La definizione e classificazione dell'IRC

A. Guarnieri
ASO S. Croce e Carle - CN
S.C. Nefrologia e Dialisi

Definizione e classificazione della malattia renale cronica

Danno renale presente da almeno tre mesi, definito da anomalie funzionali o strutturali del rene, con o senza alterazioni del filtrato glomerulare, con implicazioni per la salute.

Table 2 | 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)

Abbreviations: CKD, chronic kidney disease; GFR, glomerular filtration rate.

Kidney International Supplements (2013) **3**, 19–62

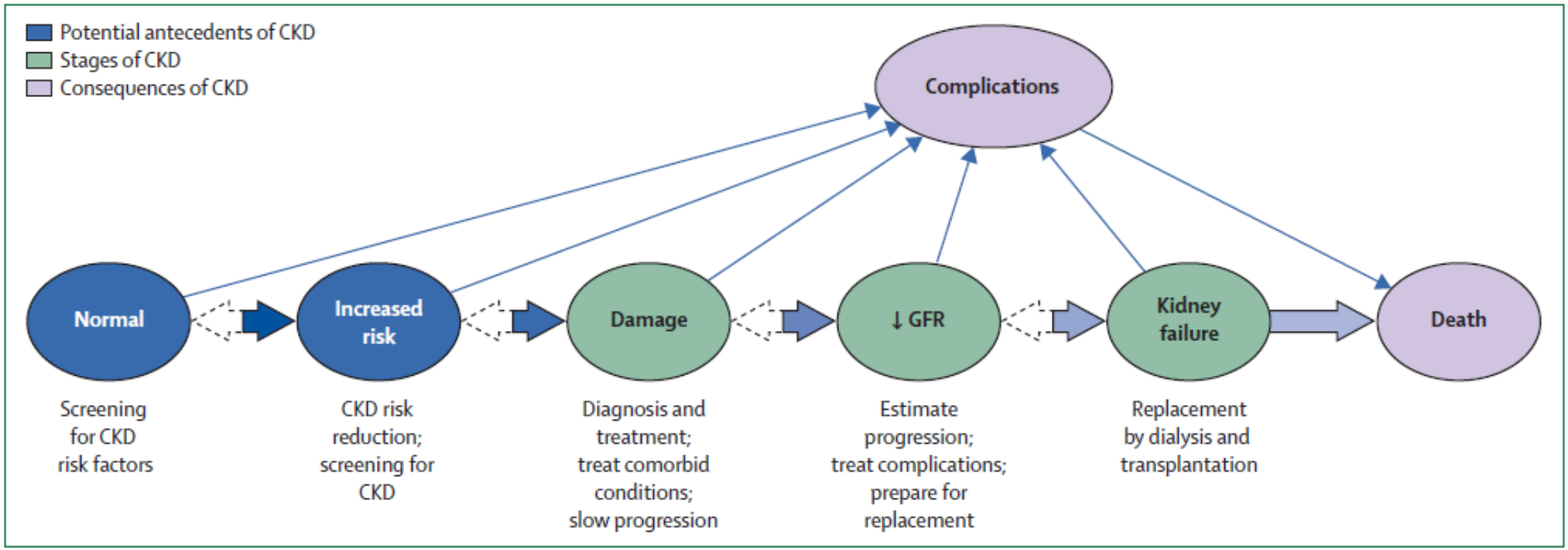
TREATMENT IN GENERAL PRACTICE

This article is one of a series on the management of some of the renal diseases met with in general practice. The first group of articles on Treatment in General Practice, thirty-five in number, was republished in book form last March by H. K. Lewis & Co., and a second volume will appear in the autumn.

CHRONIC NEPHRITIS AND URAEMIA

BY

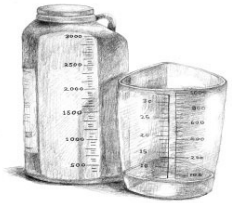
ROBERT PLATT, M.D., F.R.C.P.



Lancet 2012; 379: 165–80

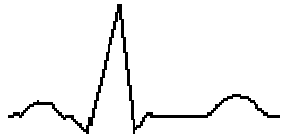
Markers di danno renale

- Albuminuria

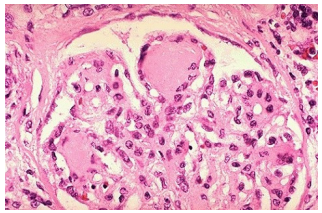


- Anomalie del sedimento urinario

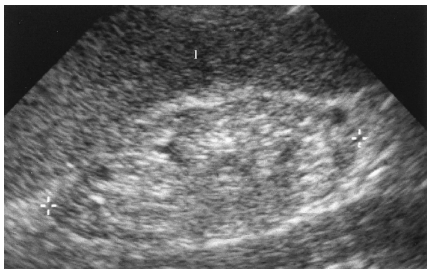
- Anomalie degli elettroliti secondarie a danni tubulari



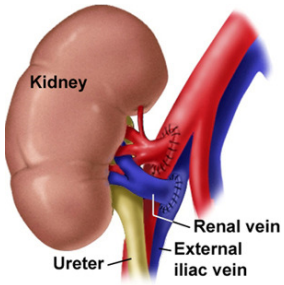
- Alterazioni istologiche



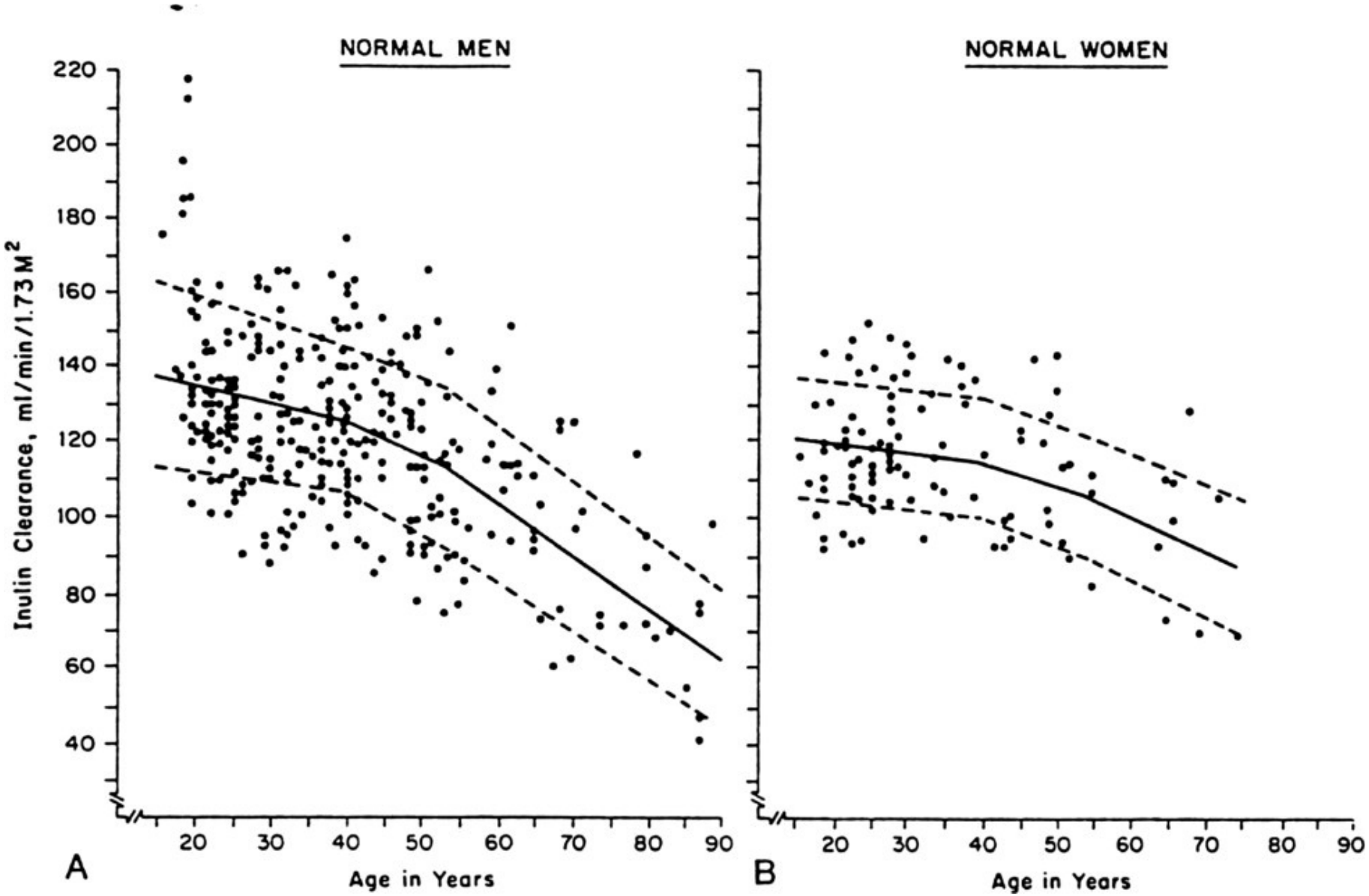
- Alterazioni evidenziabili con tecniche di immagine



- Storia di trapianto renale



IRC = GFR < 60 mL/min/1.73mq



Wesson L. Physiology of the Human Kidney, 1969

Plasma Metabolomic Profiles in Different Stages of CKD

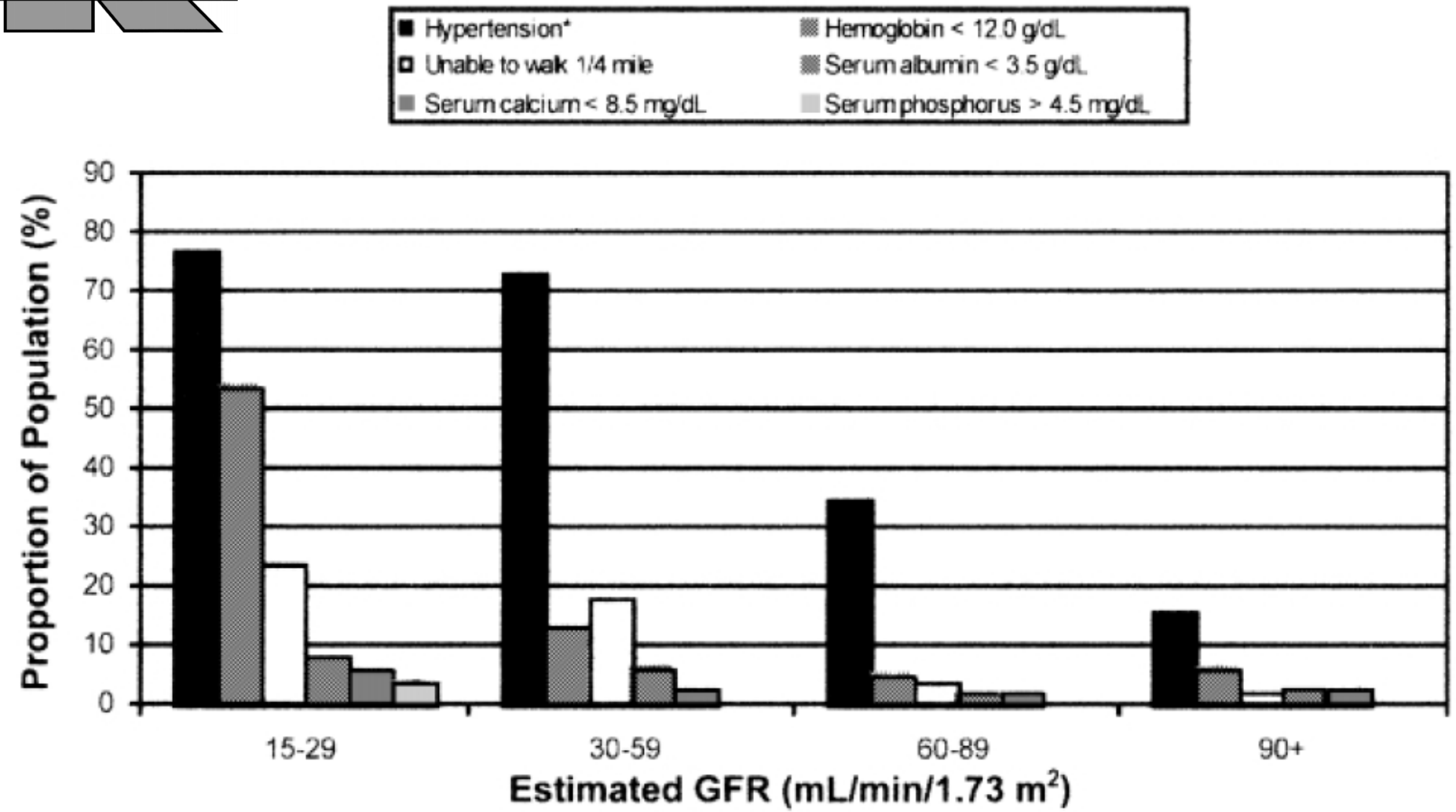
Table 2. Ratios of significant changes of specific metabolites by stage of CKD ($P \leq 0.05$), mean values, and P values

	Fold of Change			Mean ± SD			*P* Value		
	Stages 3/2	Stages 4/2	Stages 4/3	CKD Stage 2	CKD Stage 3	CKD Stage 4	Stages 3/2	Stages 4/2	Stages 4/3
Altered arginine metabolism									
Dimethylarginine (SDMA + ADMA)	8.1	4.8		0.497±0.133	4.01±2.27	2.40±1.77	7.9E-05	0.01	0.17
Citrulline	1.6	1.3[a]		0.825±0.194	1.30±0.586	1.08±0.362	0.03	0.08	
Ornithine	0.28	0.16		4.33±1.39	1.19±1.32	0.683±0.334	2.0E-4	1.4E-06	
Arginine	1.5[a]	1.5[a]		0.675±0.238	1.02±0.480	1.03±0.559	0.06	0.10	
Elevated coagulation/inflammation									
Fibrinopeptide A	689	827		0.002±0.001	1.03±0.765	1.24±0.795	3.0E-4	1.1E-14	
Phosphorylated fibrinopeptide A	18	45	2.5	0.045±0.017	0.818±0.683	2.06±2.62	0.002	4.4E-08	0.04
Proline-hydroxyproline	2.5	4.5		0.466±0.251	1.16±1.26	2.08±1.68	0.03	8.3E-05	
Impaired carboxylate anion transport									
γ-Glutamylleucine		1.3		0.821±0.283		1.07±0.161		0.03	
γ-Glutamylisoleucine	1.6	1.7		0.670±0.196	1.12±0.440	1.18±0.510	0.01	0.01	
γ-Glutamylglutamine	3.8	4.8		0.275±0.166	1.05±0.417	1.31±0.349	5.5E-05	8.9E-06	
γ-Glutamylphenylalanine	1.5	1.3		0.903±0.240	1.31±0.480	1.17±0.181	0.03	0.01	
CMPF	18.3[a]	23.6		0.307±0.279	5.61±11.9	7.23±7.20	0.06	5.0E-4	
Decreased adrenal steroid hormone production									
Dehydroisoandrosterone sulfate		0.55		1.48±0.878		0.819±0.685		0.04	
4-androsten-3-β,17-β-diol disulfate		0.26		3.91±3.76		1.02±0.958		0.01	

ADMA, asymmetric dimethylarginine; SDMA, symmetric dimethylarginine; CMPF, 3-Carboxy-4-methyl-5-propyl-2- furanpropanoate.
[a]$0.1 > P > 0.05$.

