Contents

Supplementary Methods

Study populations

The University of Washington (UW)

UW Medicine is a major healthcare organization serving the diverse populations of the Pacific Northwest region and beyond. It comprises three hospitals, 15 neighborhood clinics, a medical school, an air ambulance service and practitioners. For the present study, we included patients who were age ≥18 years and had a serum or plasma creatinine measured in the UW laboratory system between January 1, 2018 and August 15, 2019. Data were extracted from a data warehouse department from Sunquest Laboratory (Tuscon, AZ UW Medicine's laboratory information service). We excluded those who had serum creatinine measured in an inpatient or an emergency room setting as these could be confounded by concurrent acute kidney injury (AKI). We also excluded those with missing self-reported race, missing sex, and those aged >105 years (due to concerns about accuracy of birth date in electronic heath record). Our final dataset included N=170,941 unique patients **(Supplement Figure 1)**. The study was reviewed by the Human Subject Division at the UW, which determined that this activity did not qualify as human subjects research (STUDY00012562), therefore informed consent was waived.[1]

The National Health and Nutrition Examination Survey (NHANES)

NHANES is an ongoing, continuous series of nationally representative cross-sectional studies of community-dwelling adults and children in the United States. The study intentionally oversamples participants of Black race, Hispanic ethnicity, or both, in a stratified, clustered probability sampling design. NHANES participants undergo extensive interviews about demographic, socioeconomic, dietary, and health-related questions, as well as a physical examination. For this analysis, we used data from three NHANES cycles: 2013-2014, 2015-

2016, and 2017-2018[2], and included all adults ages ≥20 years with non-missing mobile health examination data and non-missing serum creatinine, for an analytic population of 15,392.

eGFR equations

We compared three creatinine-based eGFR equations for these analyses: 2009 CKD EPI equation, the 2009 CKD EPI equation with the race coefficient removed (2009 CKD-EPI$_{\text{no race}}$) and the 2021 CKD-EPI equation, which was recalibrated without the race variable. We chose to use the serum creatinine-based equations only since serum cystatin C is not readily available at many other institutions presently; and the purpose of this analysis was to evaluate the impact of these equations in a real-world population. Standardized Jaffe method with calibrators traceable to the NIST Standard Reference Material (SRM 967) on the Beckman Coulter AU system was used to measure serum creatinine for the UW cohort. For those with multiple serum creatinine measures during this time period, we only included the first ambulatory measure of creatinine. For the NHANES 2013-2014 and 2015-2016 cohorts, kinetic rate Jaffe method with calibrators traceable to the isotope dilution mass spectrometry (IDMS) reference method on a Beckman UniCel® DxC 800 Synchron analyzer, and for 2017-2018 cohort, an enzymatic method on a Roche Cobas 600 was used to measure serum creatinine.

For each individual at UW, we retrieved associated age, sex, and self-reported race (Black versus non-Black) from the electronic health record. For NHANES, age and sex were obtained through collected demographics and race was classified as non-Hispanic White, non-Hispanic Black, Mexican-American, Other Hispanic, Other race – including multiracial. Please see **Supplemental Table S4** for further details on the equations.[3]

Outcomes

We initially classified individuals into CKD stages based upon eGFR as outlined by Kidney Disease Improving Global Outcomes (KDIGO) using 2009 CKD-EPI equation.[4] These categories were eGFR (mL/min/1.73m^2) ≥90, 60-89, 45-59, 30-44, 15-29, and <15. We then used 2009 CKD-EPI$_{\text{no race}}$ and 2021 CKD-EPI equations, respectively, and reclassified them into a higher or lower KDIGO CKD categories based on eGFR.

Statistical analysis

All analyses were conducted in R 4.1.1 (R Statistical Foundation for Computing) and Stata version 15.1 (StataCorp). For all analyses of NHANES data, we used Stata's *svy* commands to incorporate NHANES recommendations for weighting to account for nonresponse bias and the sampling design. For NHANES data, we summarized demographics and prevalence by calculating weighted mean and standard deviation for continuous variables and weighted proportions for categorical variables; for analysis of UW data, we calculated means and standard deviations for continuous variables and proportions for categorical variables. We used the paired t-test (weighted appropriately, where necessary) to estimate the mean and corresponding 95% confidence intervals for the difference in eGFR using various methods of estimation. Finally, we cross-tabulated the number of participants in each eGFR category, comparing the 2009 CKD-EPI equation with race coefficient with alternative eGFR estimation methods, and calculated the proportion of participants in each category that would and would not be reclassified with use of alternative eGFR estimation.

