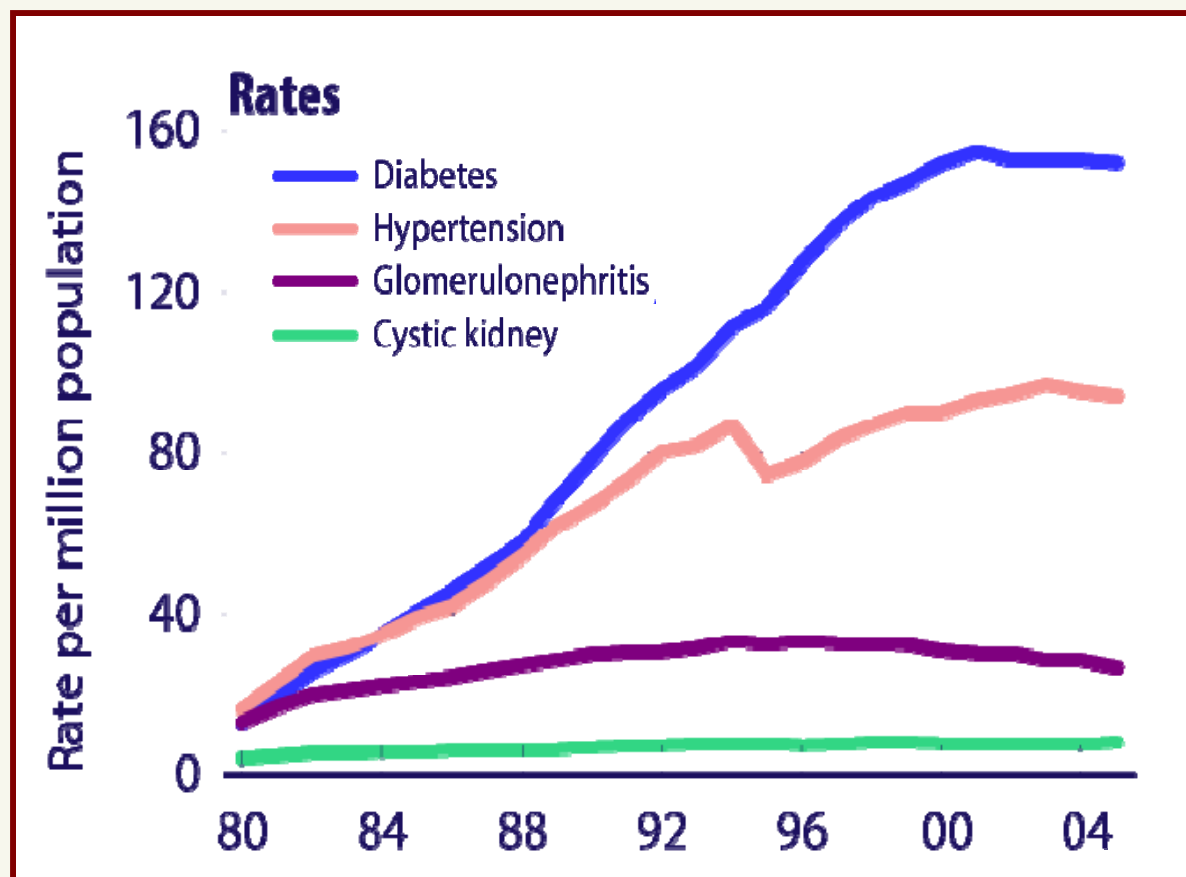
*Improving Patient Outcomes
in the Primary Care Setting*



Prevalence of ESRD has been rising steadily



Diabetes and hypertension are leading causes of kidney failure

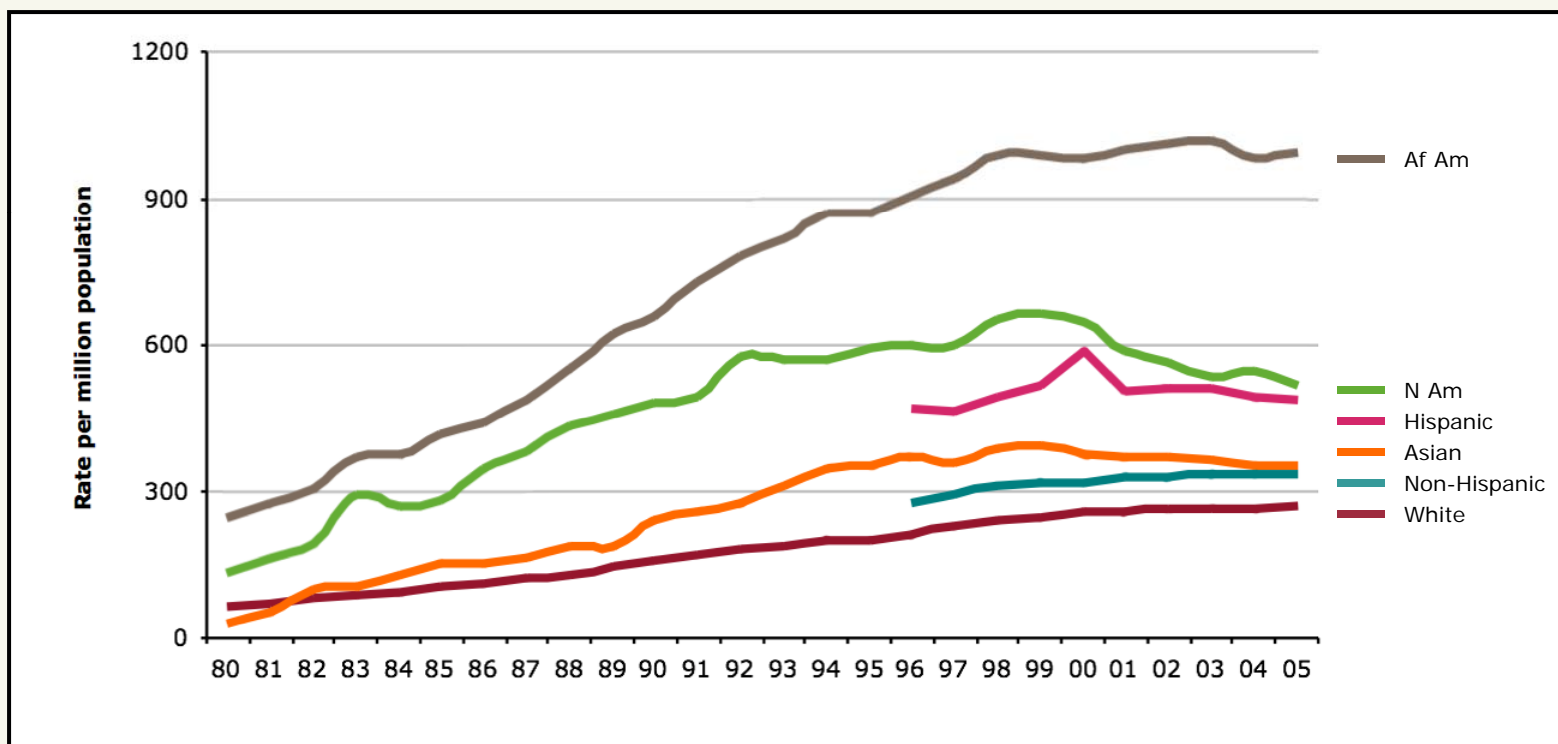


Incident ESRD rates, by primary diagnosis, adjusted for age, gender, & race.

