# Supplementary Online Content

Chen J, Budoff MJ, Reilly MP, et al; for the CRIC Investigators. Coronary artery calcification and risk of cardiovascular disease and death among patients with chronic kidney disease. *JAMA Cardiol*. doi:10.1001/jamacardio.2017.0363 Published online March 22, 2017

This supplementary material has been provided by the authors to give readers additional information about their work.

Frequency of Estimated-Glomerular Filtration Rate (eGFR, Bar Chart) and Median (Inter-Quartile Range) of Coronary Artery Calcification Score (Boxplot) According to eGFR Categories
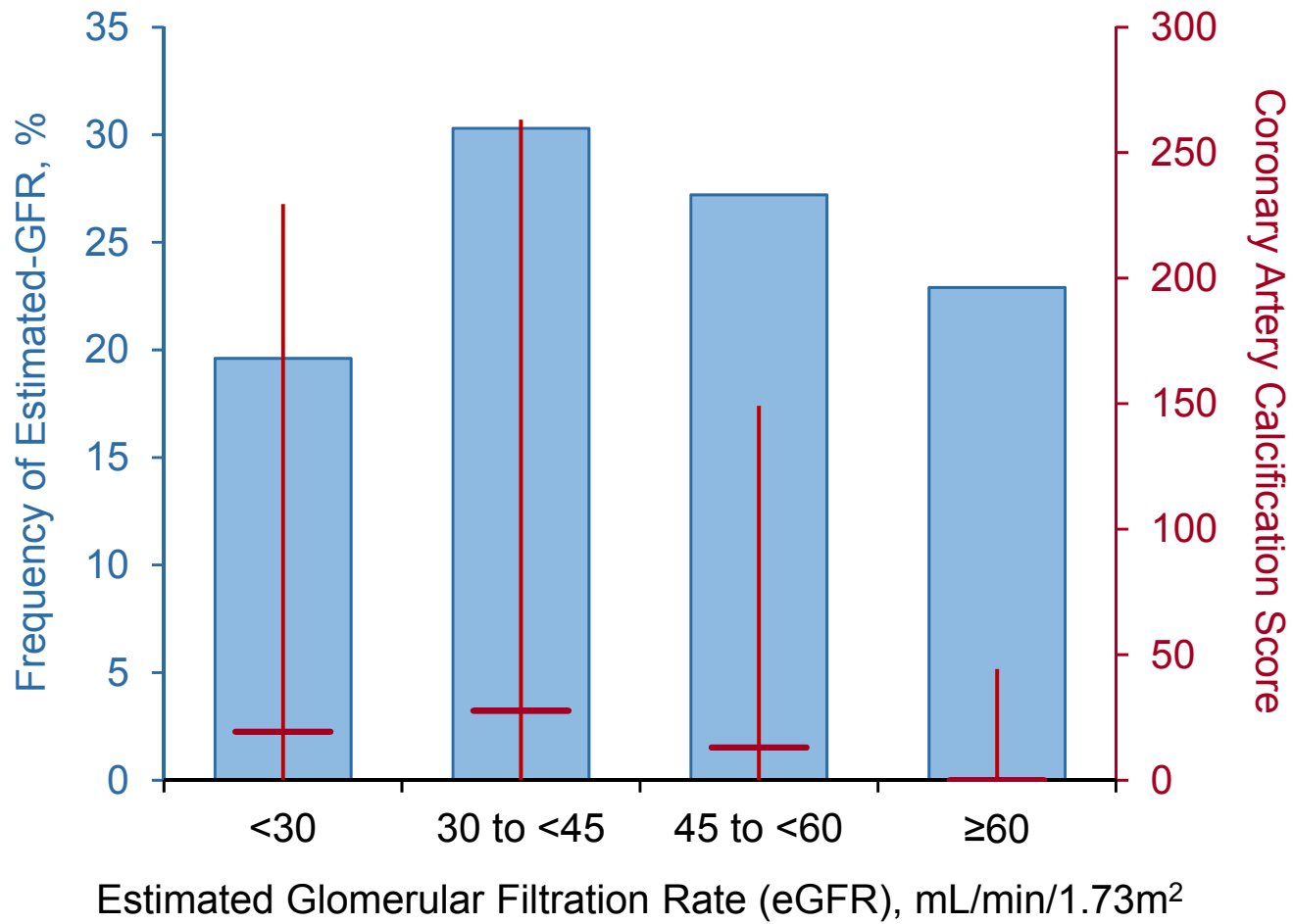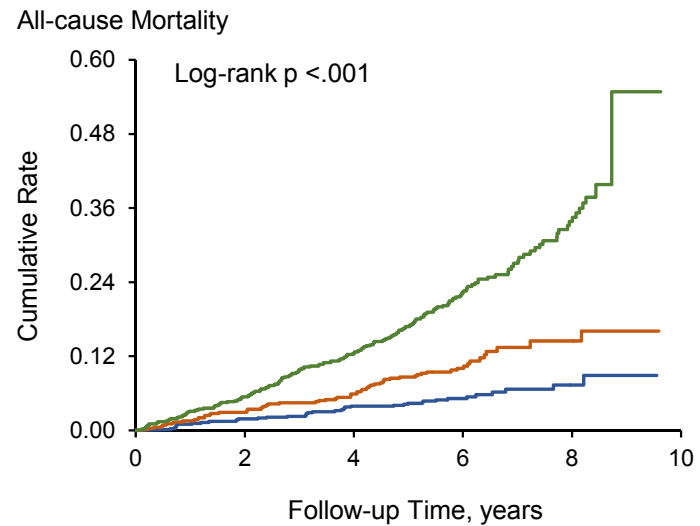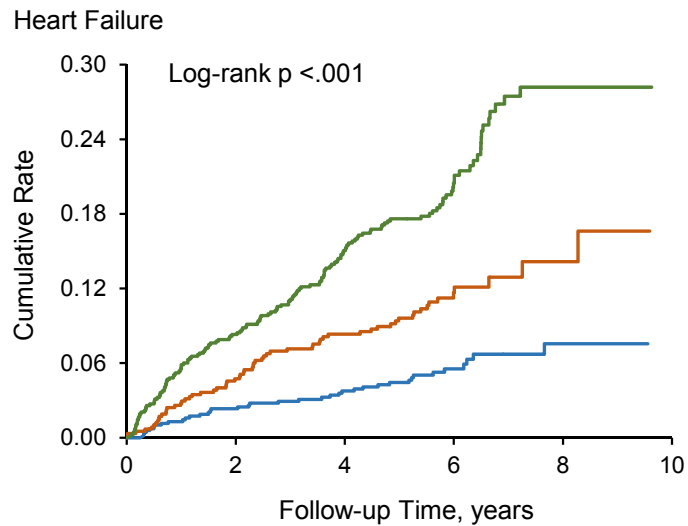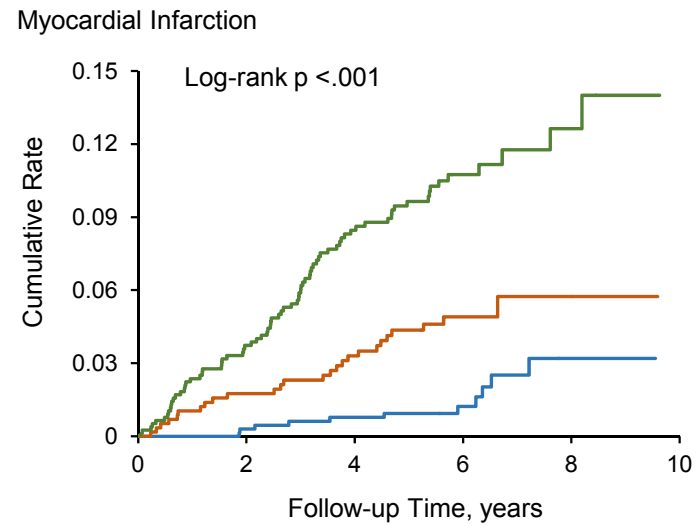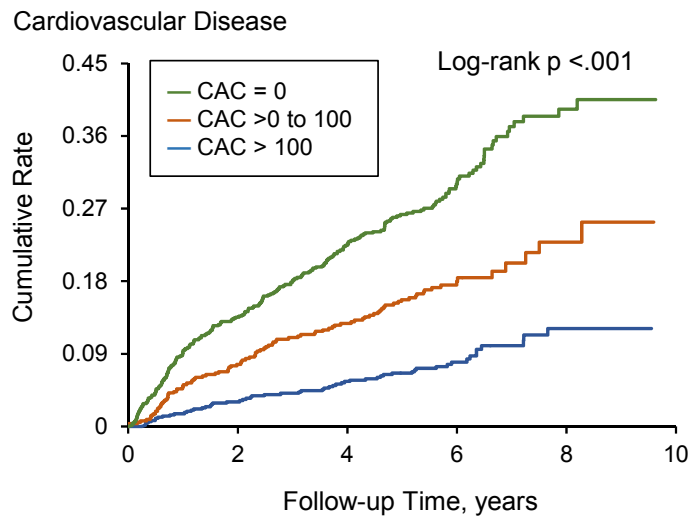
**eFigure 2.** Kaplan-Meier Cumulative Event Rates of Cardiovascular Disease, Myocardial Infarction, Heart Failure, and All-cause Mortality According to Coronary Artery Calcification among All CRIC Study Participants