Supplementary Table S1A:

Baseline characteristics of the University of Washington (UW) cohort

	N (%) or mean (SD)
N	170,941
Age, years	52.8 (17.3)
Female (%)	89,455 (52%)
Race/ethnicity	
White	115,853 (68%)
Black	11,159 (7%)
Asian	19,231 (11%)
American Indian	2,185 (1%)
Other	22,513 (13%)

Supplementary Table S1B:
Baseline characteristics of the National Health and Nutrition Examination Survey (NHANES) cohort

	N	Weighted percentages (95% CI) or mean (95% CI)
N	15,392	
Age, years		48.0 (47.4, 48.6)
Female (%)	8,012	52 (51, 53)
Race/ethnicity		
Non-Hispanic White*	5,749	65 (61, 68)
Non-Hispanic Black	3,215	11 (9, 13)
Mexican-American*	2,311	9 (7, 11)
Other*	4,117	16 (14, 17)

*Collectively referred to as non-Black

Supplement Table S2A:
Reclassification of estimated glomerular filtration rate (eGFR) category among the University of Washington Black patients when changing from 2009 CKD-EPI to 2009 CKD-EPI$_{no\ race}$ equation.

		2009 CKD-EPI$_{no\ race}$ equation					
	eGFR (mL/min/1.73m^2)	≥90 (N = 5,330)	60-89 (N = 4,112)	45-59 (N = 926)	30-44 (N = 422)	15-29 (N = 190)	<15 (N = 179)
2009 CKD-EPI equation	≥90 (N = 7,313)	5,330 (72.9)	1,983 (27.1)				
	60-89 (N = 2,686)		2,129 (79.3)	557 (20.7)			
	45-59 (N = 584)			369 (63.2)	215 (36.8)		
	30-44 (N = 258)				207 (80.2)	51 (19.8)	
	15-29 (N = 161)					139 (86.3)	22 (13.7)
	<15 (N = 157)						157 (100)

Entries are number of participants and proportions. Proportions in rows sum to 100%.

Supplement Table S2B:
Reclassification of estimated glomerular filtration rate (eGFR) category among the University of Washington Black patients when changing from 2009 CKD-EPI to 2021 CKD-EPI equation.

		2021 CKD-EPI equation					
	eGFR ($mL/min/1.73m^2$)	≥90 (N = 6,094)	60-89 (N = 3,633)	45-59 (N = 763)	30-44 (N = 328)	15-29 (N = 172)	<15 (N = 169)
2009 CKD-EPI equation	≥90 (N = 7,313)	6,094 (83.3)	1,219 (16.7)				
	60-89 (N = 2,686)		2,414 (89.9)	272 (10.1)			
	45-59 (N = 584)			491 (84.1)	93 (15.9)		
	30-44 (N = 258)				235 (91.1)	23 (8.9)	
	15-29 (N = 161)					149 (92.5)	12 (7.5)
	<15 (N = 157)						157 (100)

Entries are number of participants and proportions. Proportions in rows sum to 100%

Supplement Table S2C:
Reclassification of estimated glomerular filtration rate (eGFR) category among the University of Washington non-Black patients when changing from 2009 CKD-EPI to 2021 CKD-EPI equation.

		2021 CKD-EPI equation					
	eGFR ($mL/min/1.73m^2$)	≥90 (N = 98,965)	60-89 (N = 47,181)	45-59 (N = 7,931)	30-44 (N = 3,351)	15-29 (N = 1,342)	<15 (N = 1,012)
2009 CKD-EPI equation	≥90 (N = 84,777)	84,777 (100)					
	60-89 (N = 57,787)	14,188 (24.6)	43,599 (75.4)				
	45-59 (N = 10,179)		3,582 (35.2)	6,597 (64.8)			
	30-44 (N = 4,340)			1,334 (30.7)	3,006 (69.3)		
	15-29 (N = 1,601)				345 (21.5)	1,256 (78.5)	
	<15 (N = 1,098)					86 (7.8)	1,012 (92.2)

Entries are number of participants and proportions. Proportions in rows sum to 100%.

Supplement Table S3A:
Reclassification of estimated glomerular filtration rate (eGFR) category among the National Health and Nutrition Examination Survey (NHANES) non-Hispanic Black participants when changing from 2009 CKD-EPI to 2009 CKD-EPI$_{no\ race}$ equation.

