To the Editor:

Cardiovascular disease is a leading cause of mortality among older adults in the United States.1 Both chronic kidney disease (CKD) and dyslipidemia—important risk factors of cardiovascular disease—are common among older adults.2,3 Although there have been studies examining dyslipidemia in CKD among young and middle-aged adults, there is a paucity of literature on lipid levels by CKD stage in older adults.

Serum creatinine is the most common filtration marker used for estimated glomerular filtration rate (eGFR), the primary measure of kidney function. However, serum creatinine may overestimate kidney function in older adults because it is affected by nonkidney determinants, such as muscle mass and protein intake.4 An eGFR determined using both serum creatinine and cystatin C provides more accurate estimates.4 In this study, we sought to examine the associations between eGFR on the basis of both creatinine and cystatin C and lipid levels in older adults. We conducted a cross-sectional analysis of adults aged 67-89 years during visit 5 (2011-2013) of the Atherosclerosis Risk in Communities study. Among 6,538 individuals from visit 5, those without data on eGFR, statin use, or covariates were excluded. The final study population was 4,965 individuals (Fig S1). The eGFR was calculated using the 2021 CKD Epidemiology Collaboration creatinine-cystatin C equation without a race coefficient.5 Lipid parameters of interest included total cholesterol; low-density lipoprotein cholesterol (LDL-C), calculated via the Friedewald method; high-density lipoprotein cholesterol (HDL-C); and triglyceride (TG). We plotted adjusted lipid levels by eGFR levels from multivariable linear regression models with linear splines and 3 knots at eGFR 90, 60, and 45 mL/min/1.73 m². We also examined binary outcomes (total cholesterol ≥200 mg/dL; LDL-C ≥100 mg/dL; HDL-C <50 mg/dL; and TG ≥150 mg/dL),1 using multivariable logistic regression with eGFR

Figure 1. Adjusted associations between eGFR and lipid levels. Conversion factors for units: total cholesterol, LDL-C, and HDL-C in mg/dL to mmol/L, ×0.02586; triglycerides in mg/dL to mmol/L, ×0.01129. Abbreviations: CI, Confidence interval; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; LDL, low-density lipoprotein.
categoricals (<45, 45-60, >60 mL/min/1.73 m²). Covariates included age, sex, race-center, body mass index, history of coronary artery disease, diabetes, liver disease, hypertension, alcohol use, smoking, education, physical activity, urine albumin-to-creatinine ratio, and nonstatin lipid-lowering medications. We assessed whether the associations differed by obesity (body mass index ≥30 kg/m²) and diabetes. All analyses were stratified by statin use.

The mean age of the study population was 75.6 years; 56.1% were women, 22.9% were Black, and 52.9% were educated, and less physically active, and they had a higher body mass index with more additional comorbid conditions (Table S1).

Overall, neither total cholesterol nor LDL-C levels significantly differed by the levels of eGFR regardless of statin use (Fig 1A and B). Only among statin nonusers with an eGFR of <45 mL/min/1.73 m², a lower eGFR was associated with lower total cholesterol levels (~5.6 [95% confidence interval {CI}, −1.0 to −10.3] mg/dL per −10 mL/min/1.73 m² in eGFR).

A lower eGFR was linearly associated with lower HDL-C levels in both statin users (~0.7 [95% CI, −0.5 to −1.0] mg/dL per −10 mL/min/1.73 m² in eGFR) and nonusers (~1.2 [95% CI, −0.9 to −1.5] mg/dL per −10 mL/min/1.73 m² in eGFR) (Fig 1C). A lower eGFR was linearly associated with higher TG levels in both statin users (6.1 [95% CI, 4.0-8.2] mg/dL per −10 mL/min/1.73 m² in eGFR) and nonusers (6.5 [95% CI, 4.2-8.7] mg/dL per −10 mL/min/1.73 m² in eGFR) when eGFR was 45 to 90 mL/min/1.73 m² (Fig 1D). The results were consistent when the outcomes were analyzed as binary variables (Table 1) and when stratified by obesity or diabetes (all P values for interactions were >0.1).

Our study showed a higher burden of other lipid level abnormalities, in particular low HDL-C and high TG levels, among older adults with CKD when compared with those without CKD. Previous studies have demonstrated that an elevated TG or low HDL-C level is associated with higher risk of cardiovascular events and all-cause mortality. Patients with CKD, who have low HDL-C and elevated TG levels, may benefit from lifestyle modifications, including regular physical activity, to reduce their risk of mortality. The KDIGO (Kidney Disease Improving Global Outcome) guidelines strongly recommend statin use for older patients with CKD. Indeed, our data showed lower total cholesterol and LDL-C levels among statin users across the entire spectrum of eGFR in comparison to nonusers.

Limitations to our study include the cross-sectional study design because we cannot establish temporality between kidney function and lipid levels. However, the goal of our study was to characterize lipid levels and determine the burden of dyslipidemia by kidney function among older adults using the most accurate estimates of kidney function.

In conclusion, we demonstrated higher burden of low HDL-C and high TG levels among older adults with CKD compared with those without CKD, regardless of statin use. In addition to LDL-C levels, attention to the burden of high TG and low HDL-C levels may be needed to improve clinical outcomes in older adults with CKD.

Table 1. The Associations Between eGFR and Various Types of Dyslipidemia

| Outcome                  | Statin Users (N=2,628) | Statin Nonusers (N=2,337) |
|--------------------------|------------------------|---------------------------|
|                          | eGFR category          |                          |
|                          | (mL/min/1.73 m²)       |                          |
|                          | Prevalence             | Adjusted OR (95% CI)     |
| Total cholesterol ≥200 mg/dL | >60 218 (14.9%)       | 1 (Reference)            |
|                          | 45-60 79 (11.5%)       | 0.98 (0.73-1.32)         |
|                          | <45 44 (9.2%)          | 0.83 (0.56-1.21)         |
| LDL-C ≥100 mg/dL         | >60 451 (30.9%)        | 1 (Reference)            |
|                          | 45-60 177 (25.8%)      | 0.95 (0.76-1.19)         |
|                          | <45 109 (22.7%)        | 0.91 (0.69-1.19)         |
| HDL-C <50 mg/dL          | >60 695 (47.5%)        | 1 (Reference)            |
|                          | 45-60 417 (60.8%)      | 1.33 (1.08-1.64)         |
|                          | <45 322 (67.1%)        | 1.54 (1.19-2.00)         |
| Triglycerides ≥150 mg/dL | >60 319 (21.8%)        | 1 (Reference)            |
|                          | 45-60 200 (29.2%)      | 1.59 (1.27-2.00)         |
|                          | <45 152 (31.7%)        | 1.68 (1.30-2.19)         |

Note: Conversion factors for units: total cholesterol, LDL-C, and HDL-C in mg/dL to mmol/L, ×0.02586; triglycerides in mg/dL to mmol/L, ×0.01129.

Abbreviations: CI, Confidence interval; eGFR, estimated glomerular filtration rate; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; OR, odds ratio.

*Statistically significant odds ratio with P value < 0.05.
SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Figure S1: Derivation of the study population.

Item S1: Detailed Methods.

Table S1: Baseline characteristics of study population by eGFR category.

ARTICLE INFORMATION

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