Only certain conditions predispose to CKD

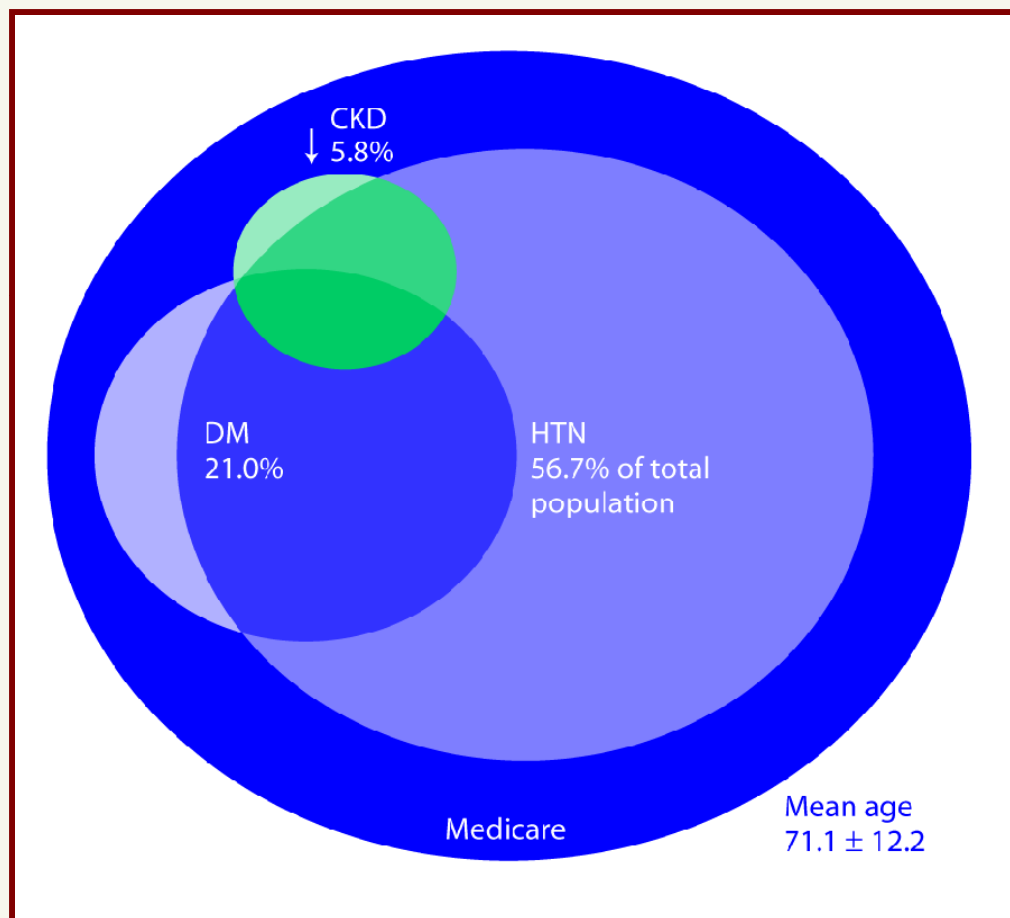
- Diabetes mellitus
- Hypertension
- Cardiovascular disease
- Family members of patients with ESRD

Incidence varies widely by race and ethnicity

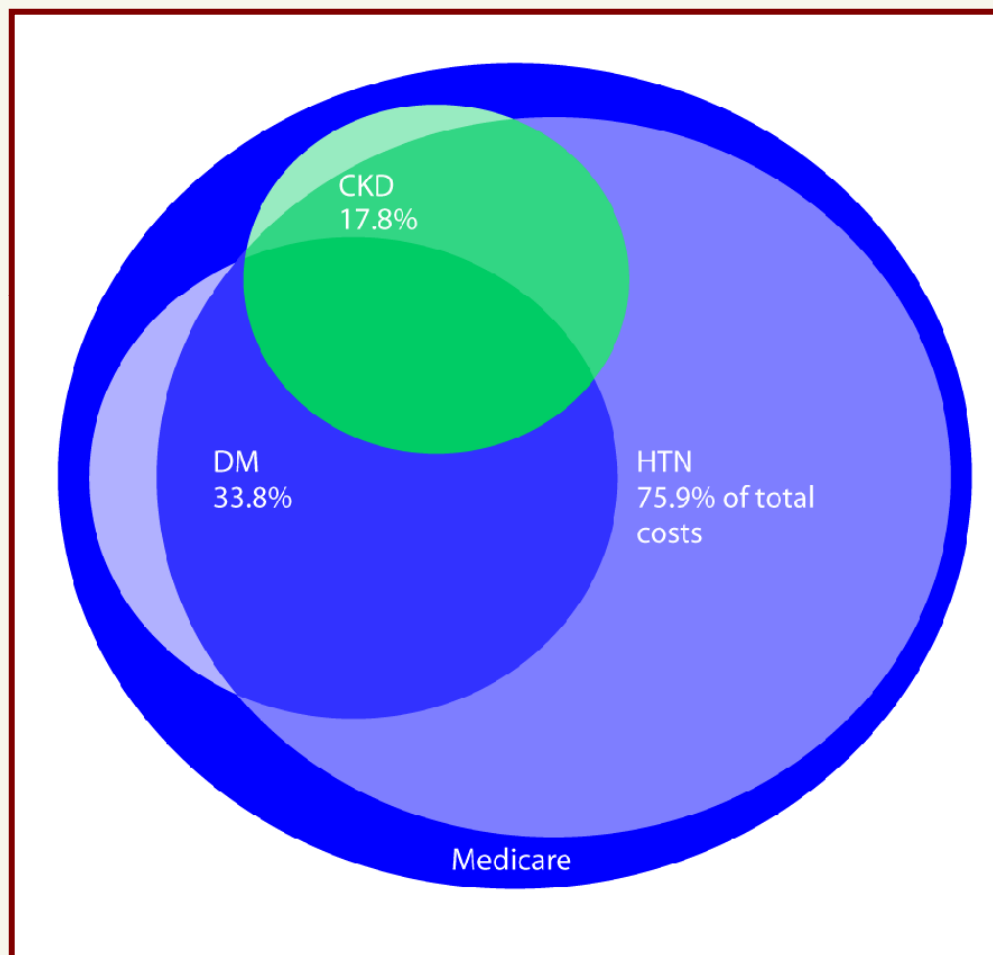


Incident ESRD patients; rates adjusted for age & gender.

