

# Urinary indices for estimation of albuminuria and proteinuria in patients with chronic kidney disease

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## Introduction and Aims

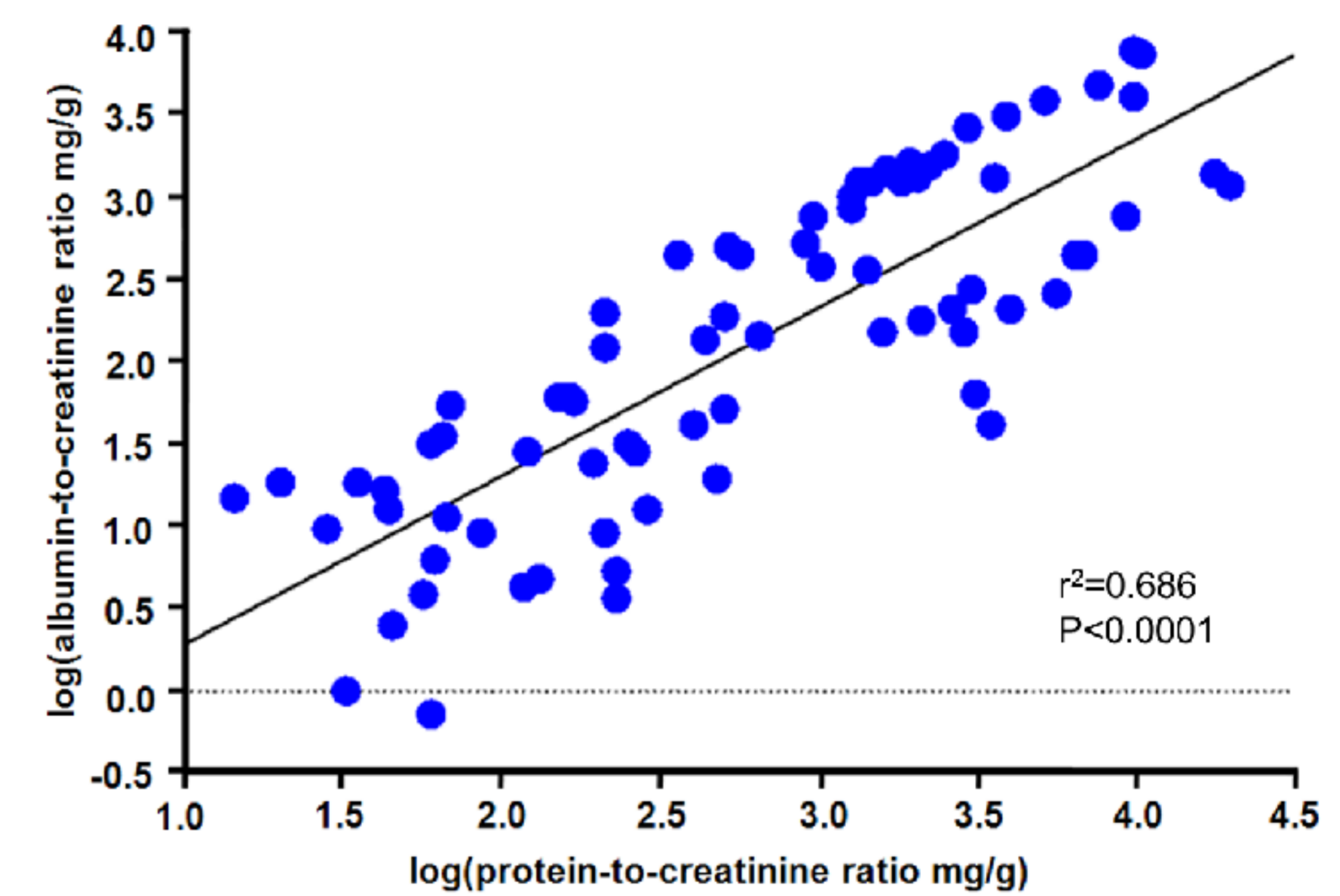
For estimation of daily urinary excretion of protein and albumin, protein-to-creatinine ratio (PCR) and albumin-to-creatinine ratio (ACR) are respectively used from spot urine. In addition, estimated protein excretion rate (ePER) and estimated albumin excretion rate (eAER) can be calculated using estimated creatinine excretion rate (eCER). Although measurement of albuminuria is preferred to that of total proteinuria in the recent KDIGO guidelines, it is not clear which is more sensitive in the detection of chronic kidney disease (CKD). Besides, urine albumin-to-protein ratio (APR) may be useful in the differential diagnosis of glomerular versus non-glomerular CKD. We evaluated these urinary indices to compare their usefulness in the diagnosis of glomerular CKD.