**eFigure 3.** Kaplan-Meier Cumulative Event Rates of Cardiovascular Disease and All-cause Mortality According to ACC/AHA-Atherosclerotic Cardiovascular Disease Risk Score among CRIC Study Participants without History of Cardiovascular Disease
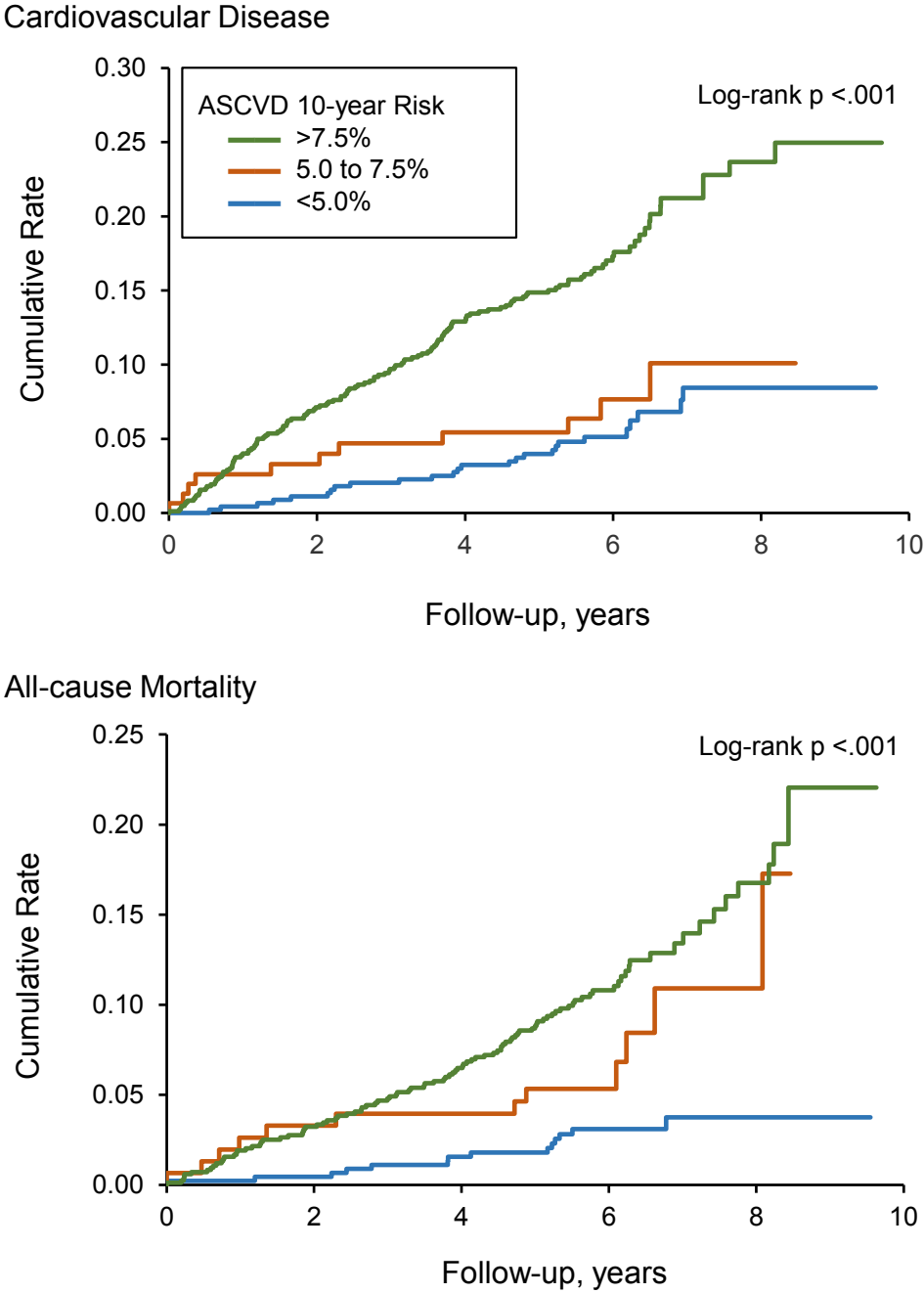
**eTable 1.** Multivariable-adjusted Hazard Ratios of Cardiovascular Disease and Death Associated with Coronary Artery Calcification among CRIC Study Participants with History of Cardiovascular Disease