Diabetes (DM) and hypertension (HTN) often coexist in CKD



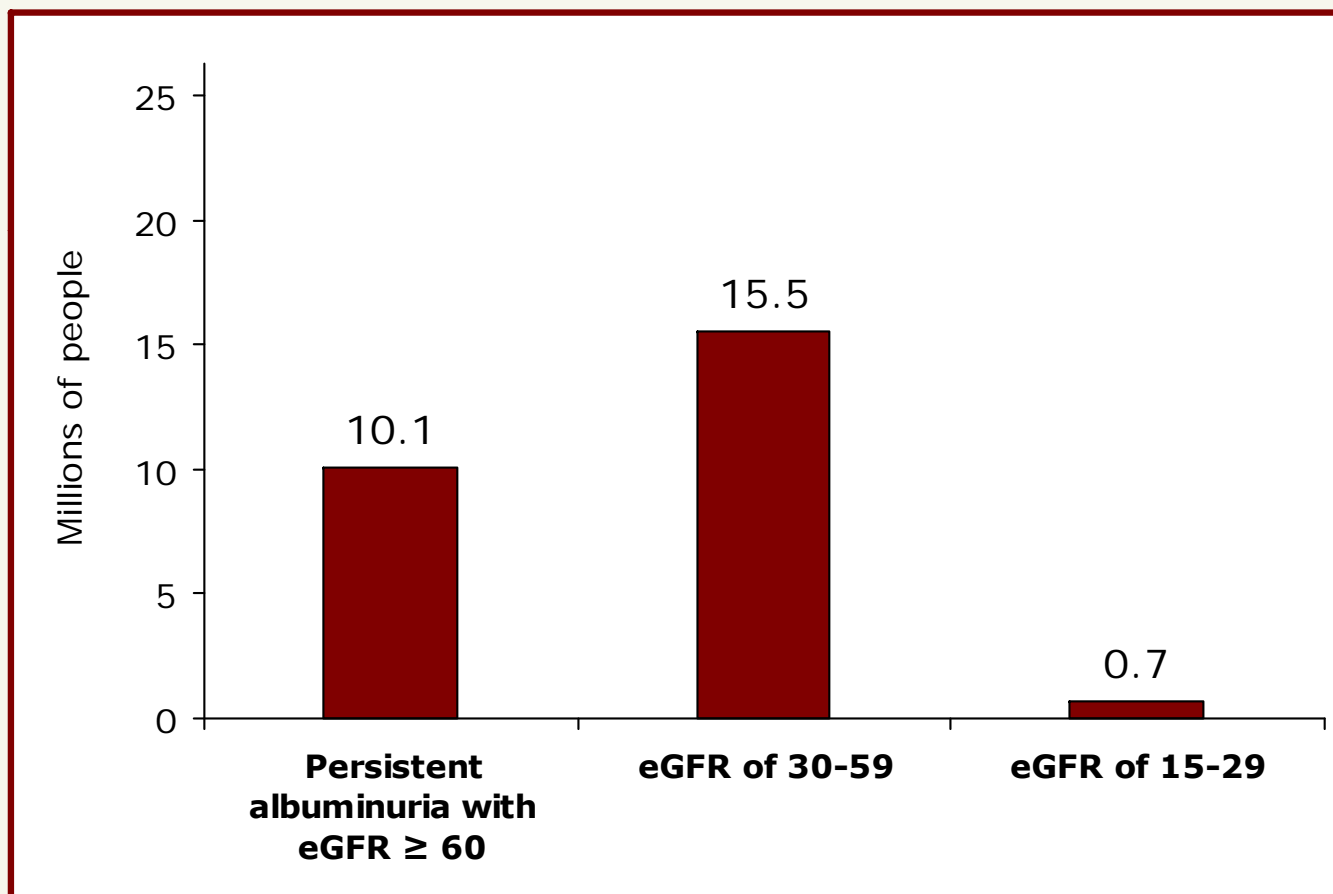
Distribution of CKD, HTN, & diabetic patients in Medicare population, 2004.



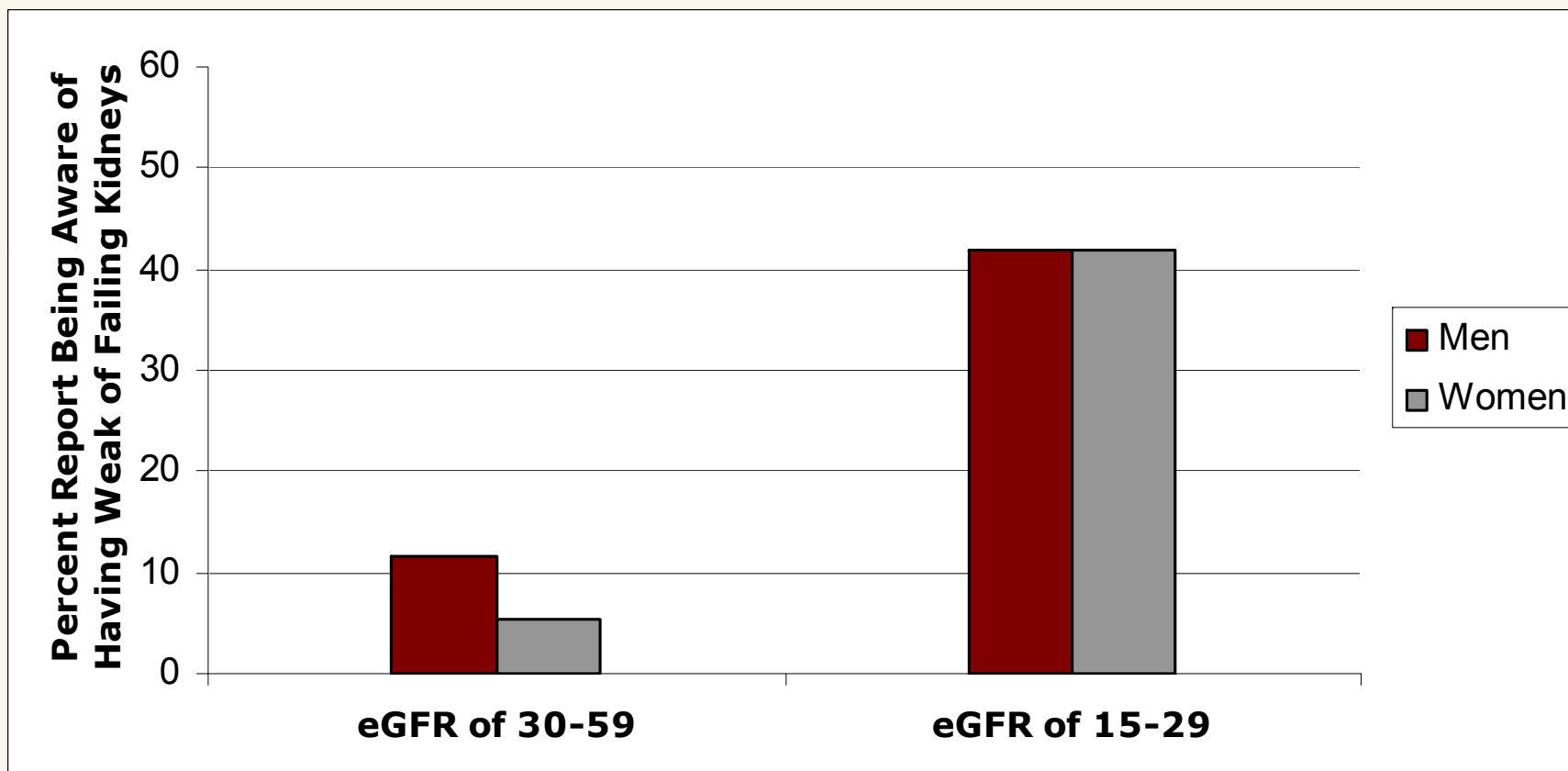
Distribution of costs for CKD, HTN, & diabetic patients in Medicare population, 2004.