## Methods

Both 24 h-urine and spot urine were collected from 77 stable CKD patients (male, 32; age, 58 ± 18 years; 39 diabetics) for measurement of albumin, protein and creatinine, and protein electrophoresis (PEP); spot urine was obtained immediately after finishing 24 h-urine collection. Based on MDRD and CKD-EPI equation, ePER<sub>MDRD</sub>, ePER<sub>CKD-EPI</sub>, eAER<sub>MDRD</sub> and eAER<sub>CKD-EPI</sub> were calculated to estimate daily proteinuria and albuminuria. Glomerular CKD was defined by clinical and pathological evidences.

## Results

### The relationship between PCR and ACR



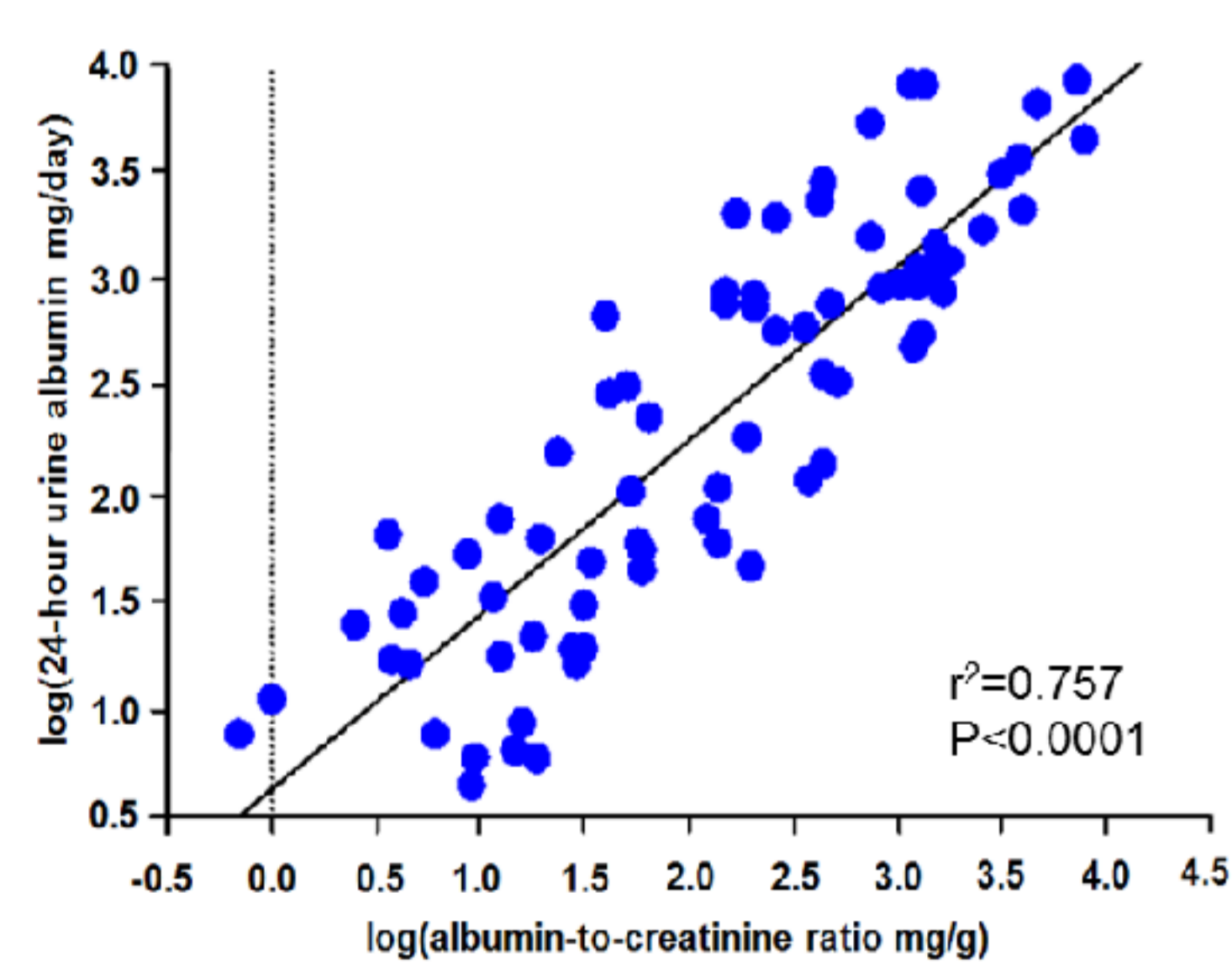
### Albuminuria versus Proteinuria: 24-hour urine