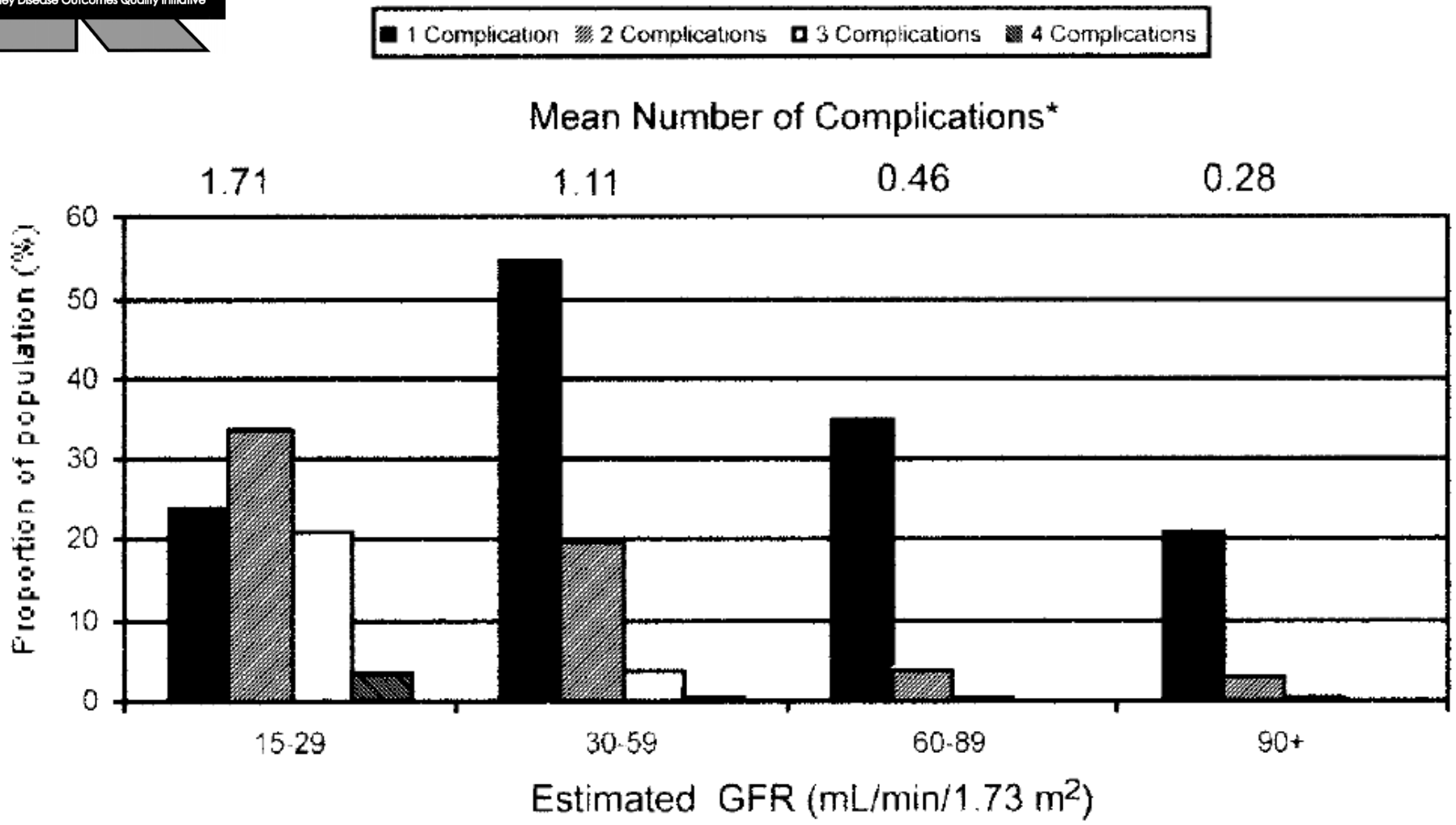
Clin J Am Soc Nephrol 8: 363–370, 2013.

National Kidney Foundation
DOQI™
Kidney Disease Outcomes Quality Initiative



American Journal of Kidney Diseases, Vol 39, No 2, Suppl 1 (February), 2002: pp S111-S169

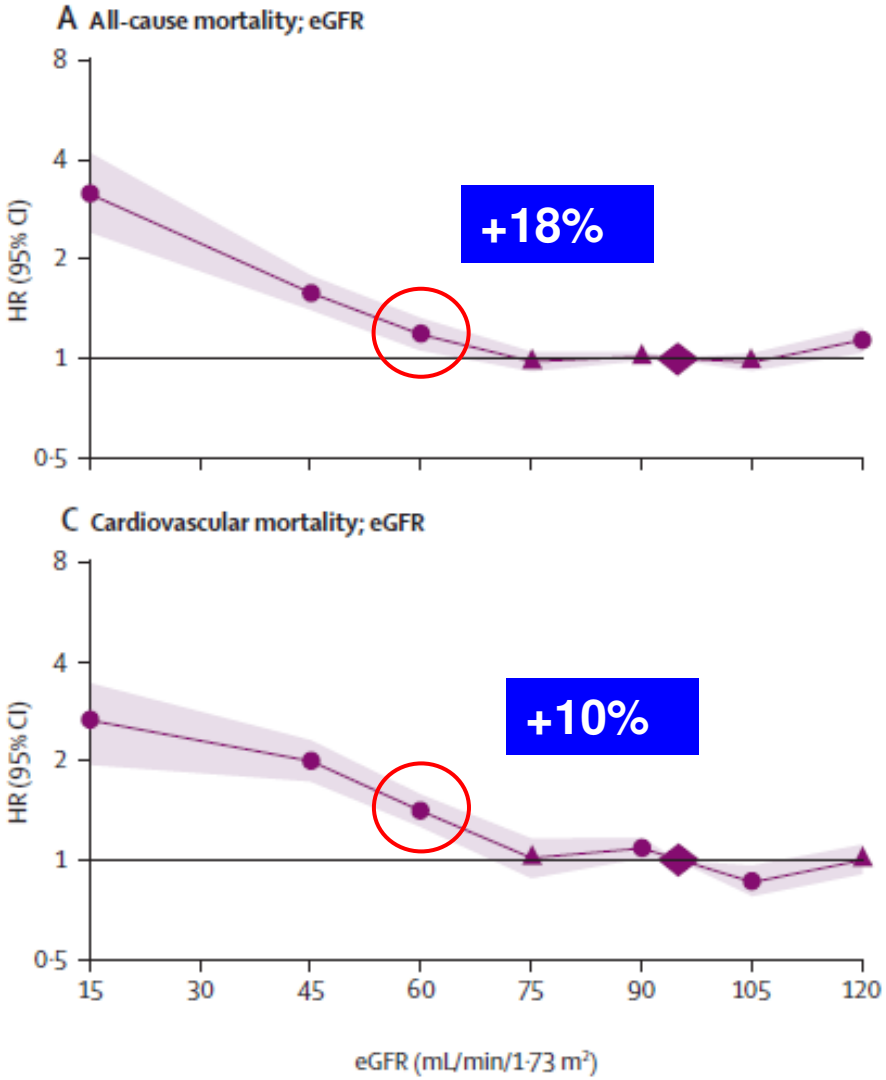
National Kidney Foundation
DOQI™
Kidney Disease Outcomes Quality Initiative



American Journal of Kidney Diseases, Vol 39, No 2, Suppl 1 (February), 2002: pp S111-S169

Association of estimated glomerular filtration rate and albuminuria with all-cause and cardiovascular mortality in general population cohorts: a collaborative meta-analysis

*Chronic Kidney Disease Prognosis Consortium**



Lancet 2010; 375: 2073–81

Table 1. Classification of CKD as Defined by KDOQI and Modified and Endorsed by KDIGO

Stage	Description	Classification by Severity	Classification by Treatment
1	Kidney damage with normal or ↑ GFR	GFR ≥ 90	T if kidney transplant recipient
2	Kidney damage with mild ↓ in GFR	GFR of 60-89	
3	Moderate ↓ in GFR	GFR of 30-59	
4	Severe ↓ in GFR	GFR of 15-29	
5	Kidney failure	GFR < 15 (or dialysis)	D if dialysis

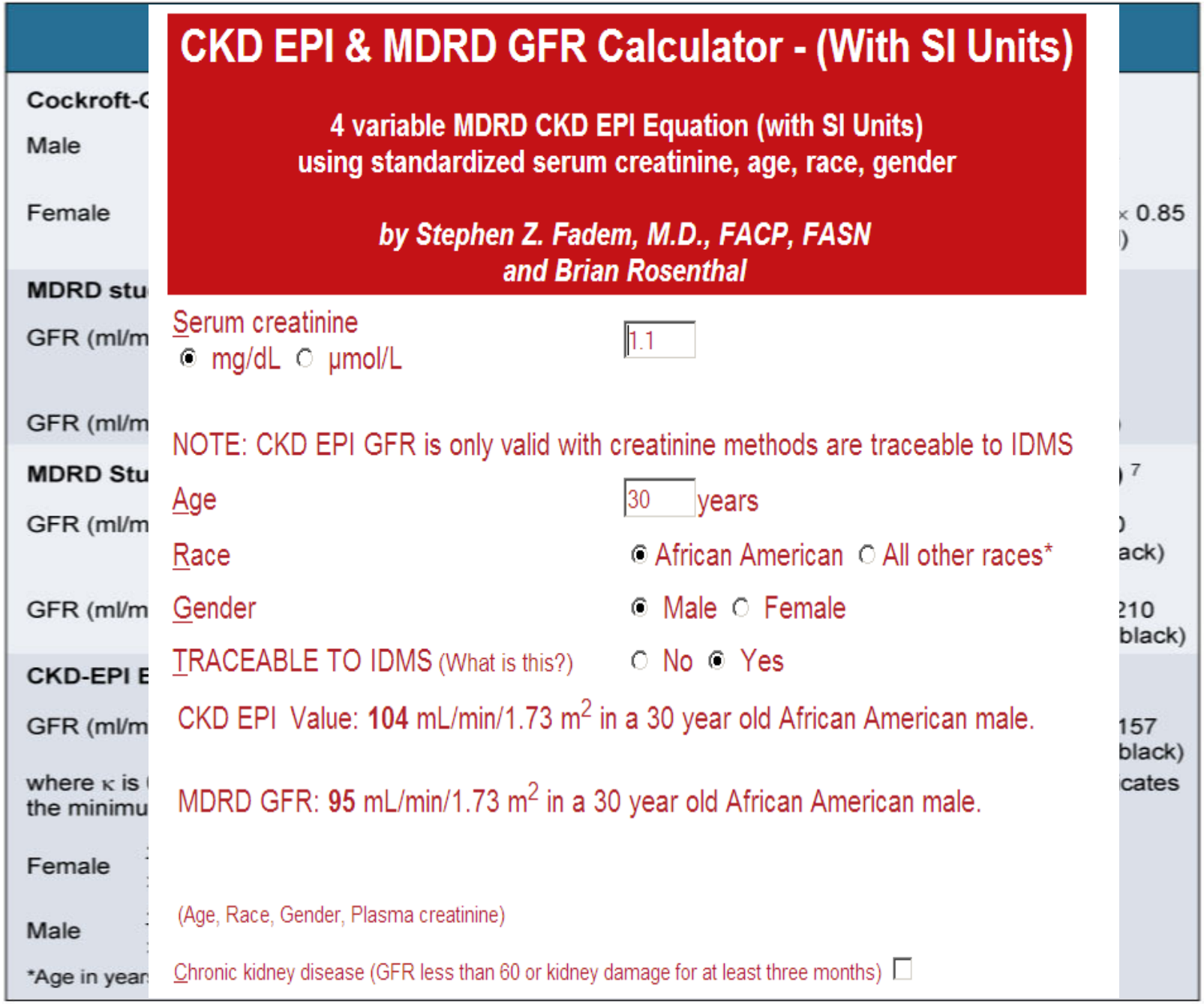
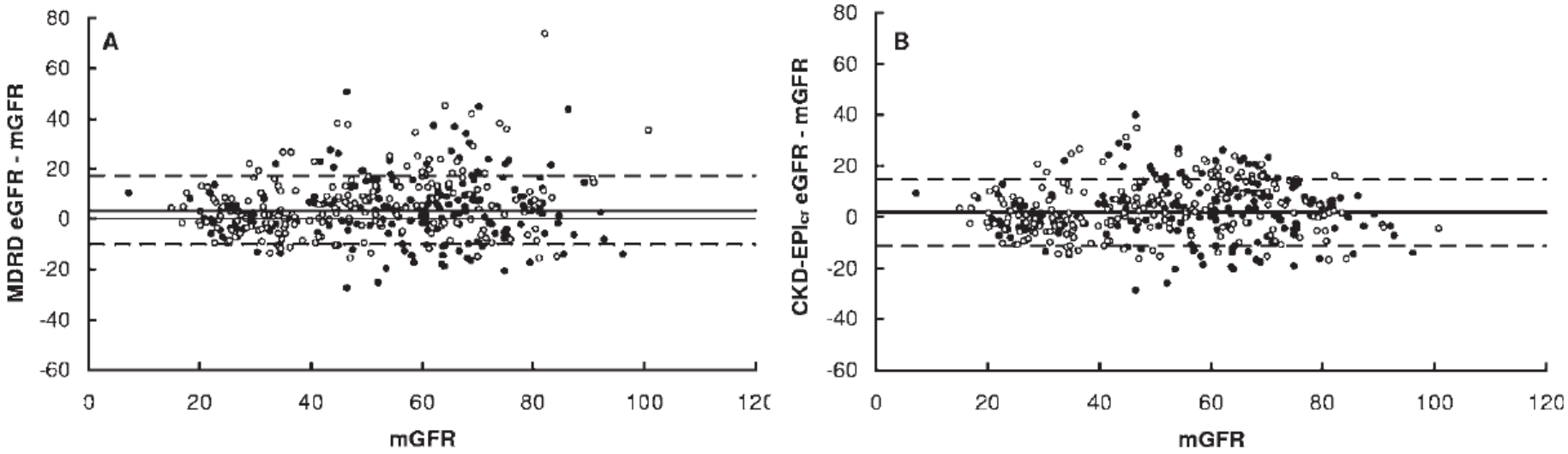


Fig. 3-5. **Equations for estimating glomerular filtration rate.** The MDRD study equation calculator can also be found online at *http://www.kidney.org/professionals/kdoqi/gfr_calculator.cfm.*

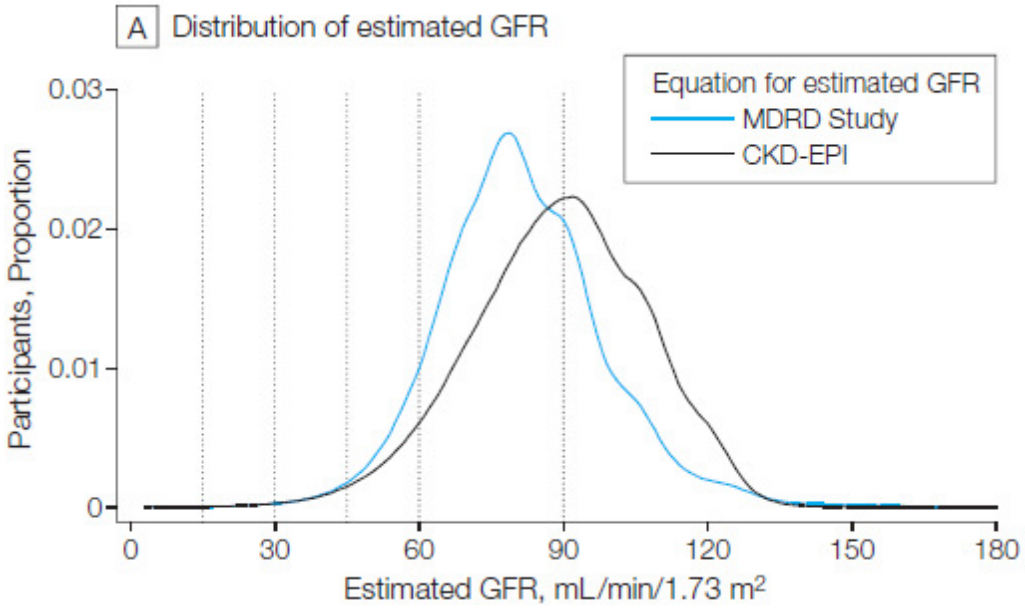
Copyright © 2010, 2007, 2003, 2000 by Saunders, an imprint of Elsevier Inc.