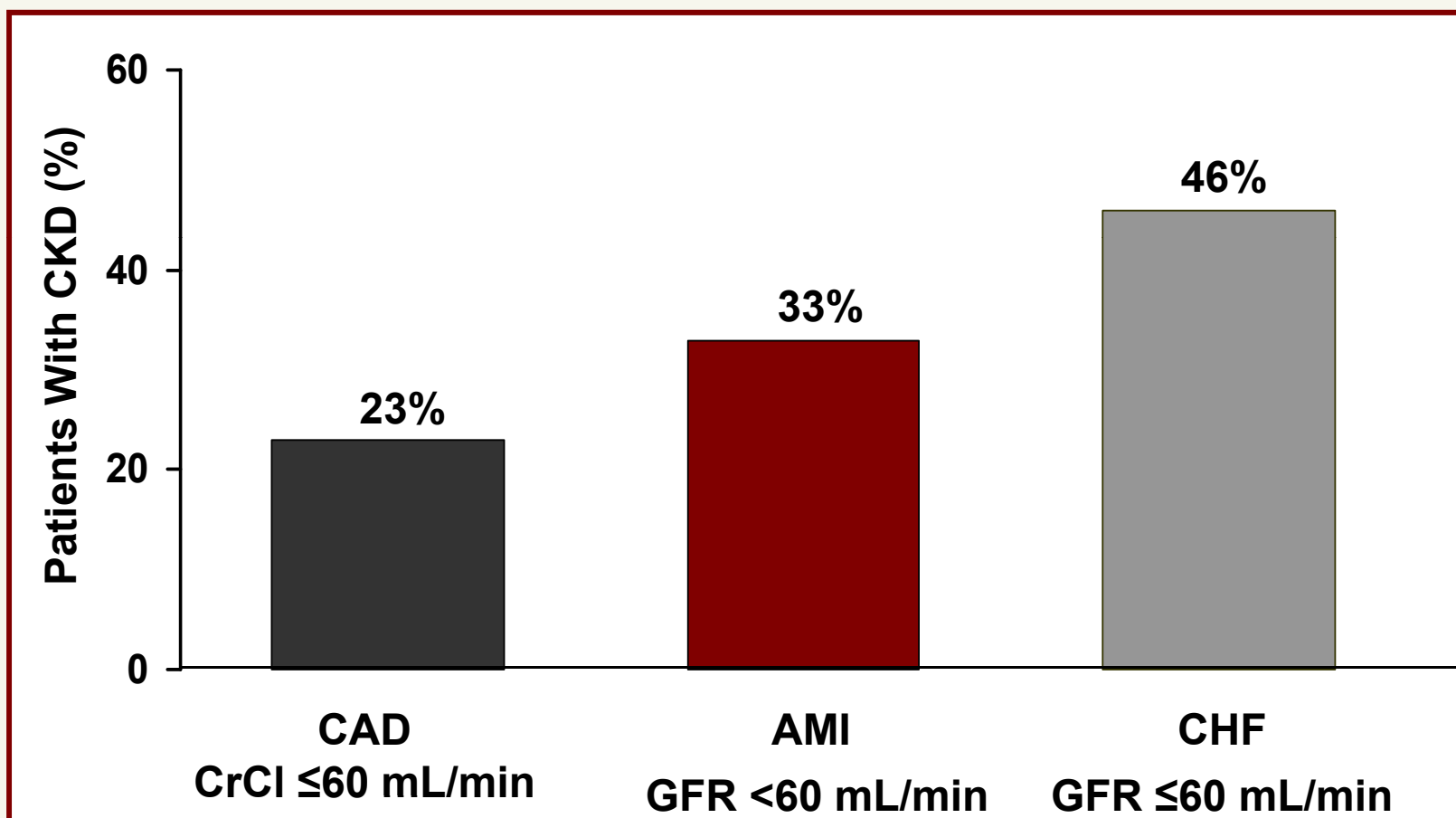
USRDS ADR, 2006

26 million Americans have CKD or albuminuria

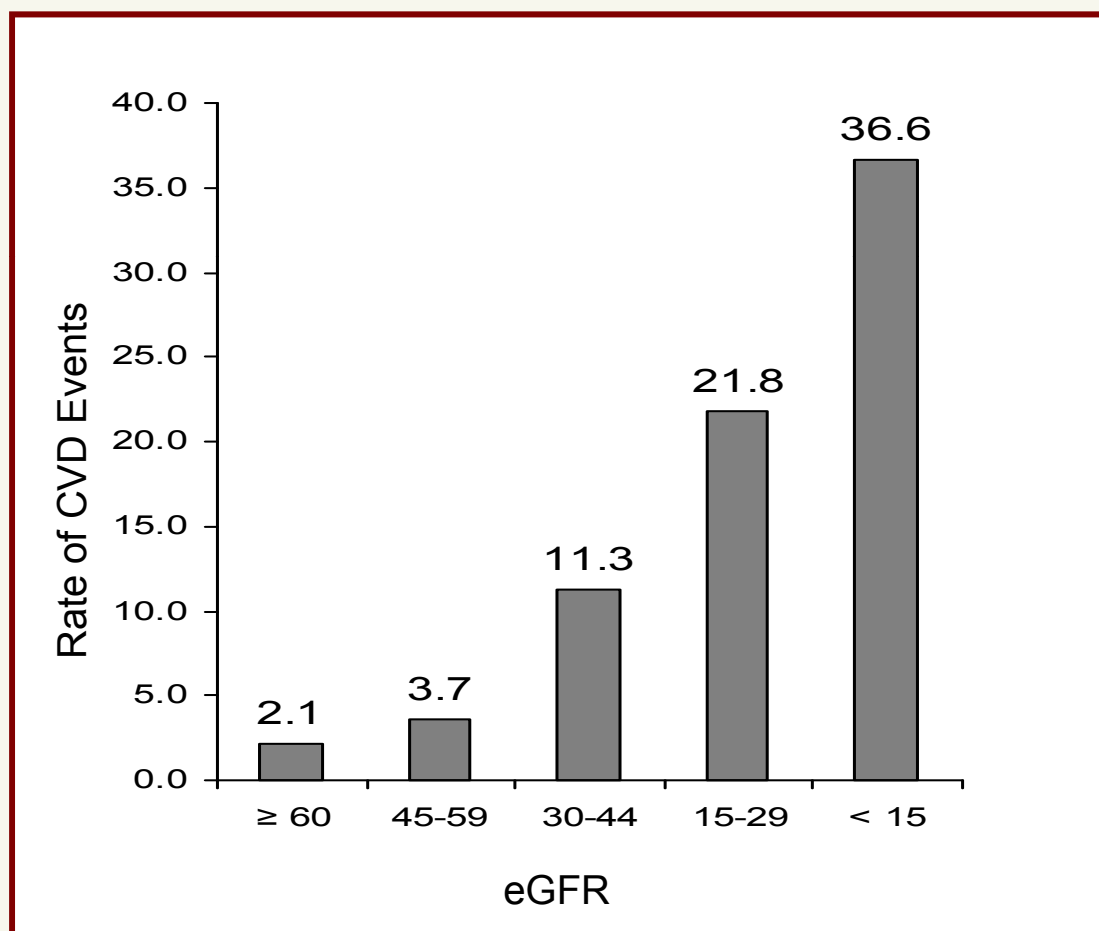


But few are aware of it – even