		2009 CKD-EPI$_{no\ race}$ equation					
	eGFR (mL/min/1.73m^2)	≥90 (N = 1,344)	60-89 (N = 1,353)	45-59 (N = 320)	30-44 (N = 131)	15-29 (N = 42)	<15 (N = 25)
2009 CKD-EPI equation	≥90 (N = 1,967)	1,344 (71.1)	623 (28.9)				
	60-89 (N = 957)		730 (77.9)	227 (22.1)			
	45-59 (N = 154)			93 (62.8)	61 (37.2)		
	30-44 (N = 84)				70 (82.1)	14 (17.9)	
	15-29 (N = 31)					28 (90.6)	3 (9.4)
	<15 (N = 22)						22 (100)

Entries are number of participants and weighted proportions. Weighted proportions in rows sum to 100%.

Supplement Table S3B:
Reclassification of estimated glomerular filtration rate (eGFR) category among the National Health and Nutrition Examination Survey (NHANES) non-Hispanic Black participants when changing from 2009 CKD-EPI to 2021 CKD-EPI equation.

		2021 CKD-EPI equation					
	eGFR ($mL/min/1.73m^2$)	≥90 (N = 1,577)	60-89 (N = 1,242)	45-59 (N = 229)	30-44 (N = 108)	15-29 (N = 35)	<15 (N = 24)
2009 CKD-EPI equation	≥90 (N = 1,967)	1,577 (81.7)	390 (18.3)				
	60-89 (N = 957)		852 (90.0)	105 (10.0)			
	45-59 (N = 154)			124 (83.4)	30 (16.6)		
	30-44 (N = 84)				78 (89.7)	6 (10.3)	
	15-29 (N = 31)					29 (93.8)	2 (6.2)
	<15 (N = 22)						22 (100)

Entries are number of participants and weighted proportions. Weighted proportions in rows sum to 100%.

Supplement Table S3C:

Reclassification of estimated glomerular filtration rate (eGFR) category among the National Health and Nutrition Examination Survey (NHANES) non-Black participants when changing from 2009 CKD-EPI to 2021 CKD-EPI equation.

		2021 CKD-EPI equation					
	eGFR ($mL/min/1.73m^2$)	≥90 (N = 7,960)	60-89 (N = 3,363)	45-59 (N = 538)	30-44 (N = 227)	15-29 (N = 61)	<15 (N = 28)
2009 CKD-EPI equation	≥90 (N = 7,049)	7,049 (100)					
	60-89 (N = 4,003)	911 (23.7)	3,092 (76.3)				
	45-59 (N = 735)		271 (37.6)	464 (62.4)			
	30-44 (N = 282)			74 (27.0)	208 (73.0)		
	15-29 (N = 77)				19 (24.4)	58 (75.6)	
	<15 (N = 31)					3 (5.7)	28 (94.3)

Entries are number of participants and weighted proportions. Weighted proportions in rows sum to 100%.

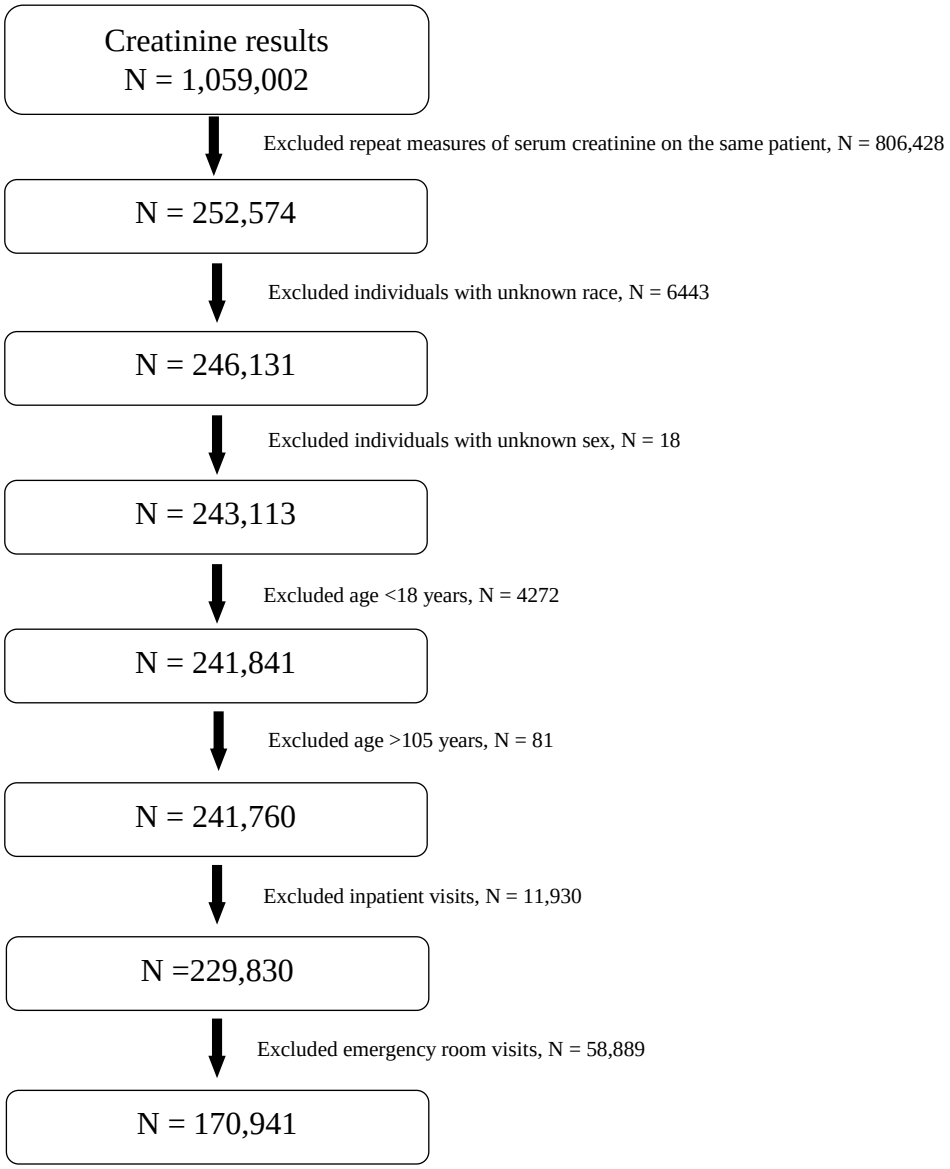
Supplement Table S4:
CKD-EPI equations for estimating glomerular filtration rate (eGFR)