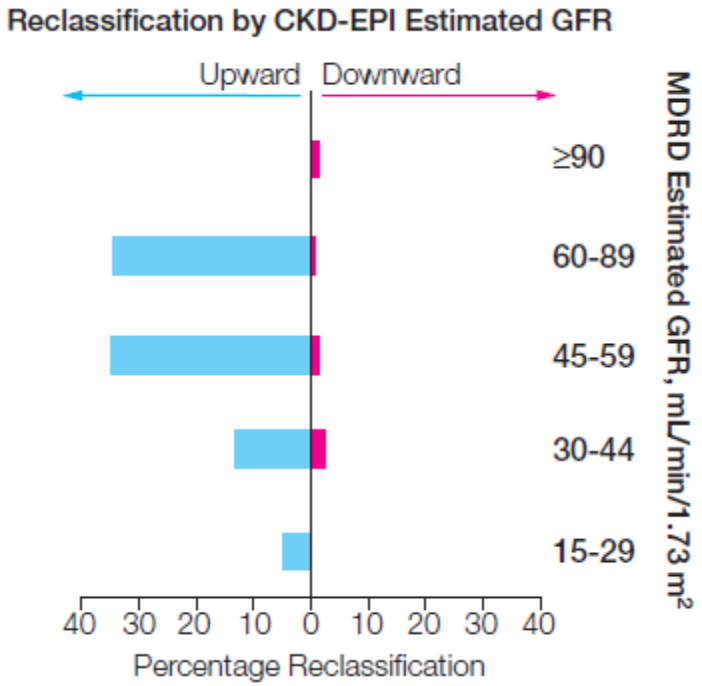
Accuracy of the MDRD (Modification of Diet in Renal Disease) Study and CKD-EPI (CKD Epidemiology Collaboration) Equations for Estimation of GFR in the Elderly



Am J Kidney Dis. 2013;61(1):57-66

Comparison of Risk Prediction Using the CKD-EPI Equation and the MDRD Study Equation for Estimated Glomerular Filtration Rate

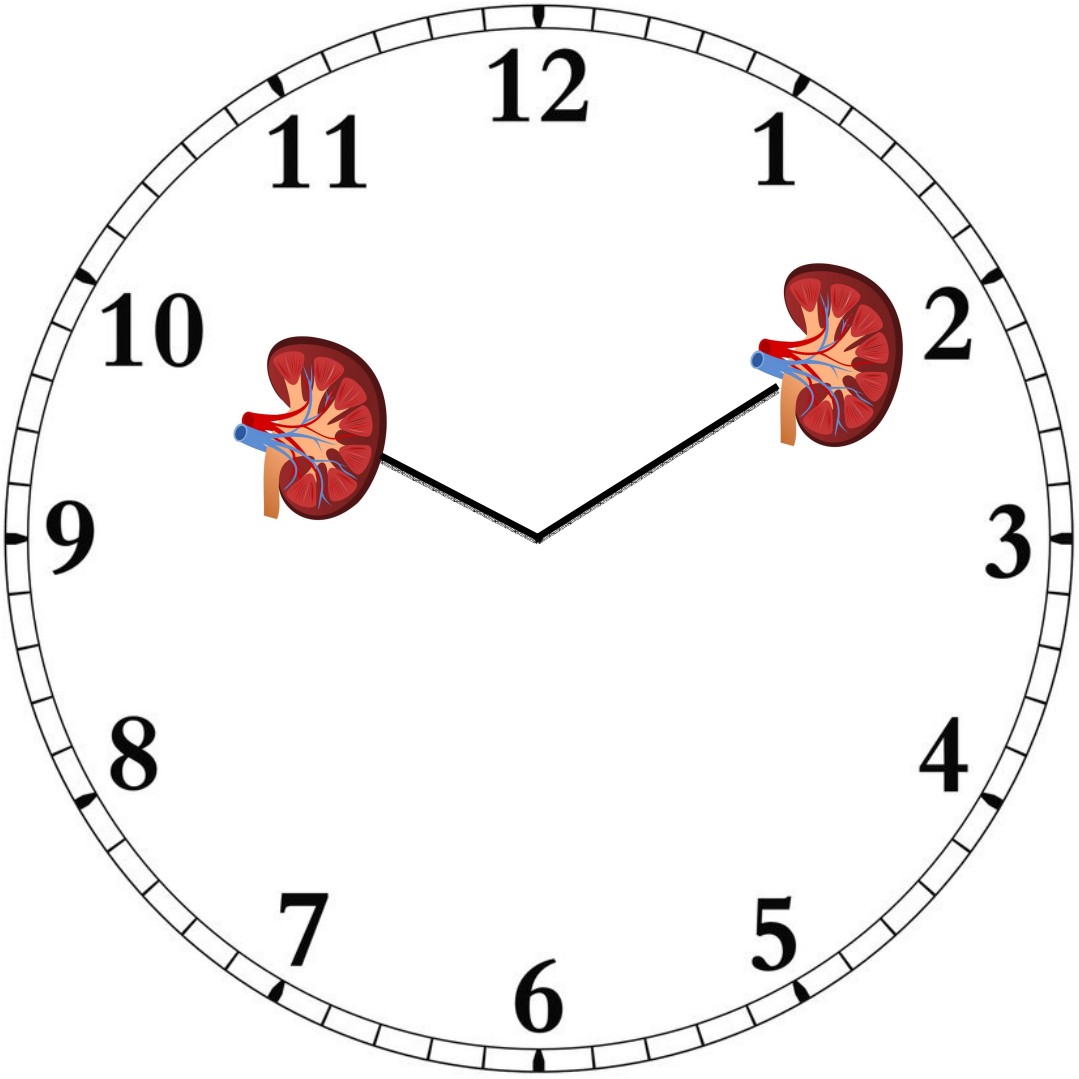




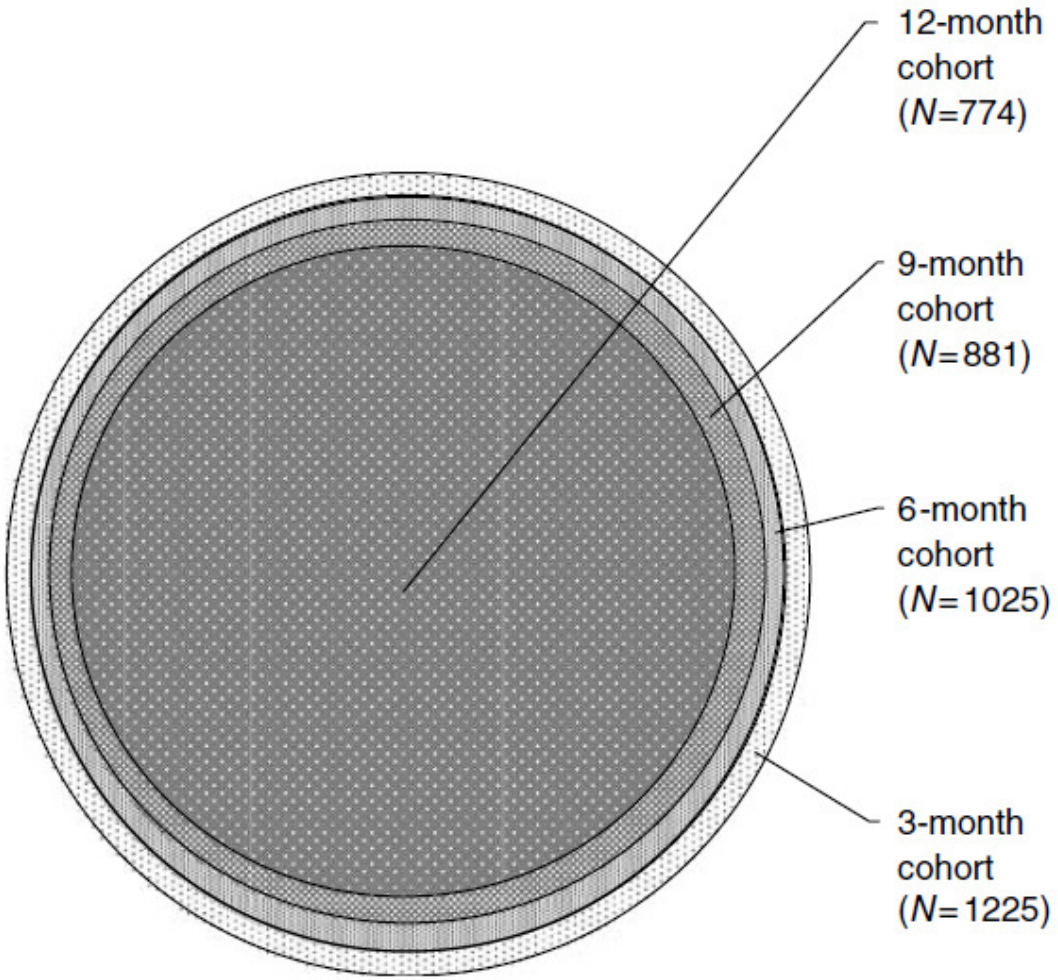
JAMA. 2012;307(18):1941-1951

Cronicità del danno

Danno renale presente da almeno tre mesi



In chronic kidney disease staging the use of the chronicity criterion affects prognosis and the rate of progression



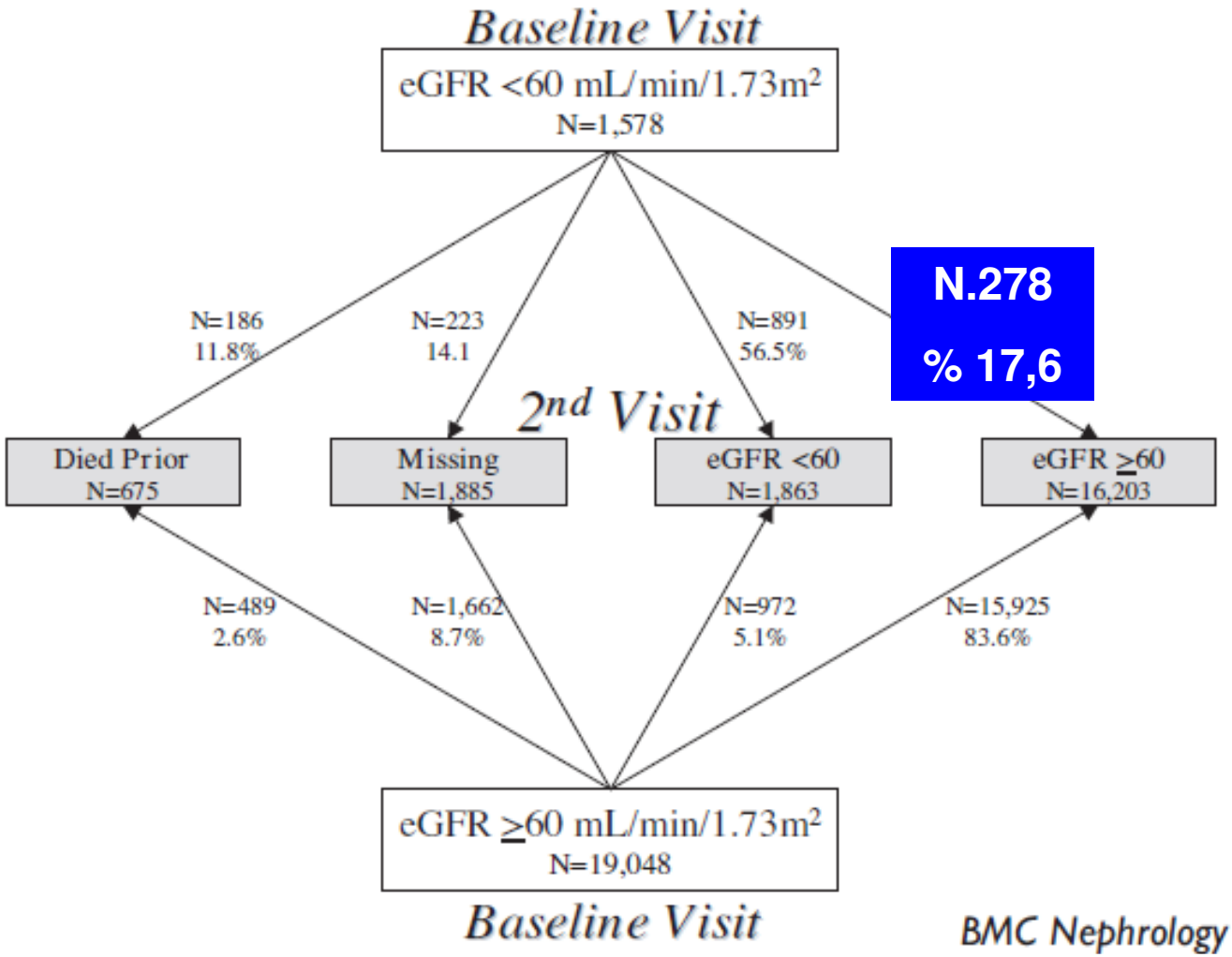
Kidney International (2007) **72**, 1242–1248