those with eGFR less than 30





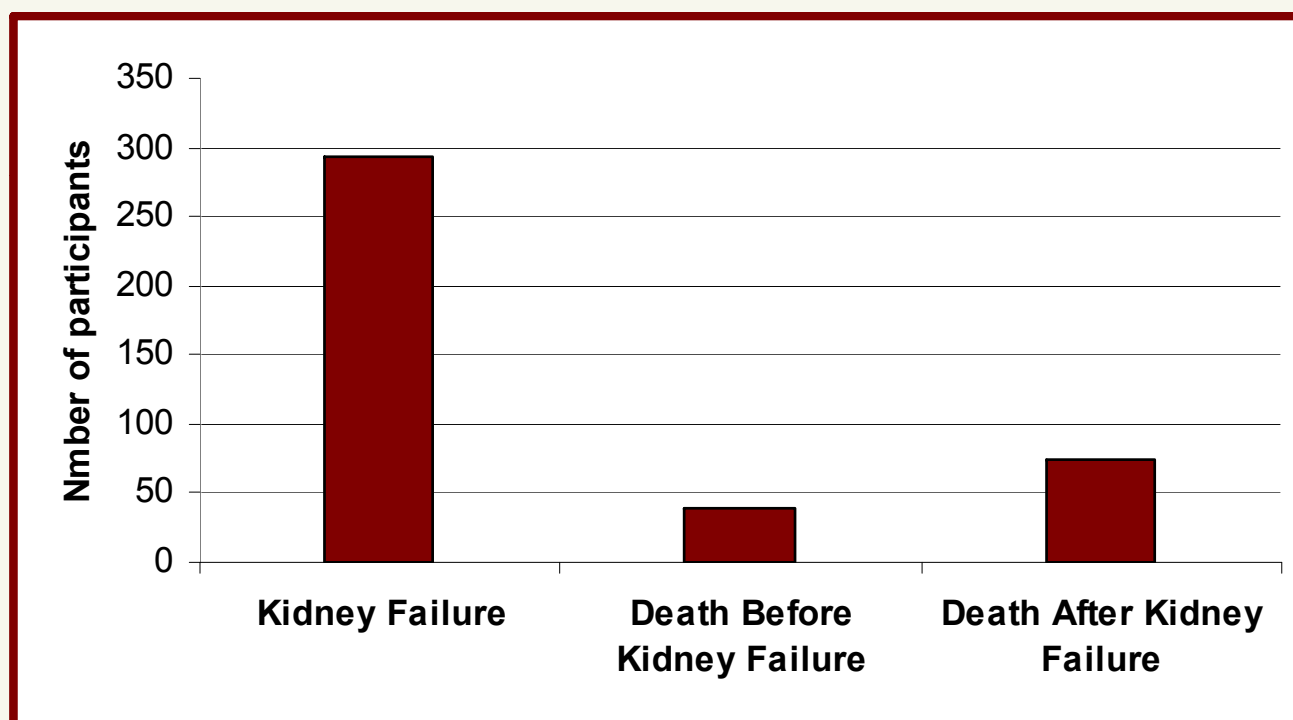
In addition to ESRD, CKD leads to CVD



Age-Standardized Rate of CVD events per 100 person-year.