| CAC categories | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | HR (95% CI) | p-value for trend | HR (95% CI) | p-value for trend | HR (95% CI) | p-value for trend |
| **Cardiovascular disease** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 1.63 (0.94, 2.81) | <.001 | 1.28 (0.73, 2.25) | .02 | 1.17 (0.65, 2.11) | .50 |
| CAC>100 | 2.55 (1.54, 4.22) | | 1.87 (1.11, 3.16) | | 1.36 (0.78, 2.36) | |
| Per 1 SD log CAC* | 1.53 (1.28, 1.83) | <.001 | 1.40 (1.16, 1.69) | <.001 | 1.29 (1.05, 1.58) | .02 |
| **Myocardial infarction** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 2.18 (0.45, 10.6) | .009 | 1.70 (0.34, 8.49) | .08 | 1.68 (0.34, 8.37) | .09 |
| CAC>100 | 5.59 (1.31, 23.8) | | 3.58 (0.81, 15.8) | | 3.43 (0.81, 14.6) | |
| Per 1 SD log CAC* | 2.53 (1.60, 4.00) | <.001 | 2.16 (1.33, 3.51) | .002 | 2.10 (1.34, 3.29) | .001 |
| **Heart failure** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 1.36 (0.72, 2.56) | .009 | 0.99 (0.52, 1.91) | .09 | 0.90 (0.45, 1.81) | 0.66 |
| CAC>100 | 2.20 (1.24, 3.93) | | 1.58 (0.87, 2.87) | | 1.13 (0.62, 2.07) | |
| Per 1 SD log CAC* | 1.50 (1.21, 1.85) | <.001 | 1.36 (1.08, 1.70) | .008 | 1.19 (0.94, 1.50) | 0.15 |
| **All-cause mortality** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 1.45 (0.73, 2.89) | <.001 | 1.38 (0.66, 2.87) | <.001 | 1.60 (0.76, 3.38) | .005 |
| CAC>100 | 2.87 (1.55, 5.33) | | 2.90 (1.48, 5.67) | | 2.60 (1.34, 5.05) | |
| Per 1 SD log CAC* | 1.72 (1.39, 2.14) | <.001 | 1.76 (1.40, 2.23) | <.001 | 1.63 (1.29, 2.07) | <.001 |

CAC = coronary artery calcification; HR = hazard ratio; CI = confidence interval; SD = standard deviation.