Research article

Open Access

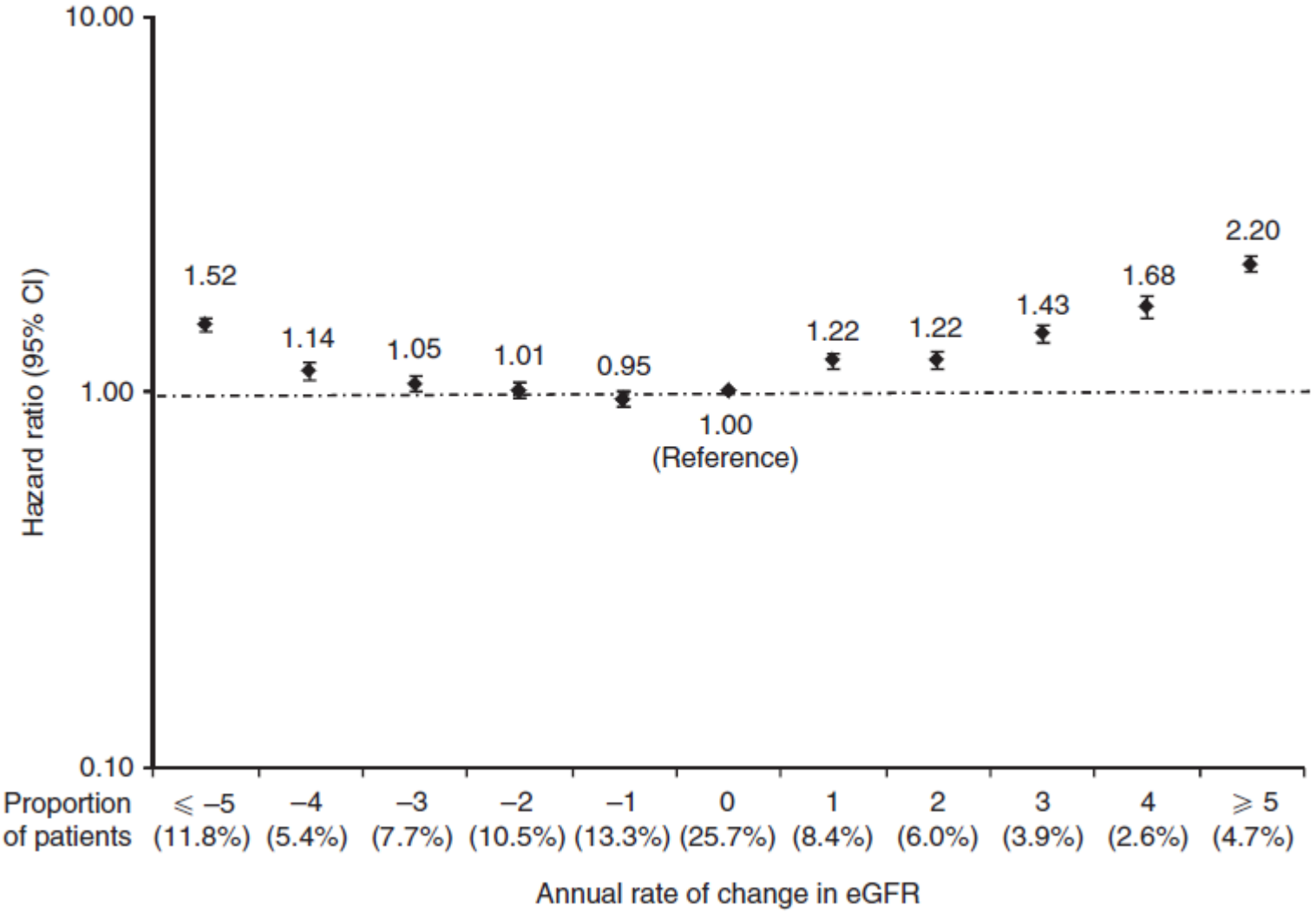
CKD classification based on estimated GFR over three years and subsequent cardiac and mortality outcomes: a cohort study

Daniel E Weiner*[1], Maria Krassilnikova[2], Hocine Tighiouart[2], Deeb N Salem[2], Andrew S Levey[1] and Mark J Sarnak[1]



BMC Nephrology 2009, 10:26

Change in the estimated glomerular filtration rate over time and risk of all-cause mortality

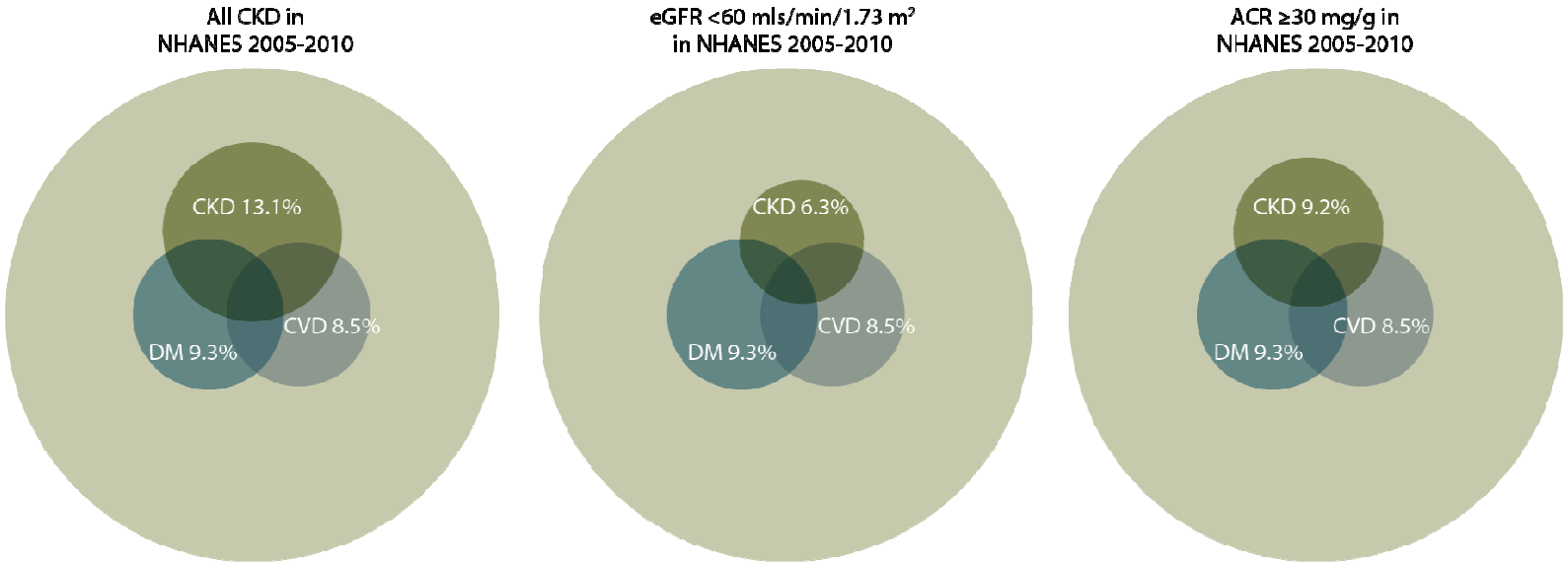


Kidney International (2013) **83**, 684–691

Classe III (eGFR 30 – 59 mL/min/1.73mq): applicabilità e caratterizzazione

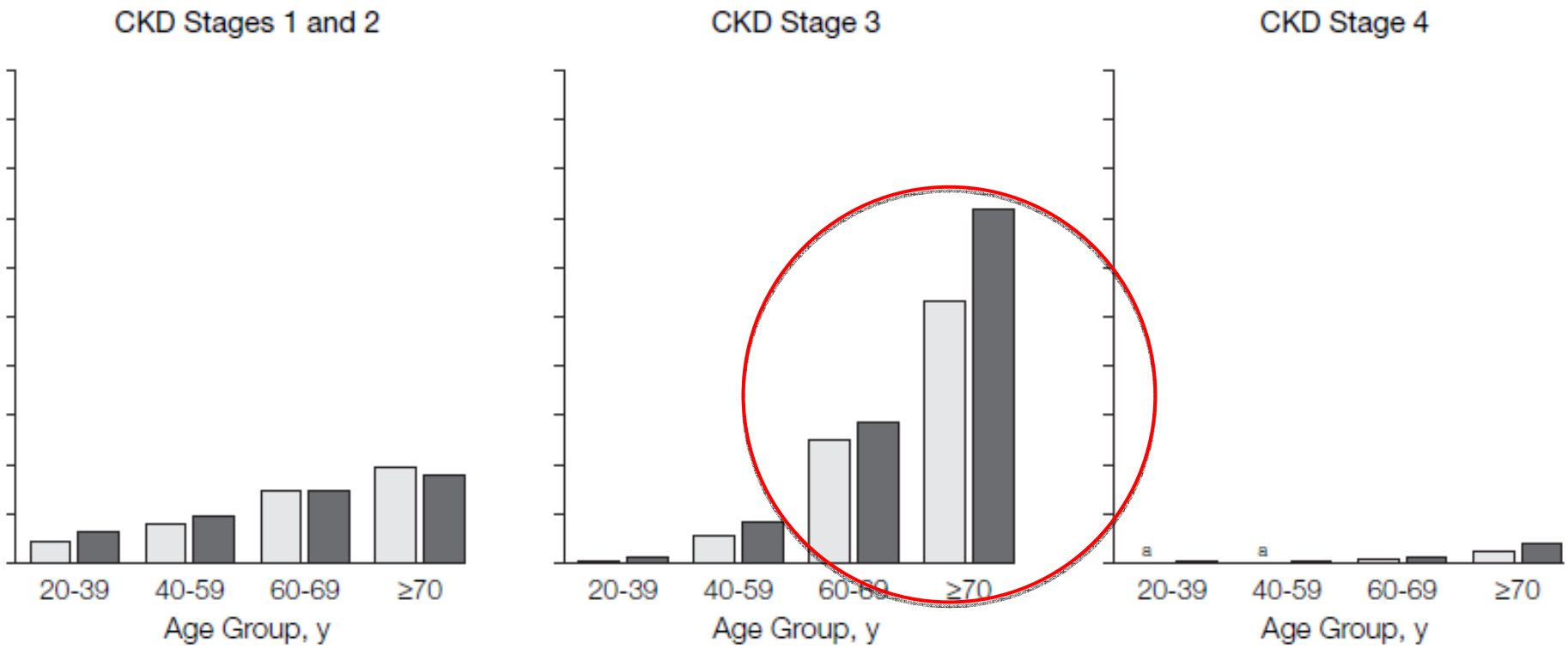
Distribution of NHANES participants with diabetes, congestive heart failure, & markers of CKD, 2005–2010

Figure 1.1 (volume 1)

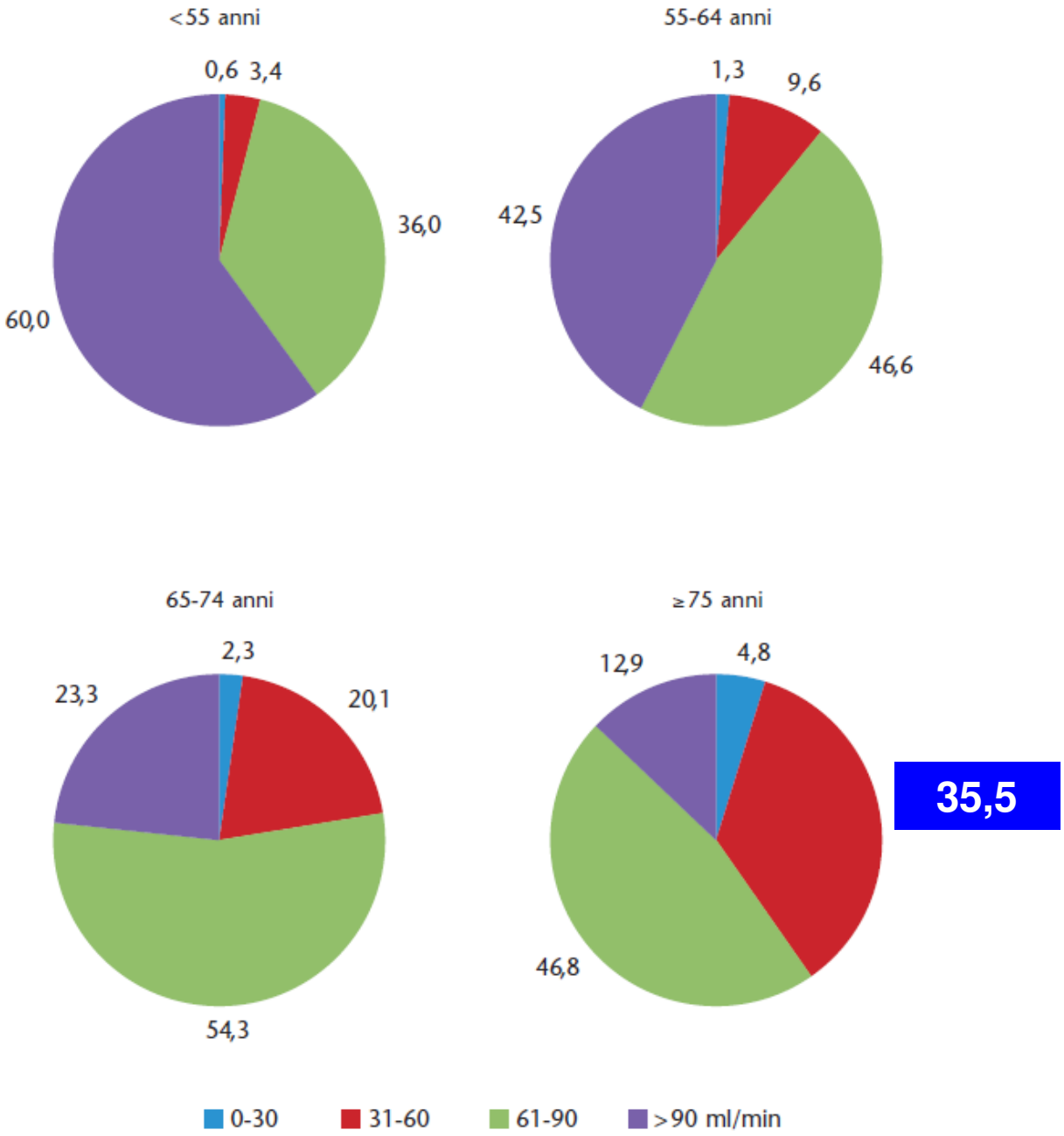


NHANES participants 2005–2010, age 20 & older; eGFR calculated using CKD-EPI equation; urine albumin creatinine ratio (ACR).

Prevalence of Chronic Kidney Disease in the United States

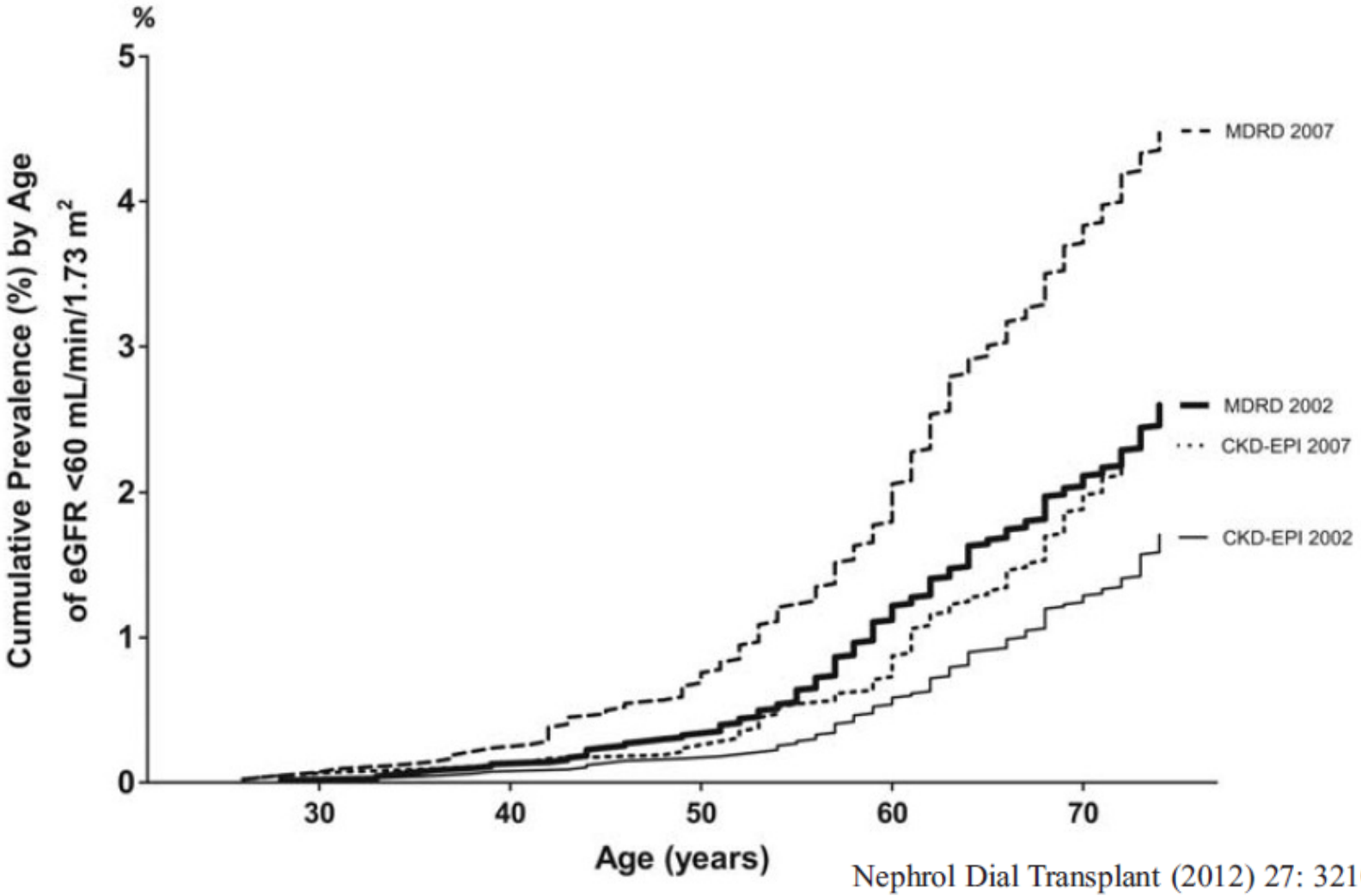


JAMA. 2007;298(17):2038-2047


<55 anni
0,6
3,4
36,0
60,0
55-64 anni
1,3
9,6
42,5
46,6
65-74 anni
2,3
23,3
20,1
54,3
≥75 anni
12,9
4,8
46,8
0-30
31-60
61-90
>90 ml/min