24-hour urine albumin		24-hour urine protein	
		Normal < 150 mg/d	Proteinuria ≥ 150 mg/d
Normal	< 30 mg/d	19 (24.7%)	0 (0%)
Microalbuminuria	30 – 300 mg/d	7 (9.1%)	13 (6.9%)
Macroalbuminuria	> 300 mg/d	0 (0%)	30 (49.3%)

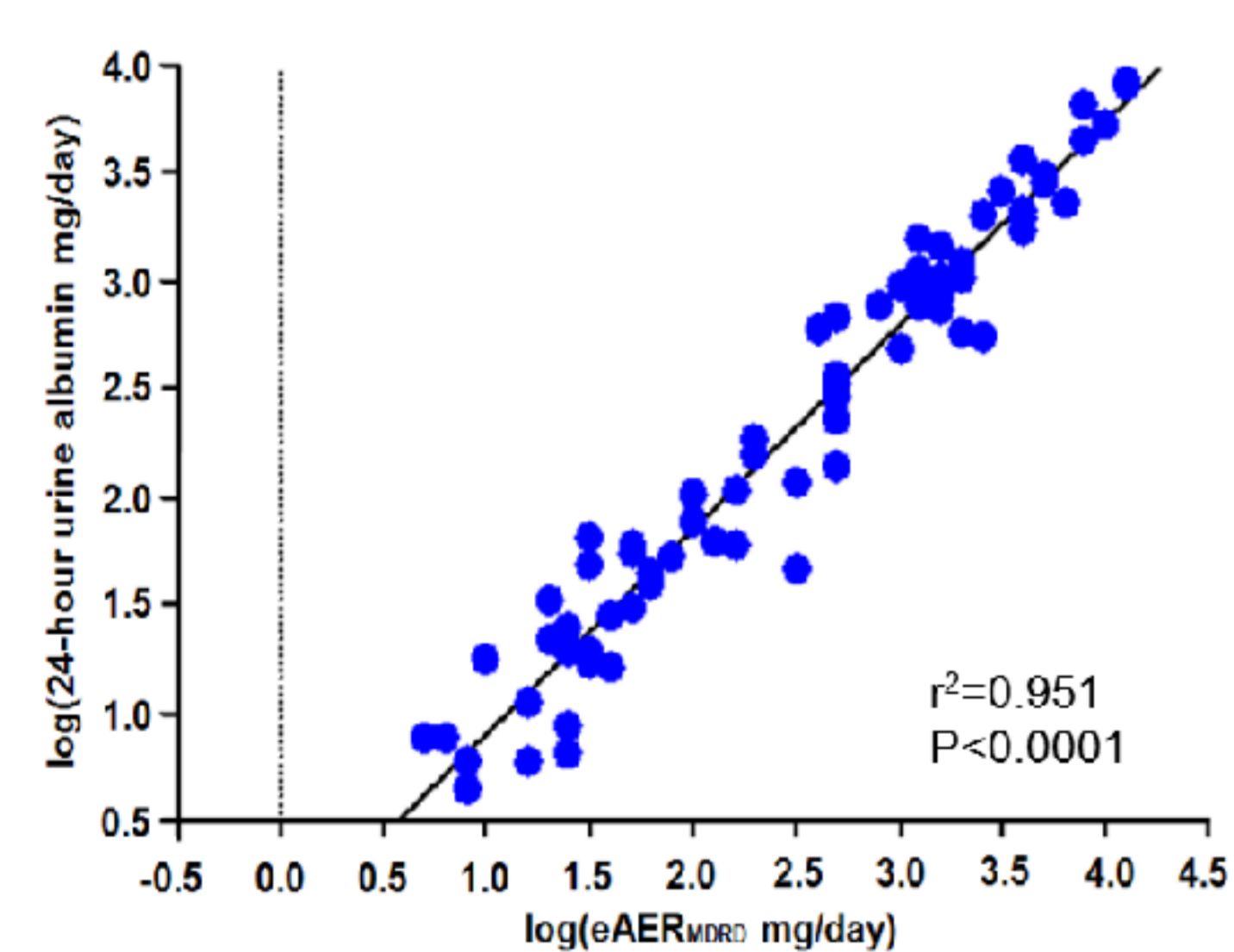
### Albuminuria versus Proteinuria: Spot urine

