

SUPPLEMENTAL MATERIAL

Table S1. Associations of ACR categories with all-cause mortality according to comorbidities (2017 ACC/AHA High Blood Pressure definition), among US adults, 1999-2019.

	n	Model 1 IDR (95% CI)	Model 2 IDR (95% CI)	Model 3 IDR (95% CI)	Model 4 IDR (95% CI)
Neither comorbidity					
ACR (mg/g)					
< 10	14,794	1.00	1.00	1.00	1.00
10 - < 30	3,581	1.63* (1.37, 1.95)	1.60* (1.35, 1.89)	1.51* (1.27, 1.79)	1.46* (1.23, 1.73)
30 - < 300	1,094	1.99* (1.53, 2.59)	1.79* (1.36, 2.36)	1.56* (1.18, 2.06)	1.40* (1.05, 1.85)
≥300	99	3.83* (1.96, 7.49)	3.92* (2.22, 6.93)	2.69* (1.44, 5.01)	2.50* (1.55, 4.03)
Hypercholesteremia only					
ACR (mg/g)					
< 10	4,696	1.00	1.00	1.00	1.00
10 - < 30	1,260	1.64* (1.28, 2.10)	1.52* (1.18, 1.95)	1.42* (1.12, 1.81)	1.40* (1.09, 1.79)
30 - < 300	395	2.39* (1.76, 3.26)	2.25* (1.64, 3.09)	2.09* (1.51, 2.90)	1.90* (1.30, 2.77)
≥300	46	1.66 (0.87, 3.17)	1.41 (0.76, 2.61)	1.11 (0.59, 2.07)	1.04 (0.54, 2.03)
Hypertension only					
ACR (mg/g)					
< 10	6,750	1.00	1.00	1.00	1.00
10 - < 30	2,934	1.60* (1.42, 1.81)	1.51* (1.33, 1.71)	1.41* (1.24, 1.61)	1.40* (1.23, 1.60)
30 - < 300	1,576	2.45* (2.15, 2.81)	2.20* (1.93, 2.50)	1.96* (1.72, 2.22)	1.80* (1.57, 2.07)
≥300	326	4.21* (3.45, 5.14)	3.34* (2.73, 4.08)	2.96* (2.44, 3.60)	2.28* (1.89, 2.76)
Both comorbidities					
ACR (mg/g)					
< 10	6,174	1.00	1.00	1.00	1.00
10 - < 30	3,408	1.53* (1.39, 1.68)	1.44* (1.31, 1.59)	1.40* (1.26, 1.54)	1.37* (1.24, 1.52)
30 - < 300	1,977	2.66* (2.37, 2.99)	2.38* (2.12, 2.68)	2.16* (1.92, 2.42)	2.03* (1.80, 2.28)
≥300	530	4.58* (3.72, 5.62)	4.06* (3.32, 4.96)	3.38* (2.73, 4.17)	2.60* (2.10, 3.23)

Abbreviations: CI: confidence interval; IDR: incidence density ratio

*Indicates estimate is significant (p < 0.05)

^a Hypertension was defined using the 2017 ACC/AHA High Blood Pressure Guideline

Model 1 is adjusted for age group, race/ethnicity, and sex

Model 2 is additionally adjusted for: Model 1 + education, income, marital status, and insurance status

Model 3 is additionally adjusted for: Model 2 + smoking, alcohol consumption, physical activity, self-rated health, and BMI

Model 4 is additionally adjusted for: Model 3 + diabetes, history of cardiovascular disease, and eGFR

Table S2. Age adjusted cause specific mortality rates according to categories of ACR among US adults, 1999-2019.

Cause of Death	6,813 total deaths	% of total deaths	IR (95% CI) Overall	IR (95% CI) ACR < 10mg/g	IR (95% CI) ACR 10 - < 30 mg/g	IR (95% CI) ACR 30 - < 300 mg/g	IR (95% CI) ACR ≥300 mg/g
Diseases of the heart	1,760	25.8	3.2 (3.0, 3.4)	1.9 (1.7, 2.2)	3.4 (3.0, 3.9)	6.7 (5.9, 7.7)	12.0 (9.5, 15.2)
Malignant neoplasms	1,532	22.5	2.9 (2.7, 3.1)	2.4 (2.2, 2.7)	3.3 (2.9, 3.7)	4.2 (3.6, 4.8)	4.2 (2.9, 5.9)
Cerebrovascular diseases	374	5.5	0.6 (0.6, 0.7)	0.4 (0.3, 0.5)	0.8 (0.6, 1.0)	1.0 (0.8, 1.4)	1.5 (1.0, 2.5)
Alzheimer's disease	248	3.6	0.5 (0.4, 0.6)	0.4 (0.3, 0.5)	0.5 (0.4, 0.7)	0.6 (0.4, 0.8)	0.2 (0.1, 0.5)
Diabetes mellitus	237	3.5	0.4 (0.3, 0.5)	0.2 (0.1, 0.2)	0.4 (0.3, 0.5)	1.1 (0.8, 1.5)	4.9 (3.4, 7.1)
All other causes	2,662	39.1	5.0 (4.7, 5.2)	3.6 (3.3, 3.9)	5.3 (4.8, 5.9)	8.8 (7.9, 9.8)	16.9 (14.2, 20.2)
CVD/Cerebrovascular Combined	2,134	31.3	3.8 (3.6, 4.1)	2.4 (2.1, 2.6)	4.2 (3.8, 4.8)	7.8 (6.9, 8.8)	13.6 (10.9, 16.9)