35,5

Comparison of the MDRD Study and the CKD-EPI Study equations in evaluating trends of estimated kidney function at population level: findings from the National FINRISK Study

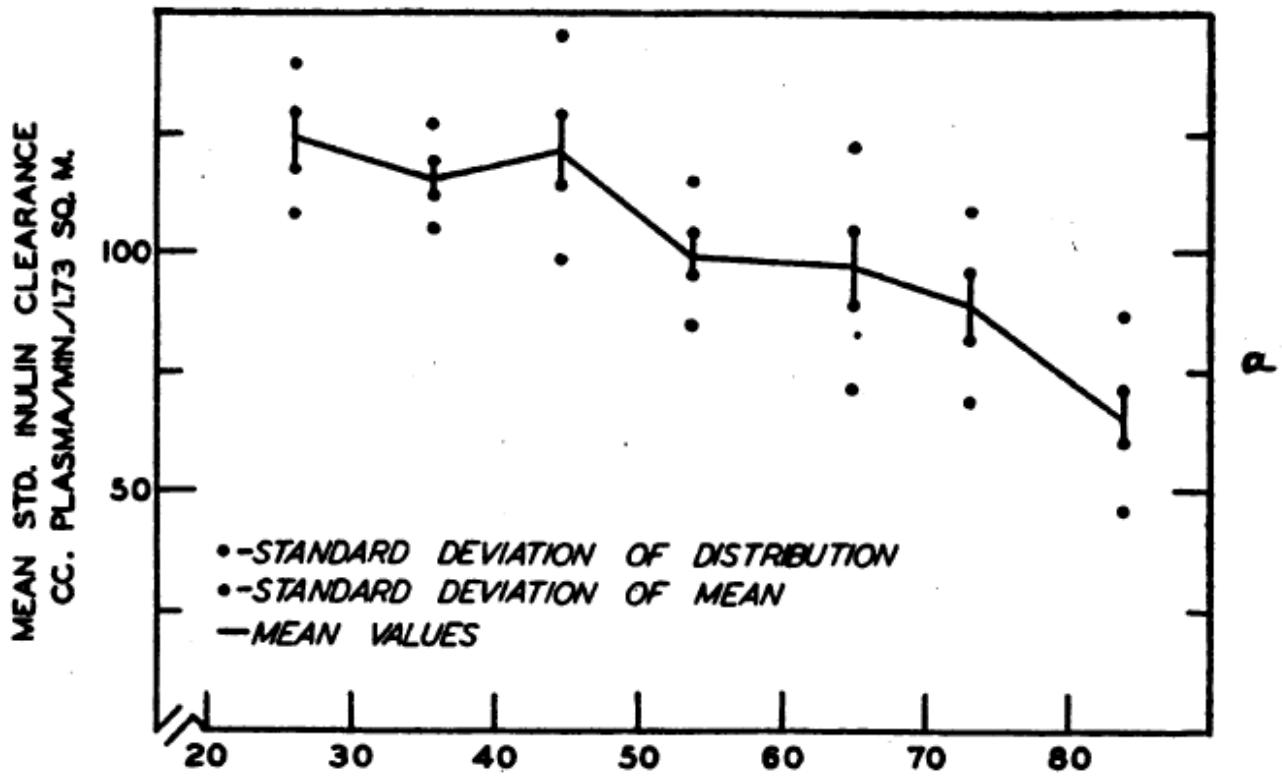


Nephrol Dial Transplant (2012) 27: 3210–3217

AGE CHANGES IN GLOMERULAR FILTRATION RATE, EFFECTIVE RENAL PLASMA FLOW, AND TUBULAR EXCRETORY CAPACITY IN ADULT MALES

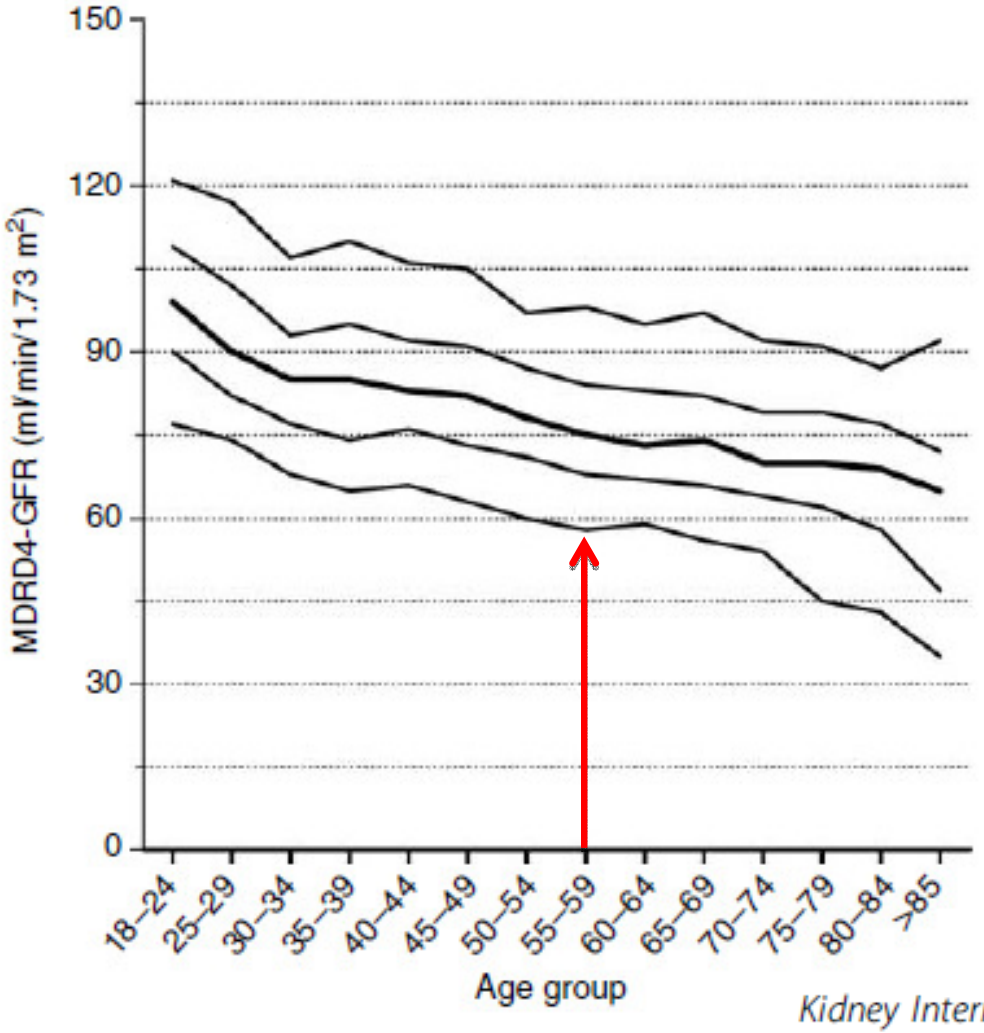
By DEAN F. DAVIES[1] AND NATHAN W. SHOCK

(Submitted for publication October 25, 1949; accepted, December 28, 1949)



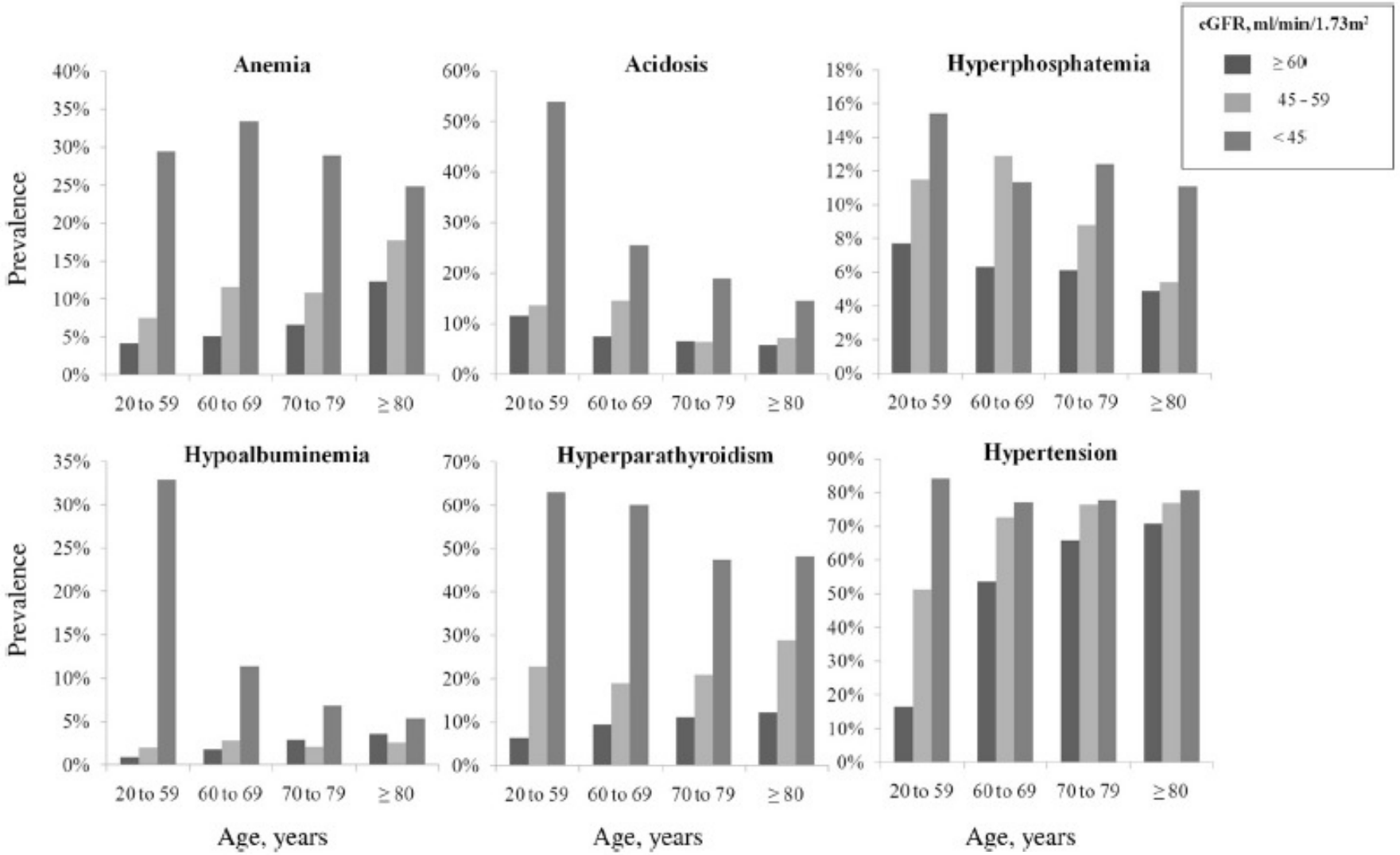
Age- and gender-specific reference values of estimated GFR in Caucasians: The Nijmegen Biomedical Study

JFM Wetzels[1], LALM Kiemeney[2], DW Swinkels[3], HL Willems[3] and M den Heijer[2,4]



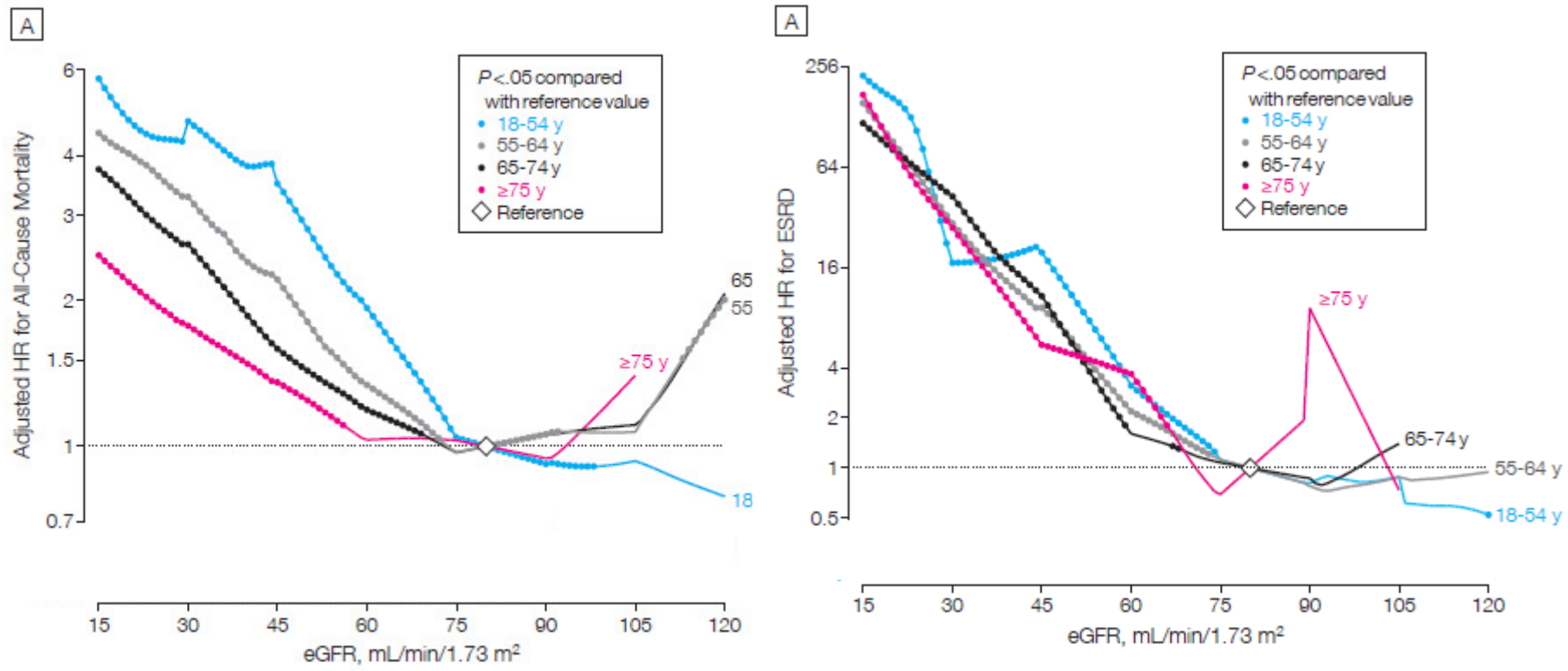
Kidney International (2007) **72**, 632–637

Age-Specific Associations of Reduced Estimated Glomerular Filtration Rate with Concurrent Chronic Kidney Disease Complications



Clin J Am Soc Nephrol 6: 2822–2828, 2011.