Model 1: Adjusted for age, gender, race, and clinic sites; Model 2: Model 1 plus ACC/AHA atherosclerotic cardiovascular disease risk factors: age, gender, race, clinical site, total cholesterol, high-density lipoprotein cholesterol, systolic blood pressure, antihypertensive treatment, current cigarette smoking, and diabetes status; Model 3: Model 2 plus education, body-mass index, physical activity, log-high sensitivity C-reactive protein, hemoglobin A1c, phosphate, log-high sensitivity troponin T, log-N-terminal pro-B-type natriuretic peptide, log-fibroblast growth factor-23, estimated-glomerular filtration rate, and log-24 hour urinary protein.

[*] One standard deviation (SD) log CAC = 2.8

**eTable 2.** Multivariable-adjusted Hazard Ratios of Cardiovascular Disease and Death Associated with Coronary Artery Calcification among All CRIC Study Participants

| CAC categories | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | HR (95% CI) | p-value for trend | HR (95% CI) | p-value for trend | HR (95% CI) | p-value for trend |
| **Cardiovascular disease** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 2.05 (1.47, 2.87) | <.001 | 1.60 (1.14, 2.25) | <.001 | 1.32 (0.91, 1.90) | .07 |
| CAC>100 | 3.33 (2.40, 4.62) | | 2.19 (1.57, 3.05) | | 1.52 (1.06, 2.19) | |
| Per 1 SD log CAC* | 1.78 (1.57, 2.02) | <.001 | 1.50 (1.32, 1.72) | <.001 | 1.38 (1.20, 1.59) | <.001 |
| **Myocardial infarction** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 2.46 (1.20, 5.06) | <.001 | 2.01 (0.97, 4.16) | .002 | 1.31 (0.62, 2.78) | .03 |
| CAC>100 | 4.96 (2.50, 9.83) | | 3.22 (1.60, 6.46) | | 2.19 (1.09, 4.39) | |
| Per 1 SD log CAC* | 2.24 (1.73, 2.90) | <.001 | 1.84 (1.41, 2.41) | <.001 | 1.69 (1.28, 2.23) | <.001 |
| **Heart failure** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 1.91 (1.26, 2.89) | <.001 | 1.46 (0.96, 2.22) | <.001 | 1.23 (0.78, 1.96) | .01 |
| CAC>100 | 3.28 (2.20, 4.89) | | 2.17 (1.45, 3.25) | | 1.76 (1.15, 2.69) | |
| Per 1 SD log CAC* | 1.77 (1.51, 2.07) | <.001 | 1.49 (1.27, 1.75) | <.001 | 1.42 (1.19, 1.69) | <.001 |
| **All-cause mortality** | | | | | | |
| CAC=0 | 1.00 (Reference) | | 1.00 (Reference) | | 1.00 (Reference) | |
| CAC>0-100 | 1.57 (1.05, 2.36) | <.001 | 1.29 (0.85, 1.97) | <.001 | 1.24 (0.79, 1.95) | .01 |
| CAC>100 | 2.96 (2.02, 4.32) | | 2.40 (1.62, 3.54) | | 1.75 (1.15, 2.66) | |
| Per 1 SD log CAC* | 1.68 (1.45, 1.95) | <.001 | 1.56 (1.34, 1.83) | <.001 | 1.35 (1.15, 1.60) | <.001 |

CAC = coronary artery calcification; HR = hazard ratio; CI = confidence interval; SD = standard deviation.

Model 1: Adjusted for age, gender, race, and clinic sites; Model 2: Model 1 plus ACC/AHA atherosclerotic cardiovascular disease risk factors: age, gender, race, clinical site, total cholesterol, high-density lipoprotein cholesterol, systolic blood pressure, treatment for hypertension (any antihypertensive medications), current cigarette smoking, and diabetes status; Model 3: Model 2 plus education, body-mass index, physical activity, log-high sensitivity C-reactive protein, hemoglobin A1c, phosphate, log-high sensitivity troponin T, log-N-terminal pro-B-type natriuretic peptide, log-fibroblast growth factor-23, estimated-glomerular filtration rate, and log-24 hour urinary protein using backward elimination.