*IR: age-adjusted mortality rate per 1,000 person-years

Table S3. Associations of ACR categories with all-cause mortality according to presence of diabetes, obesity, CVD, and eGFR categories among US adults, 1999-2019.

	Model 1 IDR (95% CI)	Model 2 IDR (95% CI)	Model 3 IDR (95% CI)	Model 4 IDR (95% CI)
No Diabetes				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.48* (1.32, 1.65)	1.39* (1.25, 1.55)	1.33* (1.19, 1.48)	1.27* (1.13, 1.43)
30 - < 300	2.62* (2.28, 3.01)	2.29* (1.99, 2.63)	2.05* (1.79, 2.36)	1.80* (1.55, 2.08)
≥300	4.46* (3.56, 5.60)	3.69* (2.96, 4.61)	2.71* (2.01, 3.66)	2.16* (1.61, 2.88)
Diabetes				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.45* (1.19, 1.75)	1.40* (1.15, 1.70)	1.38* (1.13, 1.68)	1.33* (1.08, 1.64)
30 - < 300	2.51* (2.09, 3.01)	2.30* (1.92, 2.76)	2.18* (1.80, 2.65)	2.05* (1.70, 2.46)
≥300	4.06* (3.25, 5.06)	3.53* (2.81, 4.44)	3.19* (2.48, 4.11)	2.47* (1.90, 3.22)
BMI < 30 (kg/m²)				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.65* (1.51, 1.79)	1.53* (1.40, 1.66)	1.45* (1.33, 1.57)	1.38* (1.27, 1.50)
30 - < 300	2.60* (2.37, 2.86)	2.28* (2.06, 2.52)	2.06* (1.86, 2.28)	1.85* (1.67, 2.04)
≥300	4.21* (3.54, 5.01)	3.56* (3.02, 4.21)	2.96* (2.52, 3.48)	2.16* (1.82, 2.56)
BMI ≥30 (kg/m²)				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.48* (1.29, 1.69)	1.41* (1.24, 1.60)	1.38* (1.22, 1.57)	1.36* (1.20, 1.55)
30 - < 300	2.40* (2.09, 2.76)	2.20* (1.92, 2.52)	1.99* (1.74, 2.27)	1.80* (1.57, 2.06)
≥300	4.43* (3.56, 5.52)	3.76* (3.03, 4.68)	3.10* (2.52, 3.82)	2.41* (1.94, 3.00)
No CVD				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.61* (1.48, 1.75)	1.51* (1.39, 1.64)	1.46* (1.34, 1.59)	1.39* (1.27, 1.51)
30 - < 300	2.58* (2.35, 2.83)	2.32* (2.10, 2.55)	2.09* (1.89, 2.30)	1.95* (1.76, 2.16)
≥300	4.26 (3.63, 4.99)	3.68* (3.16, 4.29)	3.05* (2.63, 3.54)	2.44* (2.05, 2.91)
CVD				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.54* (1.39, 1.70)	1.48* (1.34, 1.64)	1.41* (1.27, 1.57)	1.39* (1.24, 1.55)
30 - < 300	2.22* (1.96, 2.51)	2.03* (1.80, 2.30)	1.92* (1.70, 2.16)	1.69* (1.49, 1.92)
≥300	3.41* (2.83, 4.11)	3.04* (2.51, 3.68)	2.71* (2.20, 3.34)	2.19* (1.80, 2.67)
eGFR ≥ 90 (mL/min)				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.58* (1.38, 1.81)	1.47* (1.29, 1.68)	1.38* (1.20, 1.59)	1.31* (1.15, 1.51)
30 - < 300	2.87* (2.45, 3.36)	2.53* (2.15, 2.97)	2.21* (1.87, 2.63)	2.03* (1.69, 2.44)
≥300	3.99* (2.71, 5.86)	3.22* (2.19, 4.74)	2.67* (1.80, 3.97)	2.33* (1.57, 3.46)
eGFR ≥ 60 and < 90 (mL/min)				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.69* (1.53, 1.85)	1.58* (1.44, 1.74)	1.51* (1.38, 1.66)	1.44* (1.31, 1.58)
30 - < 300	2.41* (2.13, 2.71)	2.15* (1.91, 2.43)	1.94* (1.72, 2.18)	1.78* (1.59, 2.00)
≥300	3.20* (2.53, 4.05)	2.84* (2.21, 3.64)	2.37* (1.84, 3.05)	2.13* (1.64, 2.76)
eGFR < 60 (mL/min)				
ACR (mg/g)				
< 10	1.00	1.00	1.00	1.00
10 - < 30	1.45* (1.29, 1.63)	1.38* (1.22, 1.56)	1.32* (1.17, 1.50)	1.30* (1.15, 1.46)