Age and Association of Kidney Measures With Mortality and End-stage Renal Disease



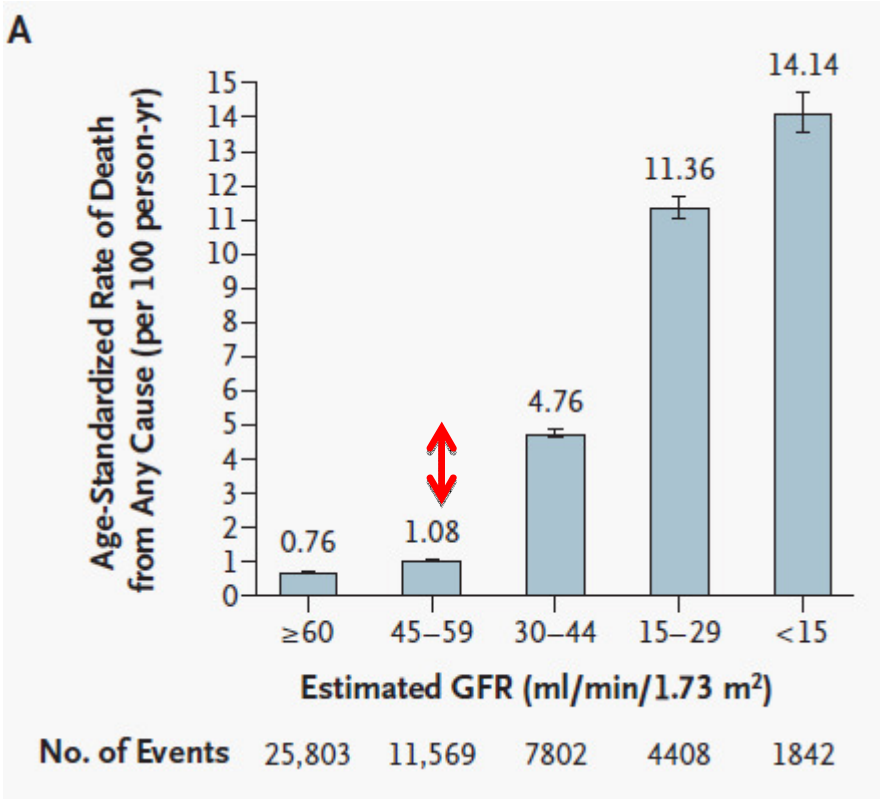
JAMA. 2012;308(22):2349-2360

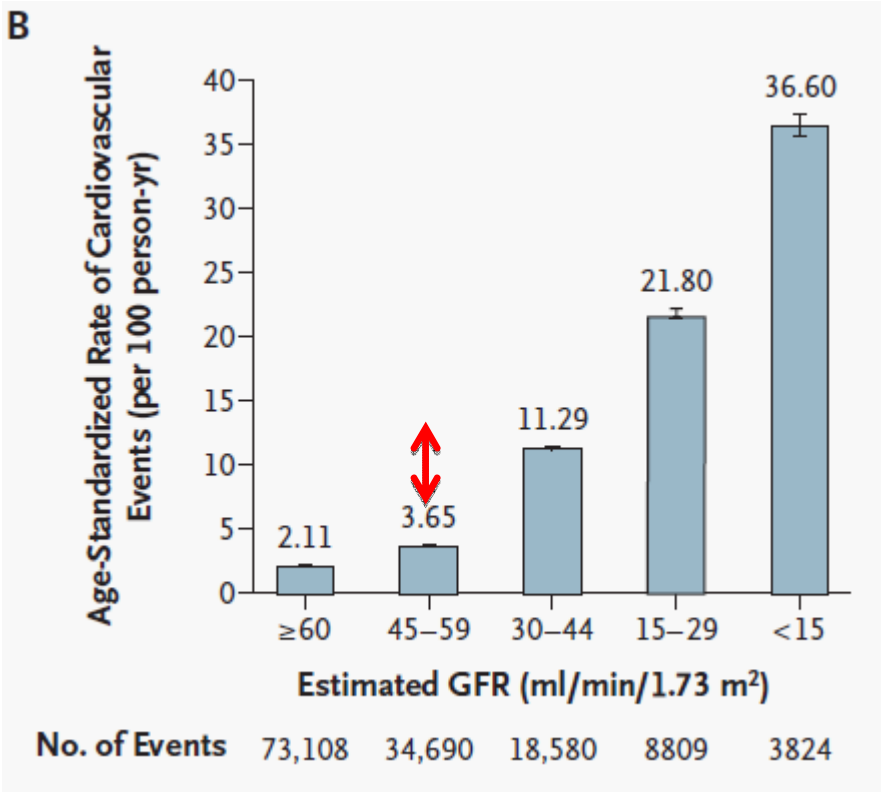
Mortality Risk Stratification in Chronic Kidney Disease: One Size for All Ages?

Age Group (Yr)	eGFR 50 to 59 (n = 38,274)	eGFR 40 to 49 (n = 25,146)
18 to 44 (n = 42,477)	1.24 (0.72 to 2.15)	—[c]
45 to 54 (n = 132,344)	0.86 (0.70 to 1.05)	2.49 (1.21 to 1.84)
55 to 64 (n = 148,669)	0.96 (0.87 to 1.06)	1.28 (1.12 to 1.48)
65 to 74 (n = 167,874)	0.90 (0.85 to 0.96)	1.16 (1.09 to 1.24)
75 to 84 (n = 125,313)	0.94 (0.90 to 0.99)	1.05 (1.00 to 1.10)
85+ (n = 10,377)	0.93 (0.83 to 1.04)	1.04 (0.93 to 1.16)

J Am Soc Nephrol 17: 846–853, 2006.

Chronic Kidney Disease and the Risks of Death, Cardiovascular Events, and Hospitalization



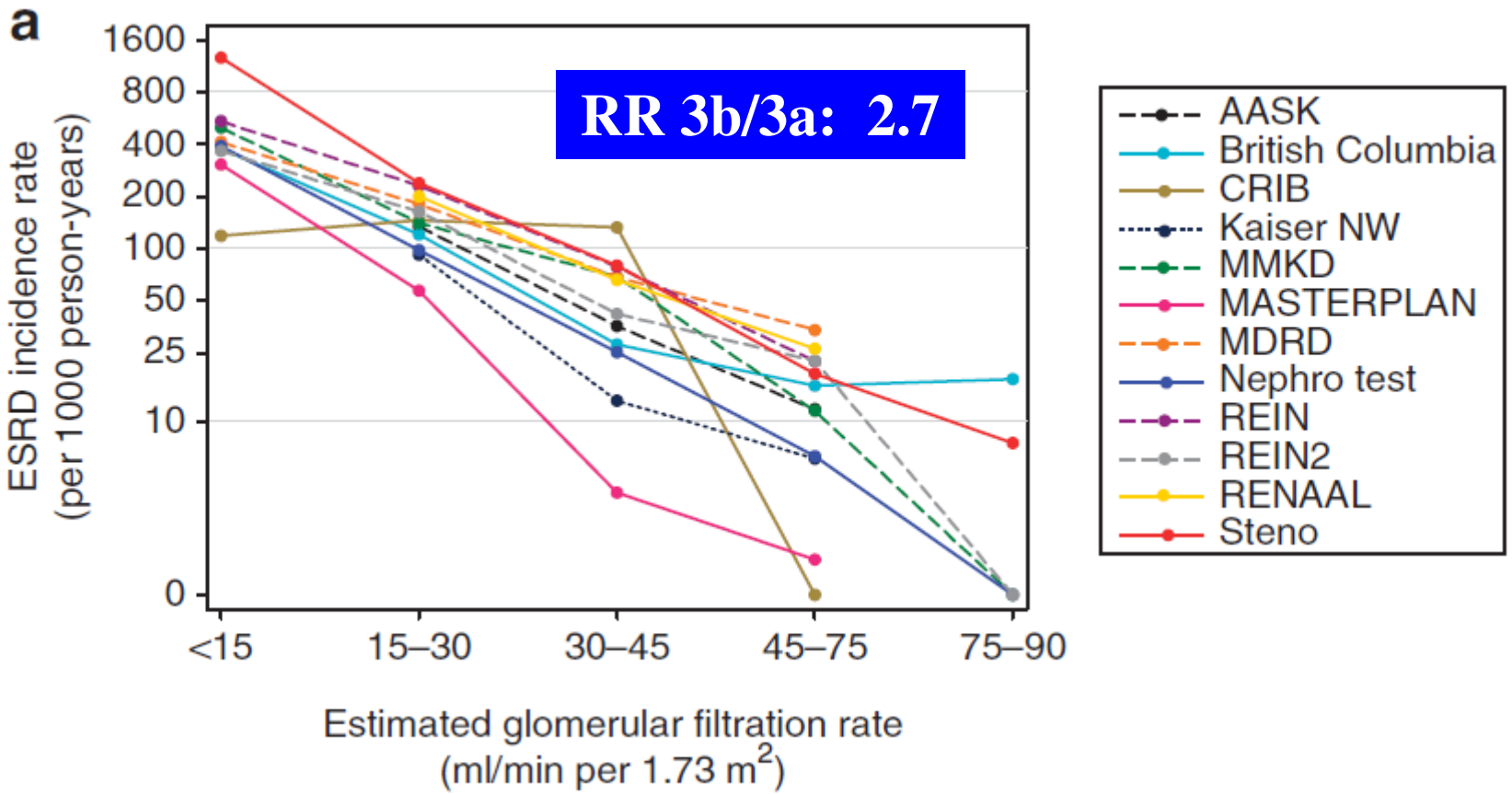


N Engl J Med 2004;351:1296-305.

Table 5 | GFR categories in CKD

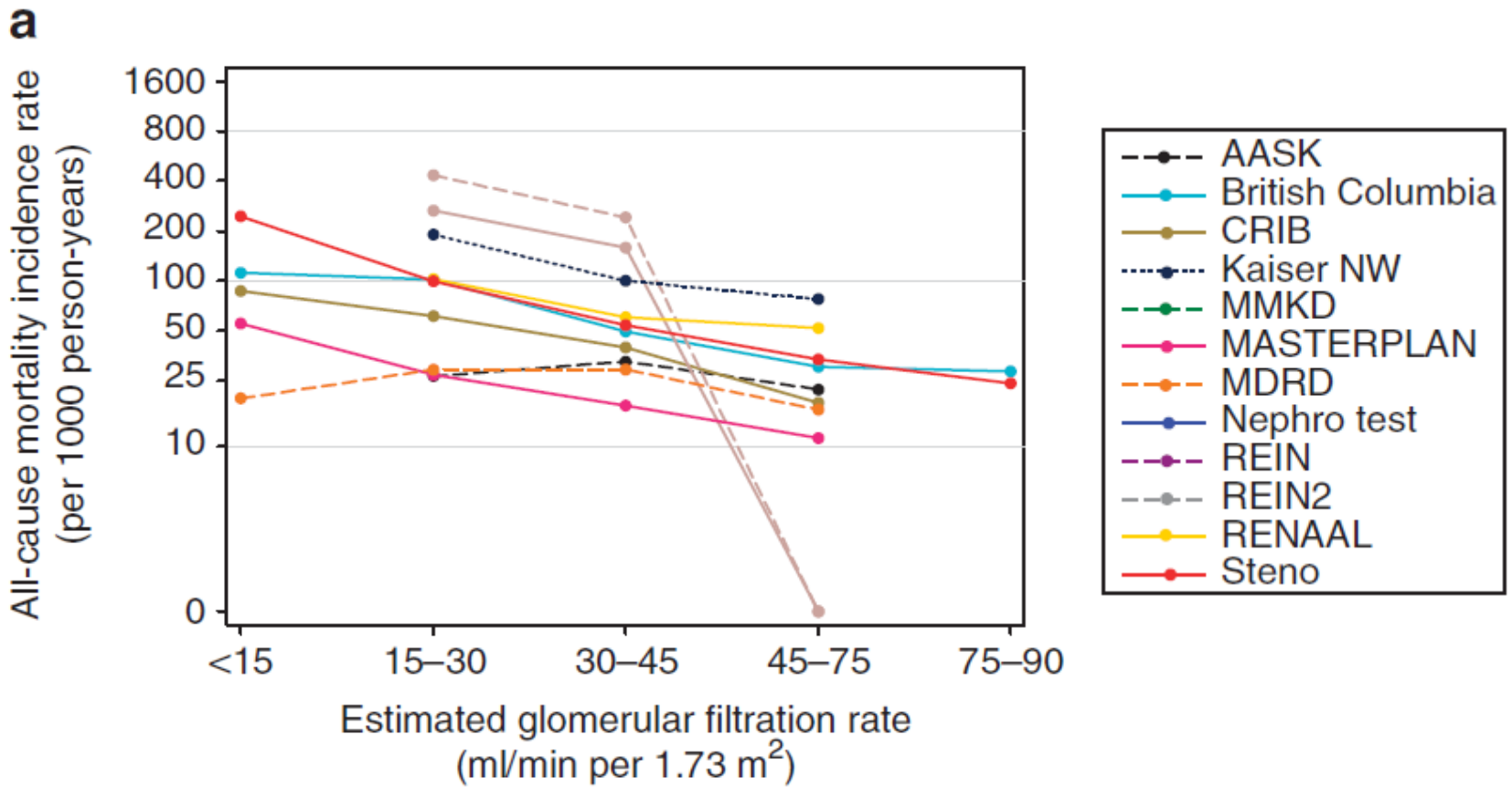
GFR category	GFR (ml/min/1.73 m^2)	Terms
G1	≥ 90	Normal or high
G2	60–89	Mildly decreased*
G3a	45–59	Mildly to moderately decreased
G3b	30–44	Moderately to severely decreased
G4	15–29	Severely decreased
G5	<15	Kidney failure

Lower estimated glomerular filtration rate and higher albuminuria are associated with mortality and end-stage renal disease. A collaborative meta-analysis of kidney disease population cohorts



Kidney International (2011) **79,** 1331–1340

Lower estimated glomerular filtration rate and higher albuminuria are associated with mortality and end-stage renal disease. A collaborative meta-analysis of kidney disease population cohorts