[*] One standard deviation (SD) log CAC = 2.8

**eTable 3.** Improvement in Prediction of Cardiovascular Disease and Mortality by Adding Coronary Artery Calcification to Cardiovascular Risk Factors among CRIC Study Participants without History of Cardiovascular Disease

| Events | Model 1 | | | | | Model 2 | | | | | Model 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C-statistics without CAC | C-statistics with CAC | Change in C-statistics with/without CAC | Continuous NRI for event* (95% CI) | IDI for event* | C-statistics without CAC | C-statistics with CAC | Change in C-statistics with/without CAC | Continuous NRI for event* (95% CI) | IDI for event* | C-statistics without CAC | C-statistics with CAC | Change in C-statistics with/without CAC | Continuous NRI for event* (95% CI) | IDI for event* |
| **Cardiovascular disease** | 0.66 (0.64, 0.78) | 0.74 (0.70, 0.83) | 0.07 (0.02, 0.10) | 0.50 (0.23, 0.80) | 0.06 (0.02, 0.06) | 0.76 (0.64, 0.84) | 0.78 (0.69, 0.86) | 0.02 (0.00, 0.09) | 0.42 (0.18, 0.78) | 0.04 (0.01, 0.06) | 0.81 (0.65, 0.86) | 0.83 (0.70, 0.87) | 0.02 (0.00, 0.09) | 0.47 (0.14, 0.77) | 0.02 (0.01, 0.06) |
| **Myocardial infarction** | 0.74 (0.68, 0.8) | 0.80 (0.74, 0.84) | 0.06 (0.02, 0.09) | 0.64 (0.40, 0.89) | 0.02 (0.02, 0.04) | 0.81 (0.64, 0.84) | 0.83 (0.69, 0.86) | 0.02 (0.01, 0.09) | 0.58 (0.23, 0.80) | 0.02 (0.01, 0.06) | 0.82 (0.65, 0.84) | 0.84 (0.70, 0.86) | 0.02 (0.00, 0.09) | 0.55 (0.14, 0.78) | 0.01 (0.01, 0.06) |
| **Heart failure** | 0.70 (0.66, 0.79) | 0.75 (0.71, 0.84) | 0.06 (0.02, 0.09) | 0.43 (0.18, 0.84) | 0.04 (0.02, 0.06) | 0.80 (0.64, 0.84) | 0.81 (0.69, 0.86) | 0.01 (0.00, 0.09) | 0.34 (0.18, 0.78) | 0.03 (0.01, 0.06) | 0.84 (0.65, 0.86) | 0.85 (0.70, 0.87) | 0.01 (0.00, 0.09) | 0.36 (0.14, 0.77) | 0.01 (0.01, 0.06) |
| **All-cause mortality** | 0.69 (0.64, 0.78) | 0.71 (0.68, 0.83) | 0.03 (0.01, 0.10) | 0.39 (0.22, 0.78) | 0.03 (0.02, 0.06) | 0.74 (0.65, 0.84) | 0.75 (0.70, 0.85) | 0.01 (0.00, 0.09) | 0.25 (0.14, 0.77) | 0.02 (0.01, 0.06) | 0.79 (0.65, 0.86) | 0.79 (0.70, 0.87) | 0.00 (0.00, 0.08) | 0.18 (0.07, 0.76) | 0.01 (0.00, 0.06) |

NRI= net reclassification improvement; IDI= integrated discrimination improvement.

*For event during 5 years' follow-up

Model 1: Adjusted for age, gender, race, and clinic sites; Model 2: Model 1 plus ACC/AHA atherosclerotic cardiovascular disease risk factors: age, gender, race, clinical site, total cholesterol, high-density lipoprotein cholesterol, systolic blood pressure, treatment for hypertension (any antihypertensive medications), current cigarette smoking, and diabetes status; Model 3: Model 2 plus education, body-mass index, physical activity, log-high sensitivity C-reactive protein, hemoglobin A1c, phosphate, log-high sensitivity troponin T, log-N-terminal pro-B-type natriuretic peptide, log-fibroblast growth factor-23, estimated-glomerular filtration rate, and log-24 hour urinary protein.