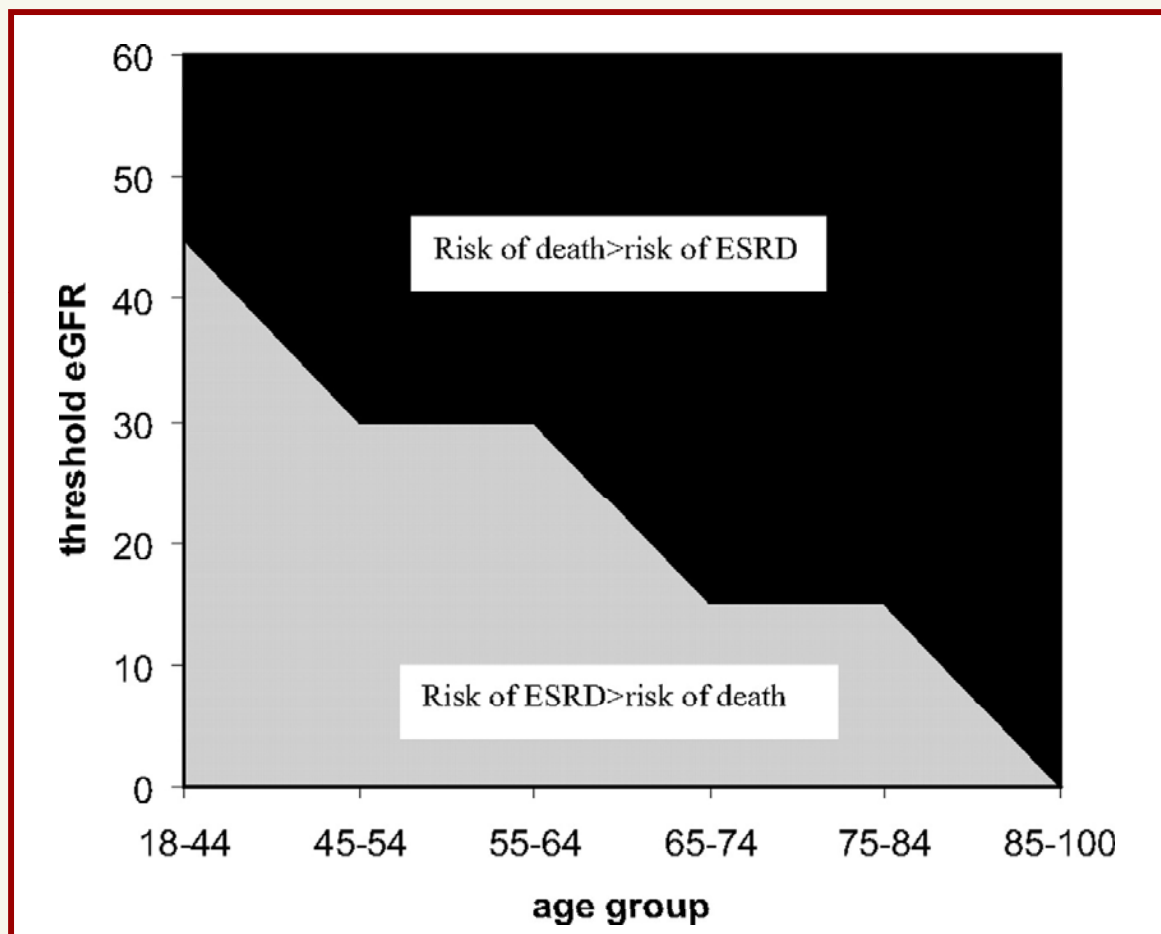
Go, et al., 2004

People with CKD do progress to kidney failure—especially those middle-aged and younger



Long term (7 year) follow up of non-diabetic CKD;
mean GFR=39, mean age=52 year old).

Younger people with CKD are more likely to develop ESRD before death

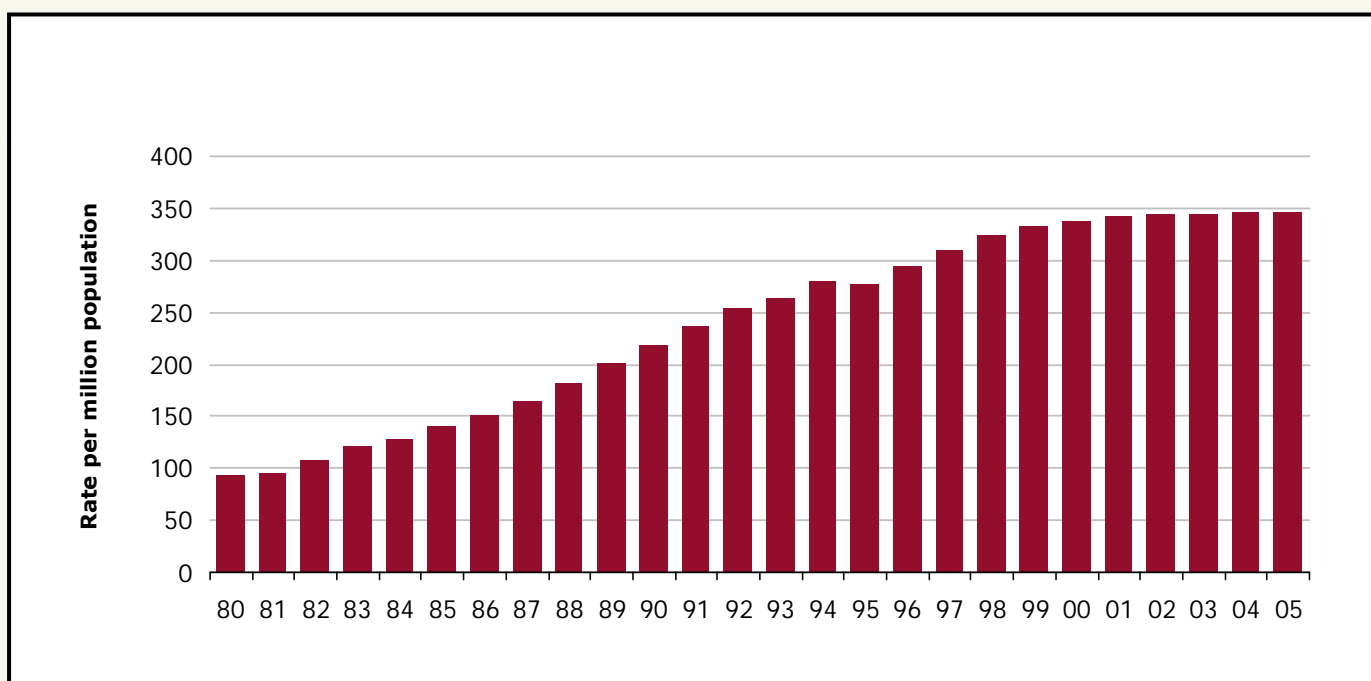


Annual mortality by age group and eGFR.

We can have an impact on progression of CKD

- Intensive glycemic control lessens progression from microalbuminuria in Type 1 diabetes—goal in Type 2 is less clear
 - DCCT, 1993
 - ACCORD, 2008
- Antihypertensive therapy with ACE Inhibitors or ARBs lessens proteinuria and progression
 - Giatras, et al., 1997
 - Psait, et al., 2000
 - Jafar, et al., 2001
- Blood pressure below 130/80 is beneficial
 - Sarnak, et al., 2005

Incidence of ESRD has leveled off, perhaps because of better use of preventive measures