30 - < 300	2.13* (1.86, 2.44)	1.98* (1.73, 2.26)	1.80* (1.56, 2.08)	1.70* (1.49, 1.95)
≥300	3.94* (3.31, 4.68)	3.45* (2.91, 4.09)	3.03* (2.54, 3.61)	2.70* (2.26, 3.23)

Abbreviations: CI: confidence interval; CVD: Cardiovascular Disease eGFR: estimated glomerular filtration rate

*Indicates estimate is significant ($p < 0.05$)

**Chi squared p-value statistically significant at < 0.05 for DM, obesity, CVD, and eGFR

Model 1 is adjusted for age group, race/ethnicity, and sex

Model 2 is additionally adjusted for: Model 1 + education, income, marital status, and insurance status

Model 3 is additionally adjusted for: Model 2 + smoking, alcohol consumption, physical activity, self-rated health, and BMI (in obesity stratified models: BMI not adjusted for)

Model 4 is additionally adjusted for: Model 3 + comorbidities, diabetes, history of cardiovascular disease, and eGFR (in diabetes stratified models: diabetes not adjusted for; in CVD stratified models: history of CVD not adjusted for; in eGFR stratified models: eGFR not adjusted for)

Table S4. Associations of ACR categories with all-cause mortality according to sex among US adults, 1999-2019.

	Model 1 IDR (95% CI)	Model 2 IDR (95% CI)	Model 3 IDR (95% CI)	Model 4 IDR (95% CI)
ACR (mg/g)				
Men				
<10 (reference)	1.00	1.00	1.00	1.00
10 - < 30	1.65* (1.49, 1.83)	1.53* (1.38, 1.69)	1.45* (1.31, 1.61)	1.40* (1.26, 1.55)
30 - < 300	2.42* (2.18, 2.68)	2.22* (2.00, 2.47)	1.97* (1.77, 2.20)	1.73* (1.54, 1.93)
≥300	3.94* (3.29, 4.72)	3.37* (2.84, 4.01)	2.70* (2.24, 3.25)	2.02* (1.67, 2.44)
Women				
<10	0.70* (0.64, 0.77)	0.61* (0.56, 0.67)	0.64* (0.58, 0.70)	0.65* (0.59, 0.71)
10 - < 30	1.12* (1.02, 1.22)	0.93 (0.85, 1.02)	0.91* (0.83, 1.00)	0.89* (0.82, 0.98)
30 - < 300	1.94* (1.75, 2.16)	1.46* (1.30, 1.63)	1.37* (1.22, 1.54)	1.29* (1.15, 1.45)
≥300	3.70* (3.07, 4.47)	2.69* (2.20, 3.29)	2.42* (2.01, 2.91)	1.82* (1.51, 2.21)

*Indicates estimate is significant ($p < 0.05$)

Abbreviations: CI: confidence interval; IDR: incidence density ratio

Model 1 is adjusted for age group, and race/ethnicity

Model 2 is additionally adjusted for: Model 1 + education, income, marital status, and insurance status

Model 3 is additionally adjusted for: Model 2 + smoking, alcohol consumption, physical activity, self-rated health, and BMI

Model 4 is additionally adjusted for: Model 3 + diabetes, history of cardiovascular disease, comorbidities and eGFR

Table S5. Associations of ACR categories with all-cause mortality according to comorbidities among US adults, 1999-2019.