Albumin-to-creatinine ratio (ACR)		Protein-to-creatinine ratio (PCR)	
		Normal < 0.2	Proteinuria ≥ 0.2
Normal	< 30 mg/g	13 (16.9%)	1 (1.3%)
Microalbuminuria	30 – 300 mg/g	10 (13.0%)	11 (14.3%)
Macroalbuminuria	> 300 mg/g	0 (0%)	42 (54.5%)

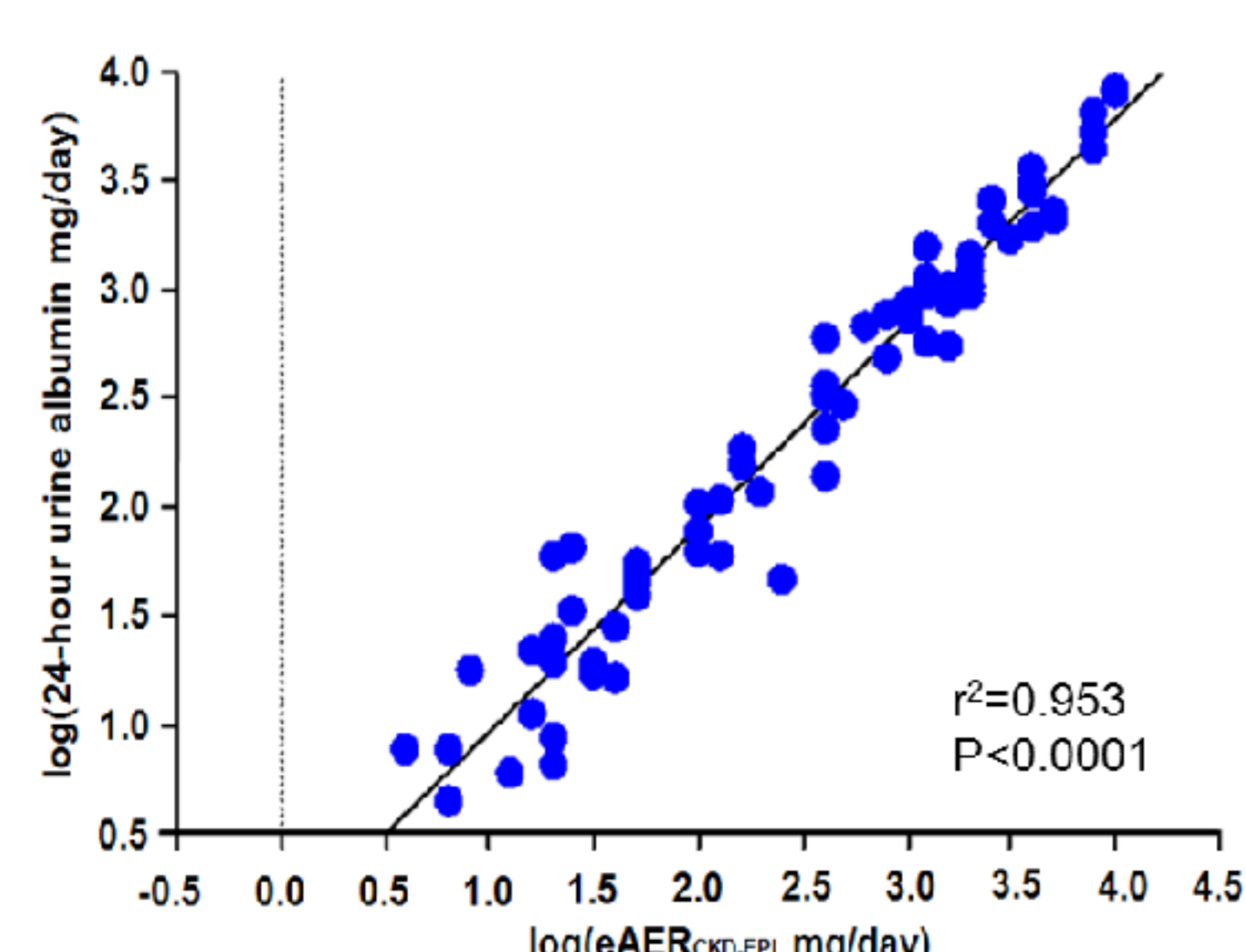
### 24-hour urine albumin and ACR



### 24-hour urine albumin and eAER<sub>MDRD</sub>



### 24-hour urine albumin and eAER<sub>CKD-EPI</sub>

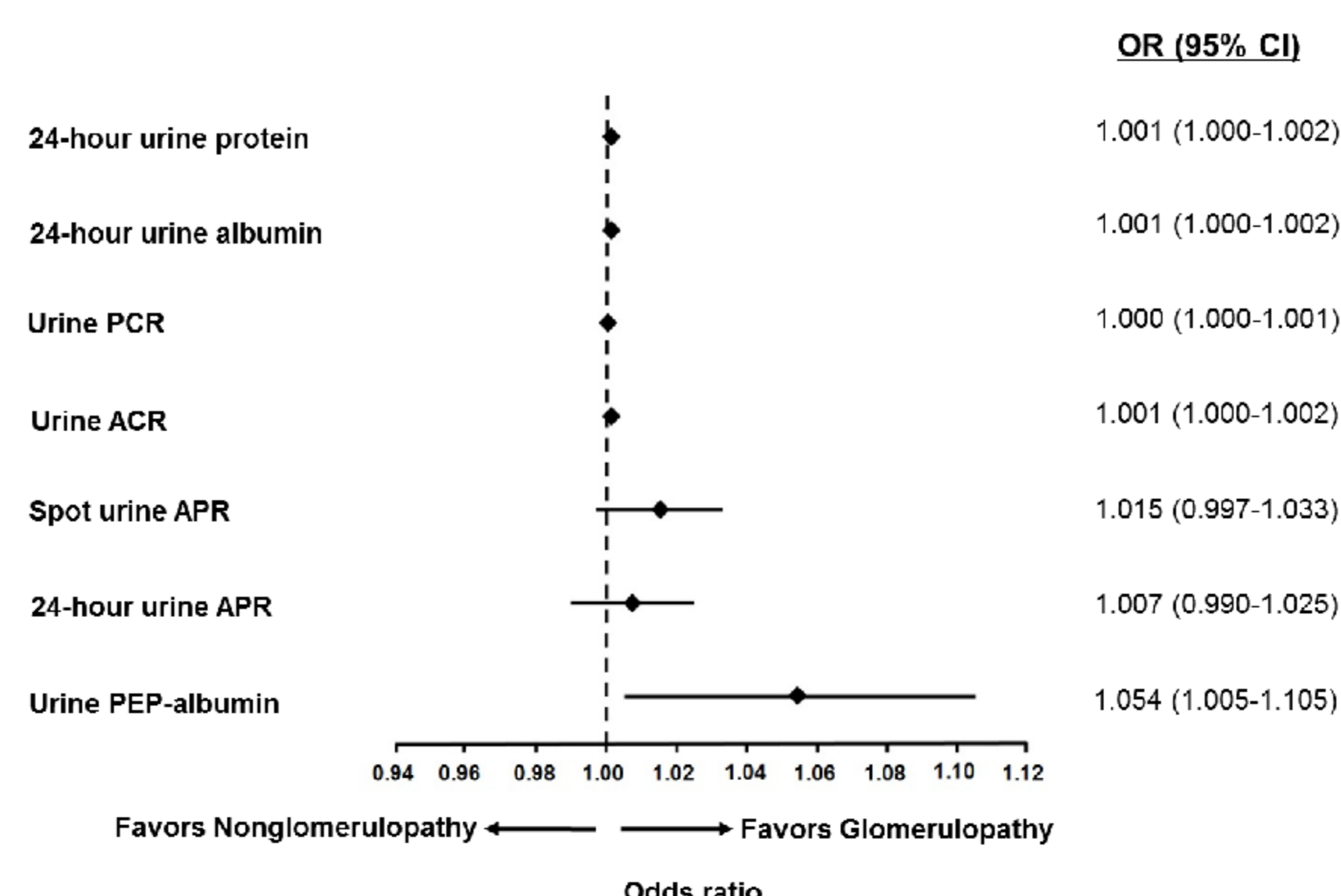


### Comparisons between glomerulopathy and nonglomerulopathy

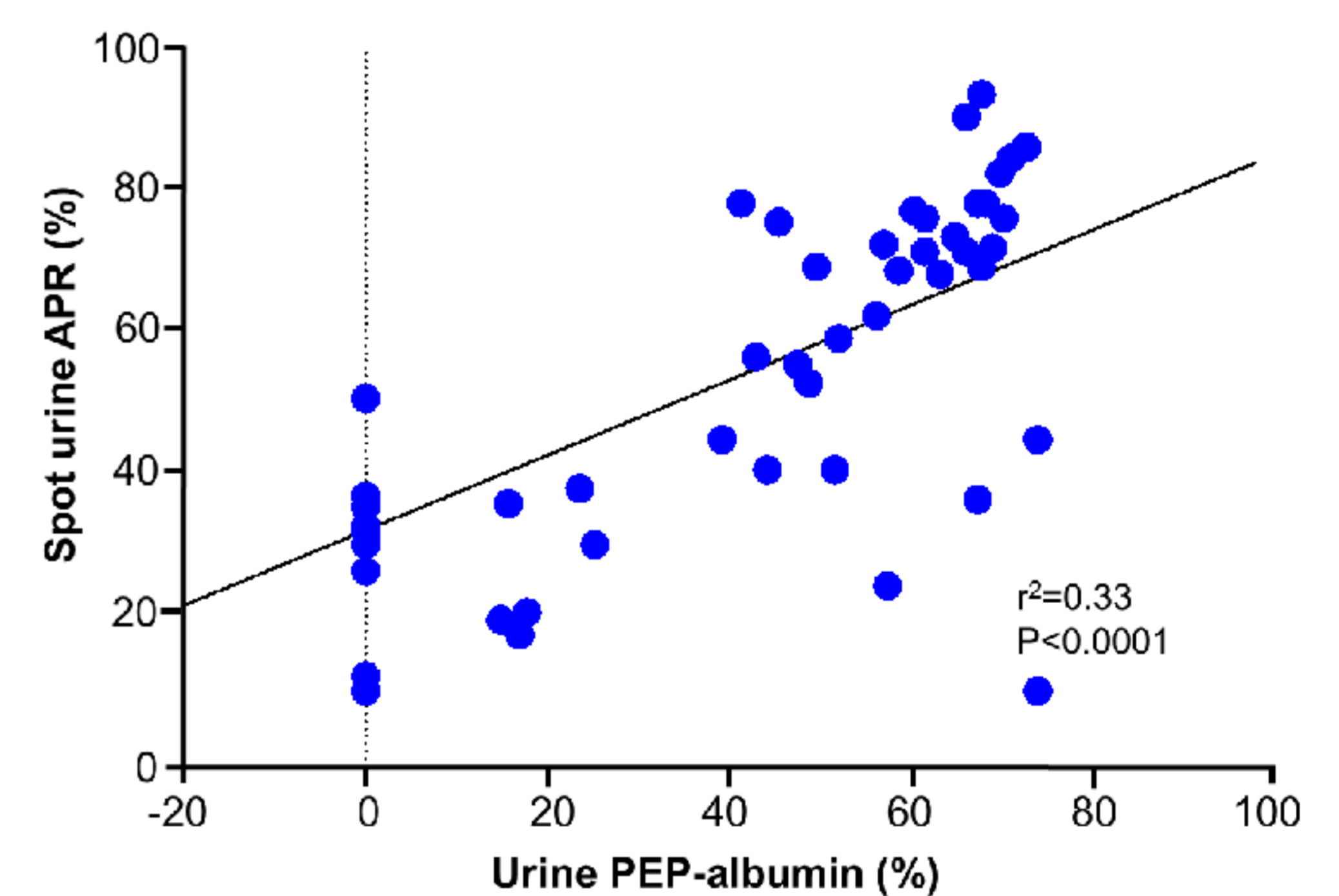