Kidney International (2011) **79,** 1331–1340

Proteinuria

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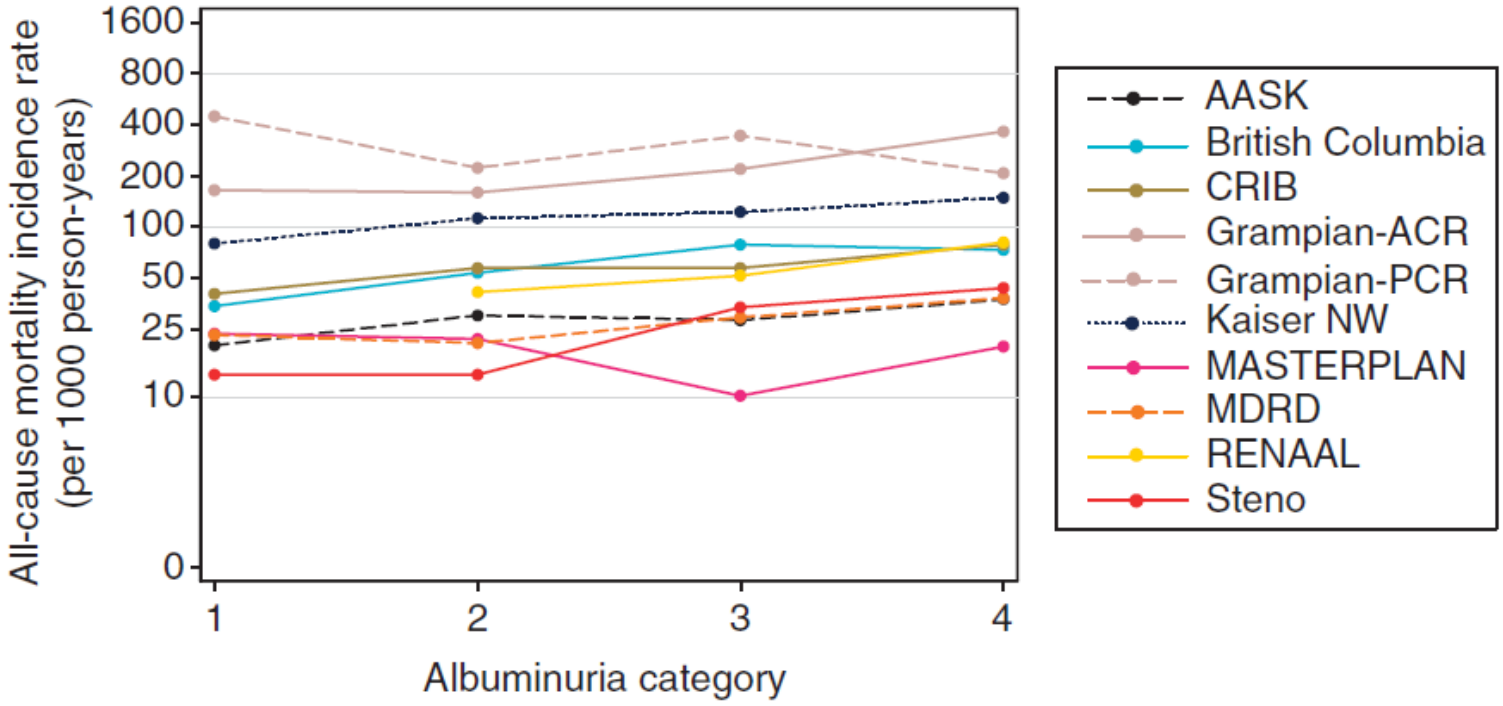
5	Kidney failure	GFR < 15 (or dialysis)	D if dialysis

➔Uomo 20 anni, e-GFR 35 mL/min, proteinuria 3 grammi, creatininemia in progressione: stadio III.

➔Uomo 70 anni, e-GFR 55 mL/min, proteinuria assente, creatininemia stabile: stadio III.

Lower estimated glomerular filtration rate and higher albuminuria are associated with mortality and end-stage renal disease. A collaborative meta-analysis of kidney disease population cohorts

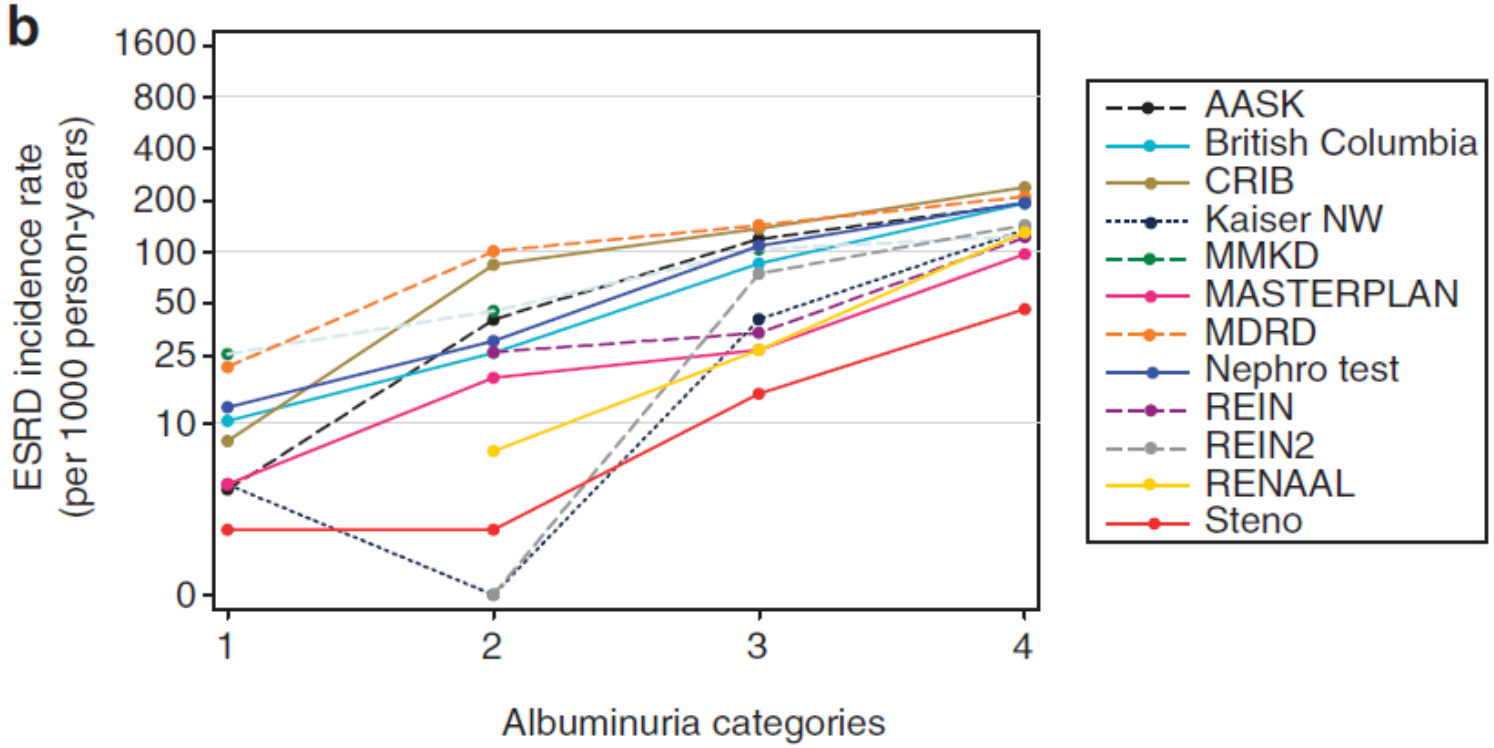
b



Reference	1.46 (1.24, 1.71)	1.80 (1.38, 2.35)	2.26 (1.68, 3.04)

Kidney International (2011) **79,** 1331–1340

Lower estimated glomerular filtration rate and higher albuminuria are associated with mortality and end-stage renal disease. A collaborative meta-analysis of kidney disease population cohorts



Reference	2. 92 (2. 08, 4. 10)	7. 70 (4. 52, 13. 10)	15. 01 (8. 36, 26. 95)

Kidney International (2011) **79,** 1331–1340

Associations of estimated glomerular filtration rate and albuminuria with mortality and renal failure by sex: a meta-analysis

BMJ 2013;346:f324

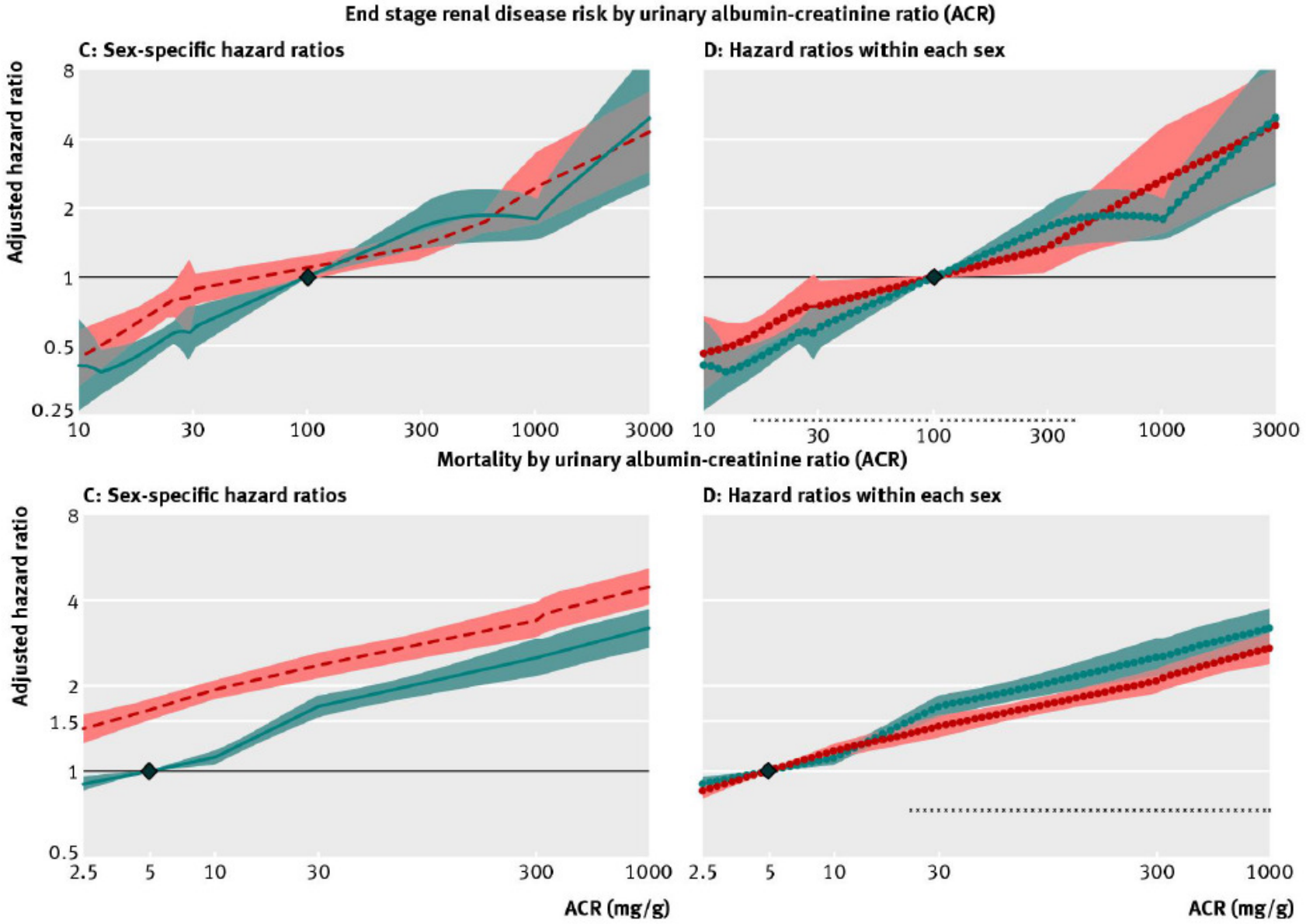
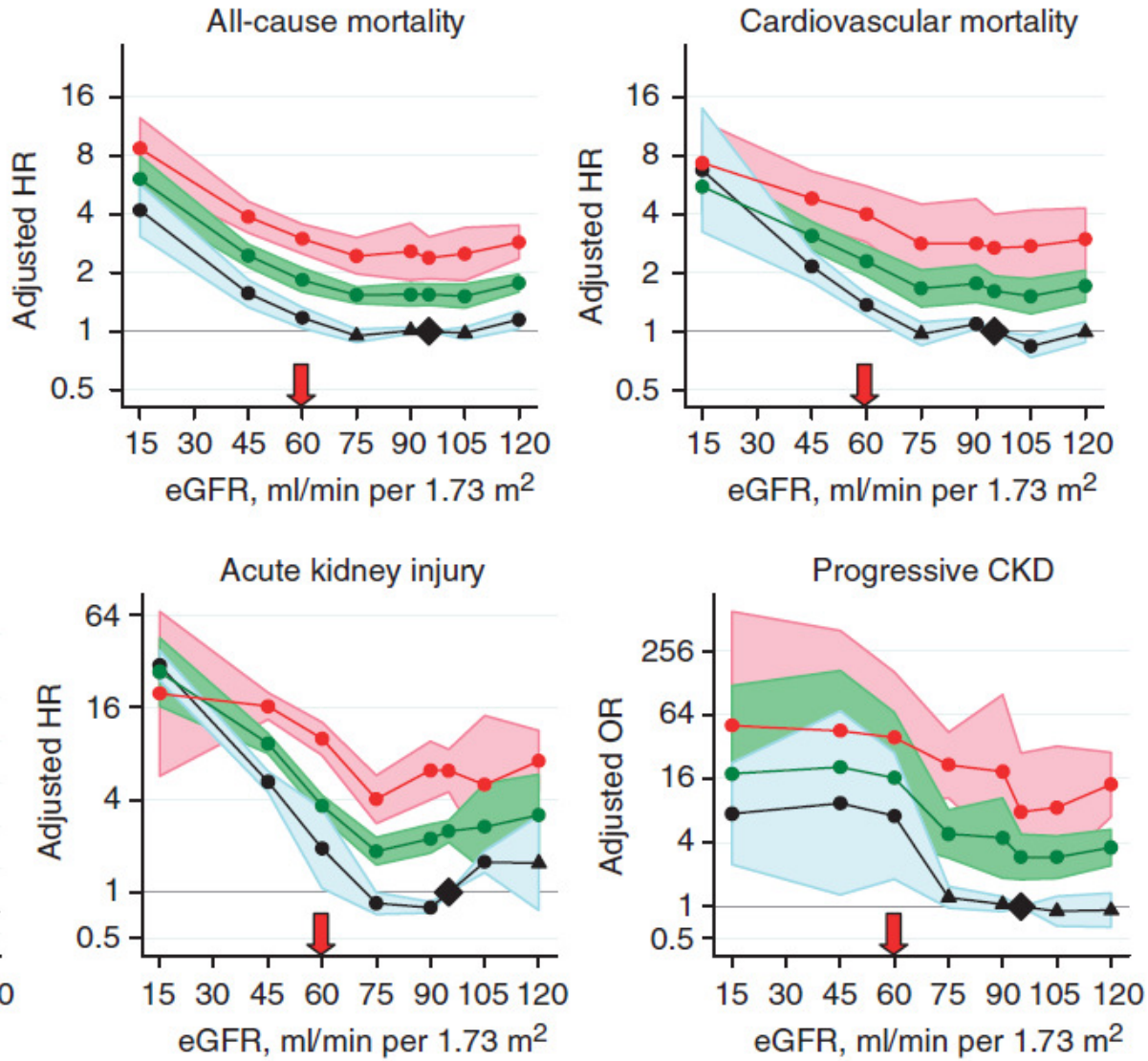
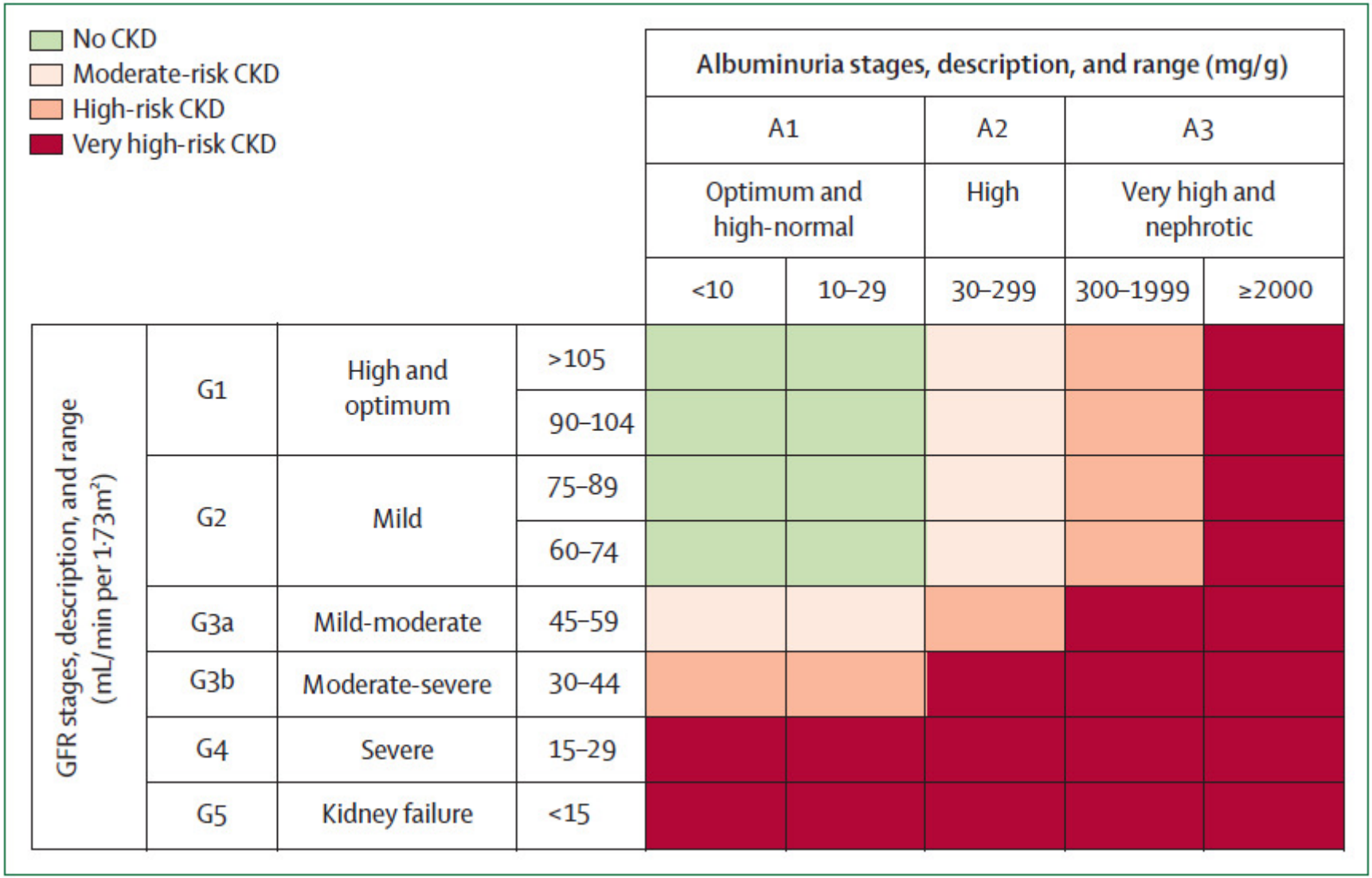