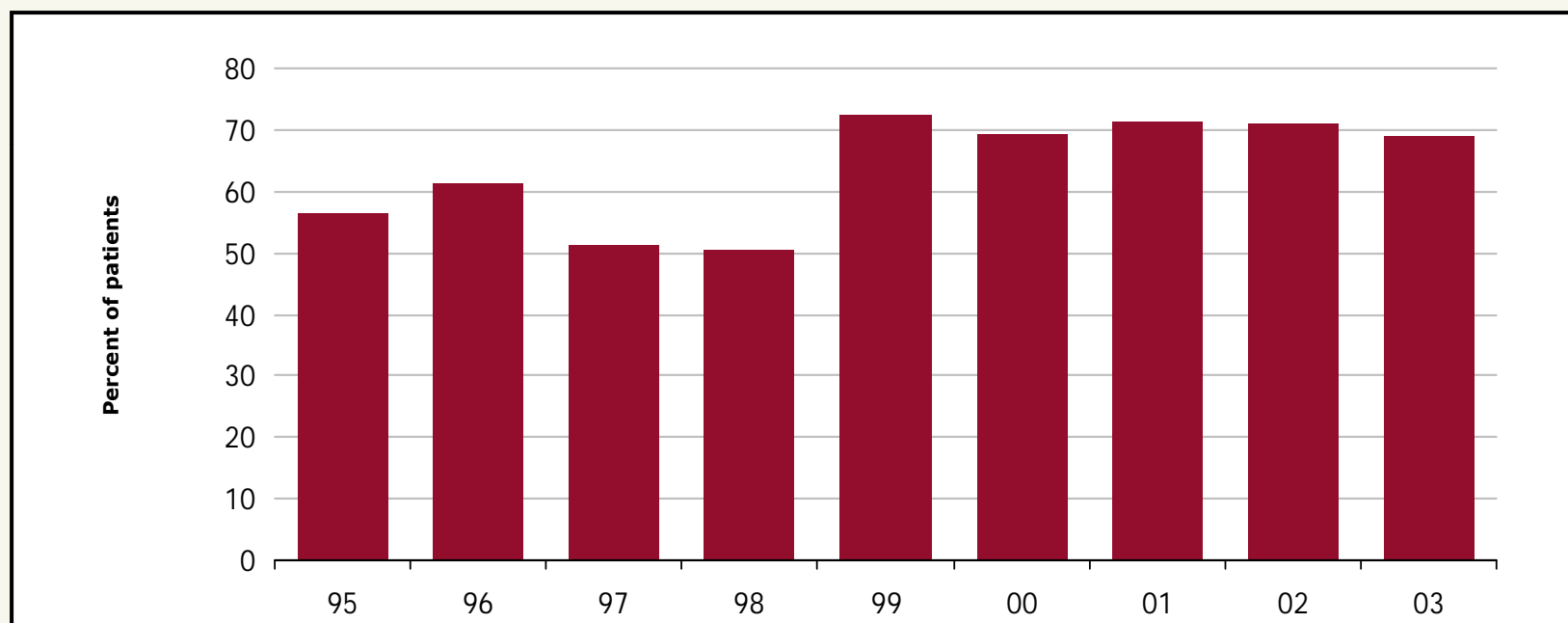


Incident ESRD patients; rates adjusted for age, gender & race.

- Estimated GFR reporting is not universal
 - Only 38% of labs routinely report eGFR with creatinine
- CKD is usually not coded as a diagnosis
 - Less than 40% of patients with eGFR <30 were coded

Adherence to treatment guidelines – room for improvement

The percentage of diabetic CKD patients receiving ACE-Is/ARBs
has been slow to improve



The people to test are those at greatest risk

- Diabetes mellitus
- Hypertension
- Cardiovascular disease
- Family members of patients with ESRD

Note on pediatric patients:

- CKD may start with childhood obesity
- No recommendations for routine testing

CKD is less common in children but there are risk factors

- Family history of polycystic kidney disease or other genetic kidney disease
- Renal dysplasia or hypoplasia
- Urologic disorders—especially obstructive uropathies

2 simple tests will identify CKD in adults

- **eGFR** - Estimated GFR from serum creatinine using the MDRD equation
 - **UACR** - Urine albumin to creatinine ratio on a “spot” urine sample
 - 24-hour urine collections are NOT needed
- Diabetics should be tested once a year. Others at risk can be tested less frequently as long as normal.

- MDRD estimating equation is not applicable to children
- Updated Schwartz formula provides reasonable estimate in children with mild-moderate CKD

(GFR – 15-75 mL/min/1.73 m²)

Updated Schwartz Formula

$$eGFR = k * Ht/S_{cr}$$

Where $k=0.4$, Ht in cm and S_{cr} in mg/dL and measured by enzymatic methodology

The perils of using serum creatinine to “guess” level of renal function

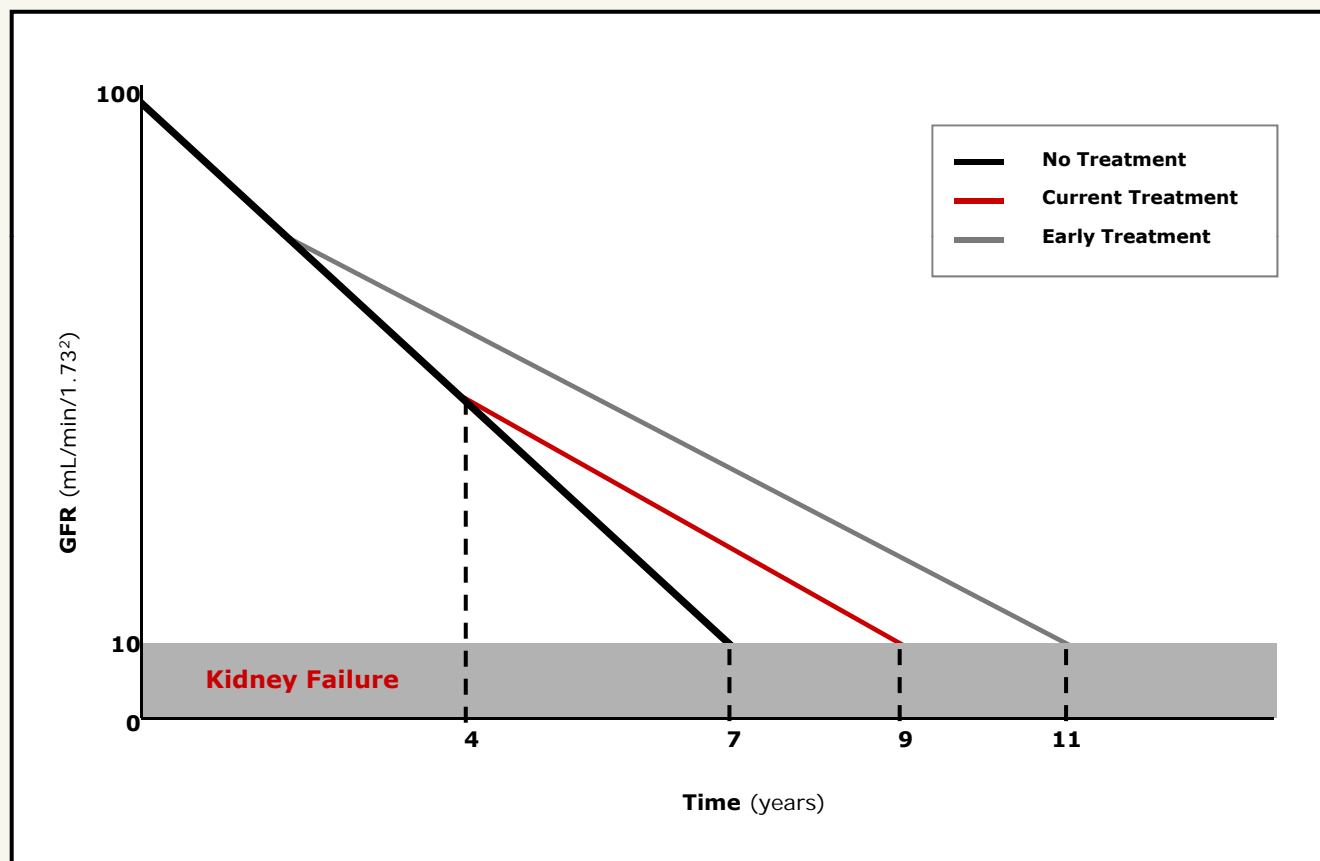
	24-yo Black Man	63-yo White Man	59-yo White Woman
SCr	1.3 mg/dL	1.3 mg/dL	1.3 mg/dL
GFR as estimated by MDRD Study equation	≥60 mL/min/1.73 m ²	59 mL/min/1.73 m ²	45 mL/min/1.73 m ²

Automatic eGFR by the laboratory reporting is best

- GFR is the accepted measure of kidney function
- GFR is difficult to infer from serum creatinine alone
- Automatic reporting identifies CKD patients with apparently “normal” serum creatinine
 - Reduces barrier to early detection and identifies people at high risk for contrast agents and other nephrotoxins

- An estimate based on population data--not the patient's *actual* GFR
- Not reliable when used with patients:
 - with GFR above 60 ml/ min/1.73 m²
 - with rapidly changing creatinine levels (e.g., acute renal failure in the ICU)
 - with extremes in muscle mass, e.g. cachexia or paraplegia
 - under age 18

Early treatment can make a difference



What can primary care providers do?