	Model 1 IDR (95% CI)	Model 2 IDR (95% CI)	Model 3 IDR (95% CI)
ACR (mg/g)			
Neither comorbidity			
< 10 (reference)	1.00	1.00	1.00
10 - < 30	1.68* (1.44, 1.96)	1.63* (1.40, 1.91)	1.54* (1.32, 1.80)
30 - < 300	2.37* (1.94, 2.90)	2.13* (1.74, 2.59)	1.82* (1.49, 2.22)
≥300	4.90* (3.12, 7.69)	4.56* (3.10, 6.70)	3.16* (2.05, 4.87)
Hypercholesteremia only			
< 10	0.97 (0.84, 1.12)	1.00 (0.87, 1.16)	0.97 (0.84, 1.12)
10 - < 30	1.51* (1.27, 1.78)	1.49* (1.26, 1.76)	1.37* (1.17, 1.61)
30 - < 300	1.97* (1.52, 2.55)	1.89* (1.46, 2.44)	1.65* (1.26, 2.16)
≥300	2.02* (1.10, 3.73)	1.74 (0.94, 3.21)	1.47 (0.81, 2.67)
Hypertension only			
< 10	1.47* (1.29, 1.67)	1.42* (1.25, 1.62)	1.40* (1.22, 1.59)
10 - < 30	2.33* (2.01, 2.70)	2.12* (1.83, 2.46)	1.93* (1.67, 2.22)
30 - < 300	3.49* (3.07, 3.98)	3.07* (2.70, 3.50)	2.69* (2.35, 3.08)
≥300	5.86* (4.70, 7.32)	4.53* (3.57, 5.73)	3.94* (3.13, 4.96)
Both comorbidities			
< 10	1.27* (1.12, 1.42)	1.26* (1.12, 1.42)	1.17* (1.04, 1.32)
10 - < 30	1.88* (1.64, 2.16)	1.73* (1.51, 1.99)	1.57* (1.37, 1.80)
30 - < 300	3.31* (2.91, 3.76)	2.89* (2.54, 3.29)	2.51* (2.19, 2.87)
≥300	5.35* (4.32, 6.62)	4.68* (3.80, 5.77)	3.65* (2.93, 4.54)

*Indicates estimate is significant ($p < 0.05$)

Model 1 is adjusted for age group, race/ethnicity, and sex

Model 2 is additionally adjusted for: Model 1 + education, income, marital status, and insurance status

Model 3 is additionally adjusted for: Model 2 + smoking, alcohol consumption, physical activity, self-rated health, and BMI

Figure S1. Cohort Inclusion and Exclusion Flow Chart.