Table 6 | Albuminuria categories in CKD

Category	AER (mg/24 hours)	ACR (approximate equivalent)		Terms
		(mg/mmol)	(mg/g)	
A1	<30	<3	<30	Normal to mildly increased
A2	30-300	3-30	30-300	Moderately increased*
A3	>300	>30	>300	Severely increased**

Summary of relative risks from continuous meta-analysis

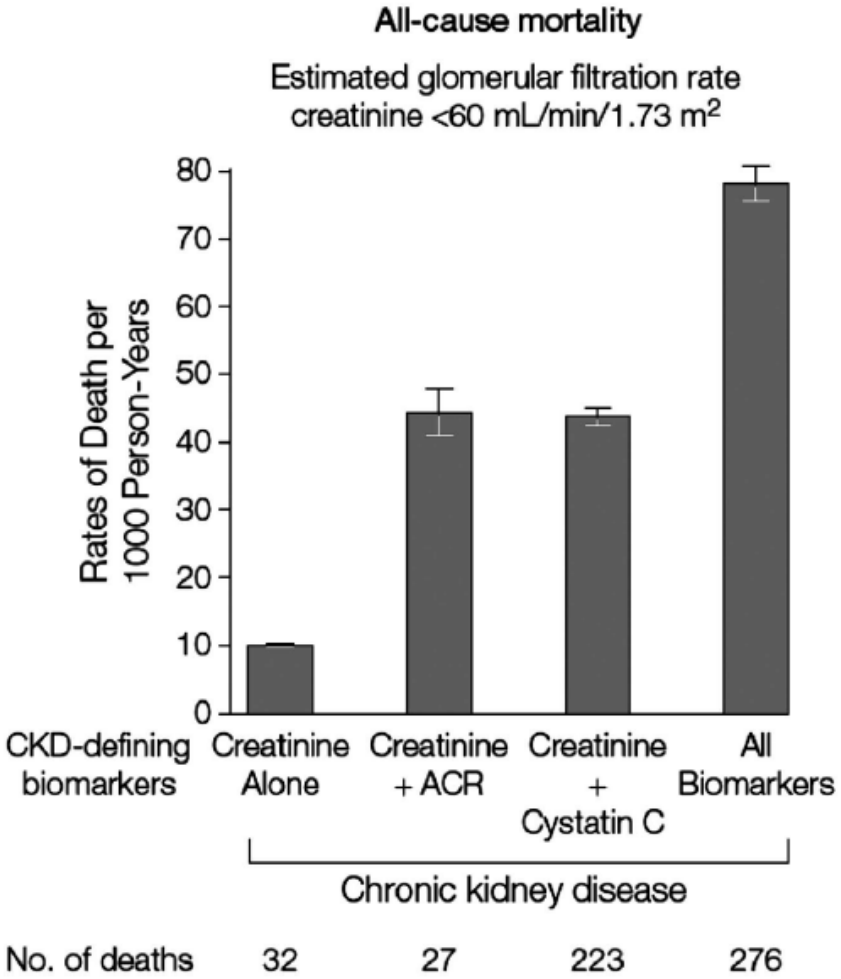


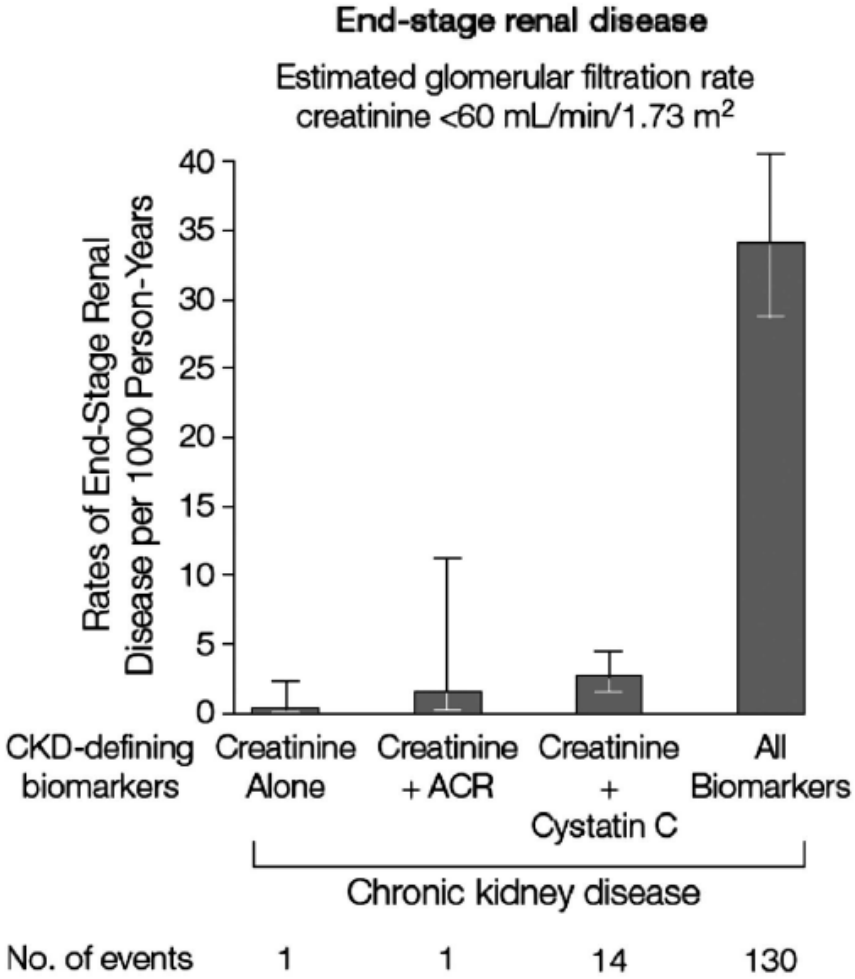

No CKD
Moderate-risk CKD
High-risk CKD
Very high-risk CKD
Albuminuria stages, description, and range (mg/g)
A1
A2
A3
Optimum and high-normal
High
Very high and nephrotic
<10
10–29
30–299
300–1999
≥2000
GFR stages, description, and range (mL/min per 1·73m²)
G1
High and optimum
>105
90–104
G2
Mild
75–89
60–74
G3a
Mild-moderate
45–59
G3b
Moderate-severe
30–44
G4
Severe
15–29
G5
Kidney failure
<15

Cause (?)

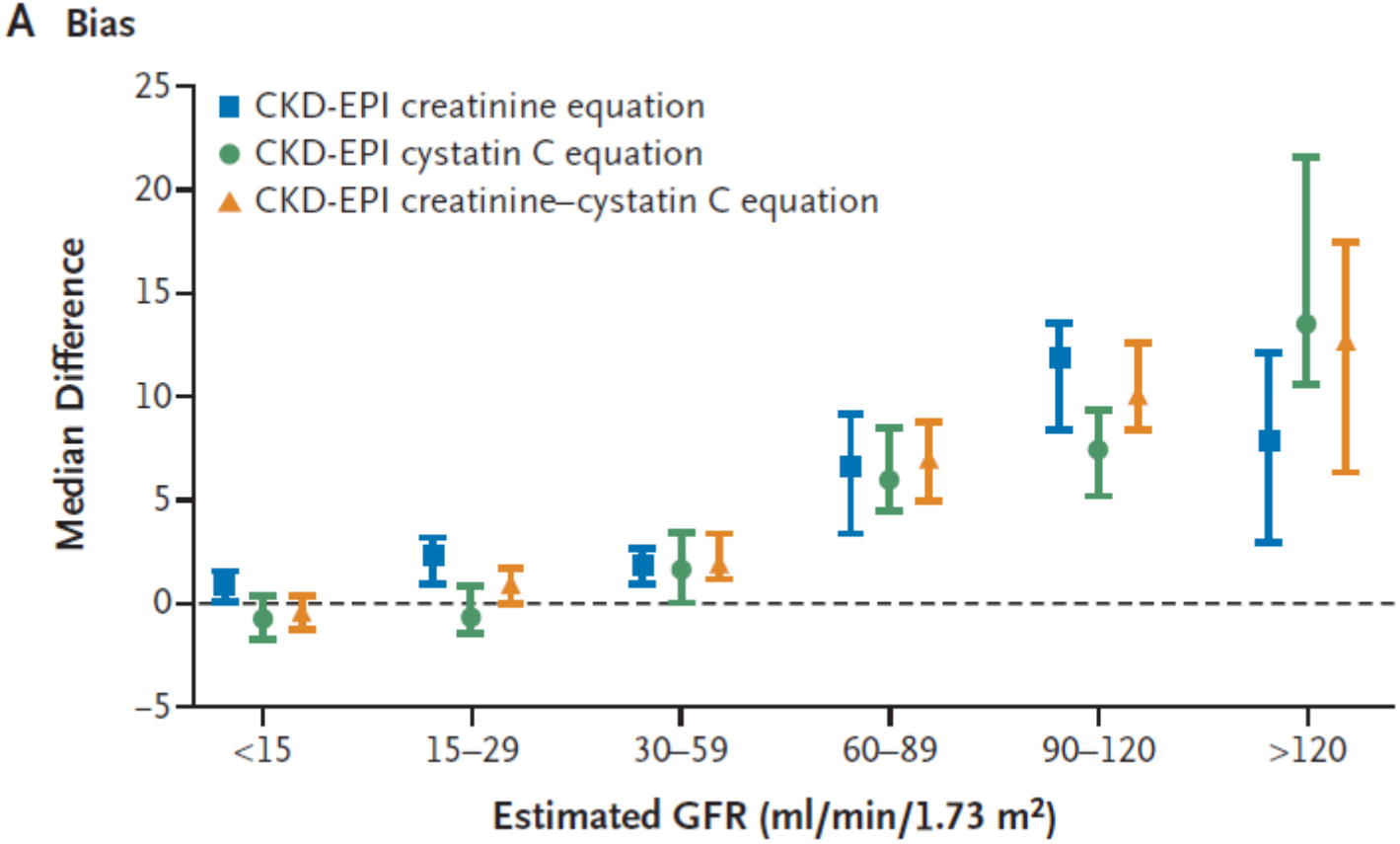
Table 4 | Classification* of CKD based on presence or absence of systemic disease and location within the kidney of pathologic-anatomic findings

	Examples of systemic diseases affecting the kidney	Examples of primary kidney diseases (absence of systemic diseases affecting the kidney)
Glomerular diseases	Diabetes, systemic autoimmune diseases, systemic infections, drugs, neoplasia (including amyloidosis)	Diffuse, focal or crescentic proliferative GN; focal and segmental glomerulosclerosis, membranous nephropathy, minimal change disease
Tubulointerstitial diseases	Systemic infections, autoimmune, sarcoidosis, drugs, urate, environmental toxins (lead, aristolochic acid), neoplasia (myeloma)	Urinary-tract infections, stones, obstruction
Vascular diseases	Atherosclerosis, hypertension, ischemia, cholesterol emboli, systemic vasculitis, thrombotic microangiopathy, systemic sclerosis	ANCA-associated renal limited vasculitis, fibromuscular dysplasia
Cystic and congenital diseases	Polycystic kidney disease, Alport syndrome, Fabry disease	Renal dysplasia, medullary cystic disease, podocytopathies


All-cause mortality
Estimated glomerular filtration rate
creatinine <60 mL/min/1.73 m2
Rates of Death per 1000 Person-Years
0
10
20
30
40
50
60
70
80
CKD-defining biomarkers
Creatinine Alone
Creatinine + ACR
Creatinine + Cystatin C
All Biomarkers
Chronic kidney disease
No. of deaths
32
27
223
276


End-stage renal disease
Estimated glomerular filtration rate
creatinine <60 mL/min/1.73 m2
Rates of End-Stage Renal Disease per 1000 Person-Years
0
5
10
15
20
25
30
35
40
CKD-defining biomarkers
Creatinine Alone
Creatinine + ACR
Creatinine + Cystatin C
All Biomarkers
Chronic kidney disease
No. of events
1
1
14
130

Estimating Glomerular Filtration Rate from Serum Creatinine and Cystatin C



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