- Recognize and test at-risk patients
- Educate patients about CKD and treatment
- Focus on good glycemic control in people with diabetes
- For those with CKD:
 - Blood pressure below 130/80
 - Use an ACE inhibitor or ARB
 - More than one drug is usually required
 - A diuretic should be part of the regimen

What can primary care providers do? (Continued)

- Monitor eGFR and UACR
- Treat cardiovascular risk, especially with smokers and hypercholesterolemia
- Screen for anemia (Hgb), malnutrition (albumin), metabolic bone disease (Ca, Phos, PTH)
- Refer to dietitian for nutritional guidance
- Consult or team with a nephrologist
- Encourage labs to report estimated eGFR and urine albumin/creatinine ratios

- To assist with diagnostic challenge (e.g. decision to biopsy)
- To assist with therapeutic challenge (e.g. blood pressure)
- Rapid decay of estimated GFR
- Most primary kidney diseases, (e.g. glomerulonephritides)
- Preparation for renal replacement therapy, especially when GFR less than 30

Nephrology referral suggestions, cont.

- Regardless of when you refer:
 - Obtaining preliminary evaluation (e.g. ultrasound, screening serologies)
 - Providing consultant with patient history including serial measures of renal function

Primary care providers – First line of defense against CKD

- Primary care professionals can play a significant role in early diagnosis, treatment, and patient education
- Therapeutic interventions for diabetic CKD are similar to those required for optimal diabetes care
 - Control of glucose, blood pressure, and lipids
- A greater emphasis on detecting CKD, and managing it prior to referral, can improve patient outcomes

CKD is Part of Primary Care

Anavekar NS, McMurray JJ, Velazquez EJ, Solomon SD, Kober L, Rouleau JL, White HD, Nordlander R, Maggioni A, Dickstein K, Zelenkofske S, Leimberger JD, Califf RM, Pfeffer MA. Relation between renal dysfunction and cardiovascular outcomes after myocardial infarction. *New England Journal of Medicine*. 2004 Sep 23;351(13):1285-95.

Coresh J, Selvin E, Stevens LA, Manzi J, Kusek JW, Eggers P, Van Lente F, Levey AS. Prevalence of chronic kidney disease in the United States. *Journal of the American Medical Association*. 2007 Nov 7;298(17):2038-47.

Giatras I, Lau J, Levey AS. Effect of angiotensin-converting enzyme inhibitors on the progression of nondiabetic renal disease: a meta-analysis of randomized trials. Angiotensin-Converting-Enzyme Inhibition and Progressive Renal Disease Study Group. *Annals of Internal Medicine*. 1997 Sep 1;127(5):337-45.

Go AS, Chertow GM, Fan D, McCulloch CE, Chi-Yuan H. Chronic Kidney Disease and the Risks of Death, Cardiovascular Events, and Hospitalization. *New England Journal of Medicine*. 2004 Sep 23;351(13):1296-1305.

Hogg RJ, Furth S, Lemley KV, Portman R, Schwartz GJ, Coresh J, Balk E, Lau J, Levin A, Kausz AT, Eknoyan G, Levey AS; National Kidney Foundation's Kidney Disease Outcomes Quality Initiative. National Kidney Foundation's Kidney Disease Outcomes Quality Initiative clinical practice guidelines for chronic kidney disease in children and adolescents: evaluation, classification, and stratification. *Pediatrics*. 2003 Jun;111(6 Pt 1):1416-21.

Ix JH, Shlipak MG, Liu HH, Schiller NB, Whooley MA. Association between renal insufficiency and inducible ischemia in patients with coronary artery disease: the heart and soul study. *Journal of the American Society of Nephrology*. 2003 Dec;14(12):3233-8.

Jafar TH, Schmid CH, Landa M, Giatras I, Toto R, Remuzzi G, Maschio G, Brenner BM, Kamper A, Zucchelli P, Becker G, Himmelman A, Bannister K, Landais P, Shahinfar S, de Jong PE, de Zeeuw D, Lau J, Levey AS. Angiotensin-converting enzyme inhibitors and progression of nondiabetic renal disease. A meta-analysis of patient-level data. *Annals of Internal Medicine*. 2001 Jul 17;135(2):73-87. Erratum in: *Ann Intern Med* 2002 Aug 20;137(4):299.

Levey AS, Greene T, Sarnak MJ, Wang X, Beck GJ, Kusek JW, Collins AJ, Kopple JD. Effect of dietary protein restriction on the progression of kidney disease: long-term follow-up of the Modification of Diet in Renal Disease (MDRD) Study. *American Journal of Kidney Diseases*. 2006 Dec;48(6):879-88.

National Diabetes Information Clearinghouse. Diabetes Control and Complications Trial (DCCT). Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, US Department of Health and Human Services; 1993 (NIH Publication No. 02-3874). Available from: <http://diabetes.niddk.nih.gov/dm/pubs/control/>.

National Kidney Disease Education Program. Manuscript submitted for review. 2008.

National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *American Journal of Kidney Diseases*. 2002 Feb;39(2 Suppl 1):S1-266.

O'Hare AM, Bertenthal D, Covinsky KE, Landefeld CS, Sen S, Mehta K, Steinman MA, Borzecki A, Walter LC. Mortality risk stratification in chronic kidney disease: one size for all ages? *Journal of the American Society of Nephrology*. 2006 Mar;17(3):846-53.

Sarnak MJ, Greene T, Wang X, Beck G, Kusek JW, Collins AJ, Levey AS. The effect of a lower target blood pressure on the progression of kidney disease: long-term follow-up of the modification of diet in renal disease study. *Annals of Internal Medicine*. 2005 Mar 1;142(5):342-51.

Shlipak MG, Smith GL, Rathore SS, Massie BM, Krumholz HM. Renal function, digoxin therapy, and heart failure outcomes: evidence from the digoxin intervention group trial. *Journal of the American Society of Nephrology*. 2004 Aug;15(8):2195-203.

Stevens LA, Fares G, Fleming J, Martin D, Murthy K, Qiu J, Stark PC, Uhlig K, Van Lente F, Levey AS. Low rates of testing and diagnostic codes usage in a commercial clinical laboratory: evidence for lack of physician awareness of chronic kidney disease. *Journal of the American Society of Nephrology*. 2005 Aug;16(8):2439-48.

U.S. Renal Data System, *USRDS 2006 Annual Data Report: Atlas of End-Stage Renal Disease in the United States*, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2006.

U.S. Renal Data System, *USRDS 2007 Annual Data Report: Atlas of End-Stage Renal Disease in the United States*, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2007.