Variables*	Glomerulopathy (n=59)	Nonglomerulopathy (n=16)	P-value
Age (year)	57 ± 17	60 ± 20	0.5275
Male	28 (47)	4 (25)	0.0995
Diabetes mellitus	33 (56)	6 (38)	0.0932
Body mass index (kg/m <sup>2</sup> )	24.4 ± 3.4	21.6 ± 4.5	0.0048
Serum creatinine (mg/dL)	1.6 ± 0.9	2.1 ± 1.6	0.1249
eGFR <sup>†</sup> (mL/min/1.73m <sup>2</sup> )	53.5 ± 28.2	40.3 ± 27.0	0.0519
24-hour proteinuria (mg/day)	2074 ± 3457	429 ± 794	0.0049
24-hour albuminuria (mg/day)	1352 ± 2096	267 ± 610	0.0063
PCR (mg/g)	2693 ± 4055	734 ± 1092	0.0189
ACR (mg/g)	1682 ± 2564	403 ± 699	0.0100
24-hour urine APR (%)	64 ± 43	55 ± 29	0.3731
Spot urine APR (%)	58 ± 27	46 ± 29	0.0920
Urine PEP-Albumin (%)	49 ± 24	11 ± 21	0.0008
Biopsy-based diagnosis (%)	28 (47)	6 (38)	0.4170
ACE inhibitor/ARB use	37 (63)	7 (44)	0.0738

\*Variables are expressed as mean ± standard deviation or as number (percentage). P values were calculated by Mann-Whitney for continuous variables and chi-squared test for categorical variables. †eGFR was calculated using MDRD equation.

### Multiple logistic regression analysis to discern between glomerulopathy and nonglomerulopathy



### The relationship between spot urine albumin-to-protein ratio (APR) and the percentage of albumin in urine protein electrophoresis



## Conclusion

Urine albumin should be quantified because microalbuminuria can be revealed in CKD patients without overt proteinuria. To estimate daily proteinuria and albuminuria, ePER and eAER may be superior to PCR and ACR, respectively. Compared with APR, urine PEP may be more useful to diagnose glomerular proteinuria.