Backbone creatinine-based CKD-EPI equation		
$eGFR = \mu \times \min(SCr/\kappa, 1)^{a_1} \times \max(SCr/\kappa, 1)^{a_2} \times c^{Age} \times d[\text{if female}] \times e[\text{if Black}]$		
Equation name	**Sex**	**Equation**
2009 CKD-EPI	Female	$144 \times (SCr/0.7)^{-0.329} \times 0.9929^{Age} \times 1.159$[if Black], for SCr ≤0.7mg/dL
		$144 \times (SCr/0.7)^{-1.209} \times 0.9929^{Age} \times 1.159$[if Black], for SCr >0.7mg/dL
	Male	$141 \times x\ (SCr/0.9)^{-0.411} \times 0.9929^{Age} \times 1.159$[if Black], for SCr ≤0.9mg/dL
		$141 \times (SCr/0.9)^{-1.209} \times 0.9929^{Age} \times 1.159$[if Black], for SCr >0.9mg/dL
2009 CKD-EPI$_{no\ race}$	Female	$144 \times (SCr/0.7)^{-0.329} \times 0.9929^{Age}$, for SCr ≤0.7mg/dL
		$144 \times (SCr/0.7)^{-1.209} \times 0.9929^{Age}$, for SCr 0.7mg/dL
	Male	$141 \times (SCr/0.9)^{-0.411} \times 0.9929^{Age}$, for SCr ≤0.9mg/dL
		$141 \times (SCr/0.9)^{-1.209} \times 0.9929^{Age}$, for SCr >0.9mg/dL
2021 CKD-EPI	Female	$143 \times (SCr/0.7)^{-0.241} \times 0.9938^{Age}$, for SCr ≤0.7mg/dL
		$143 \times (SCr/0.7)^{-1.200} \times 0.9938^{Age}$, for SCr 0.7mg/dL
	Male	$142 \times (SCr/0.9)^{-0.302} \times 0.9938^{Age}$, for SCr ≤0.9mg/dL
		$142 \times (SCr/0.9)^{-1.200} \times 0.9938^{Age}$, for SCr >0.9mg/dL

GFR is glomerular filtration rate, μ is the intercept, κ = 0.7 (females) or 0.9 (males), min(SCr/κ, 1) = the minimum of SCr/κ or 1, max(SCr /κ, 1) = the maximum of SCr/κ or 1, a_1 = coefficient for creatinine (Cr) if Cr ≤0.7 for males and ≤0.9 for females, a_2= coefficient for Cr if Cr >0.7 for males and >0.9 for females, c = coefficient for age, d = coefficient for female sex, e = coefficient for Black race. The units of variables are: age in years, serum creatinine (SCr) in milligrams per deciliter (mg/dL), and eGFR in mL/min/1.73 m^2.

Supplement Figure 1:

Patient demographics of the University of Washington cohort – Of the total of 1,059,002 serum creatinine results from January 1, 2018 to August 15, 2019, after several exclusions, the analytic population included 170,941 unique individuals



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