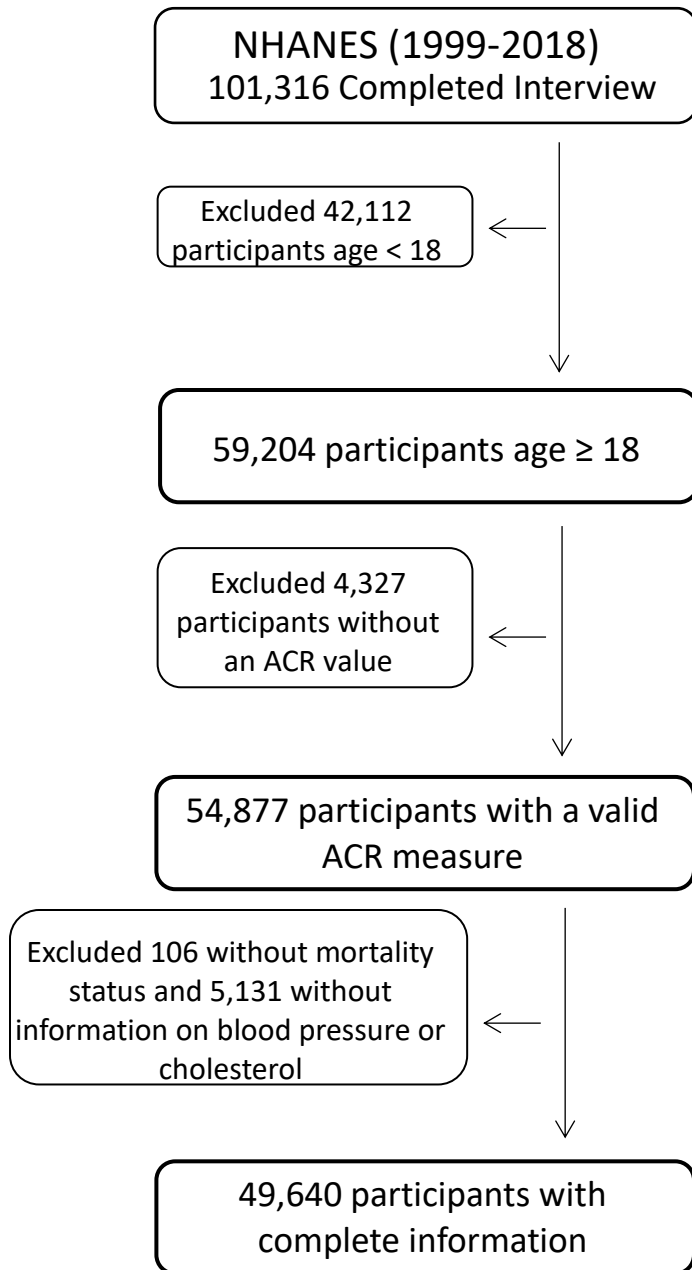
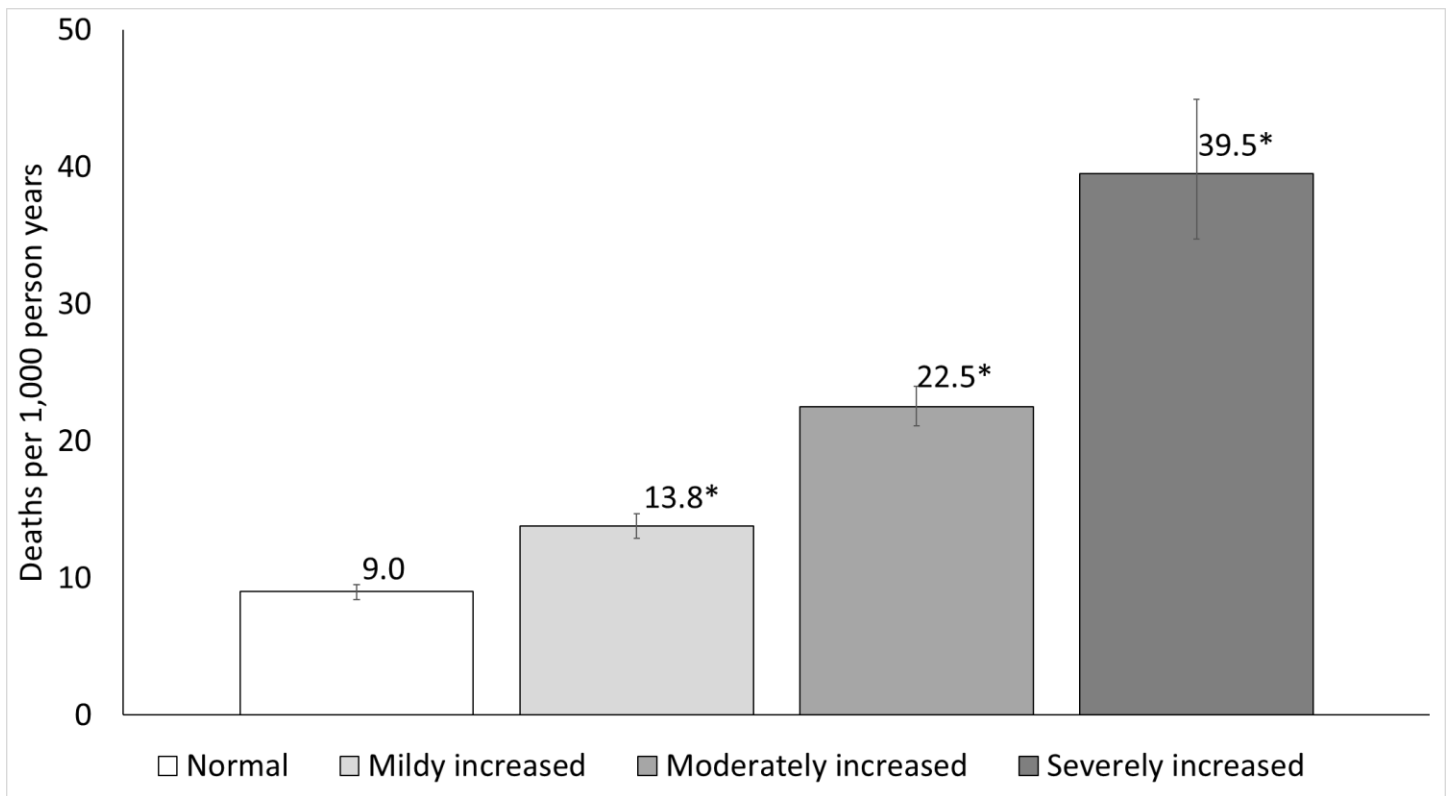


Figure S2. Age-adjusted mortality rate according to category of albuminuria among US adults, 1999-2019.



*Chi squared p-value indicates statistically different at < 0.05 for ACR category (ref: Normal)