

# Sex differences in estimated glomerular filtration rate (eGFR) as an indicator of chronic kidney disease: Health and Retirement Study

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## BACKGROUND

Chronic kidney disease (CKD) presents a substantial public health challenge, with its increasing prevalence impacting the nation's health.<sup>1</sup> Risk factors include diabetes, high blood pressure, heart disease, obesity, inherited/family history of kidney disorders, and older age.<sup>2</sup> However, CKD also exhibits notable sex-based disparities in its incidence, mechanisms, and prognosis, with females demonstrating a higher age-adjusted prevalence compared to males.<sup>3</sup> The underlying reasons for these differences remain unclear.

Our objective was to evaluate sex differences in estimated glomerular filtration rate (eGFR) as an indicator of CKD within the Health and Retirement Study (HRS), a national longitudinal study of the economic, health, marital, family status, and public and private support systems of older Americans

## METHODOLOGY

**Study sample:** During 2016, as part of the HRS Venous Blood Study, a panel of N=9,934 adults 55+ years old consented and provided a blood sample.<sup>4</sup>

**Biomarker measurements:** Serum creatinine (mg/dL) and cystatin C (mg/L) were measured by the University of Minnesota Advanced Research and Diagnostics Laboratory on the Roche COBAS 6000 Chemistry Analyzer. A total of N=9,108 participants had both measures.

**CKD-EPI Creatinine-cystatin C equation (2021)<sup>5</sup>:**  

$$= 135 \times \min(\text{Scr}/\kappa, 1)^\alpha \times \max(\text{Scr}/\kappa, 1)^{-0.544} \times \min(\text{Scys}/0.8, 1)^{-0.323} \times \max(\text{Scys}/0.8, 1)^{-0.778} \times 0.9961^{\text{Age}} \times 0.963 \text{ [if female]}$$

where:  
 Scr = standardized serum creatinine (mg/dL)  
 $\kappa = 0.7$  (females) or  $0.9$  (males)  
 $\alpha = -0.219$  (female) or  $-0.144$  (male)  
 $\min(\text{Scr}/\kappa, 1)$  is the minimum of  $\text{Scr}/\kappa$  or  $1.0$   
 $\max(\text{Scr}/\kappa, 1)$  is the maximum of  $\text{Scr}/\kappa$  or  $1.0$   
 Scys = standardized serum cystatin C (mg/L)  
 Age (years)

**eGFR:** Your kidneys filter your blood by removing waste and extra water to make urine. eGFR is an indicator of how well the kidneys are filtering.

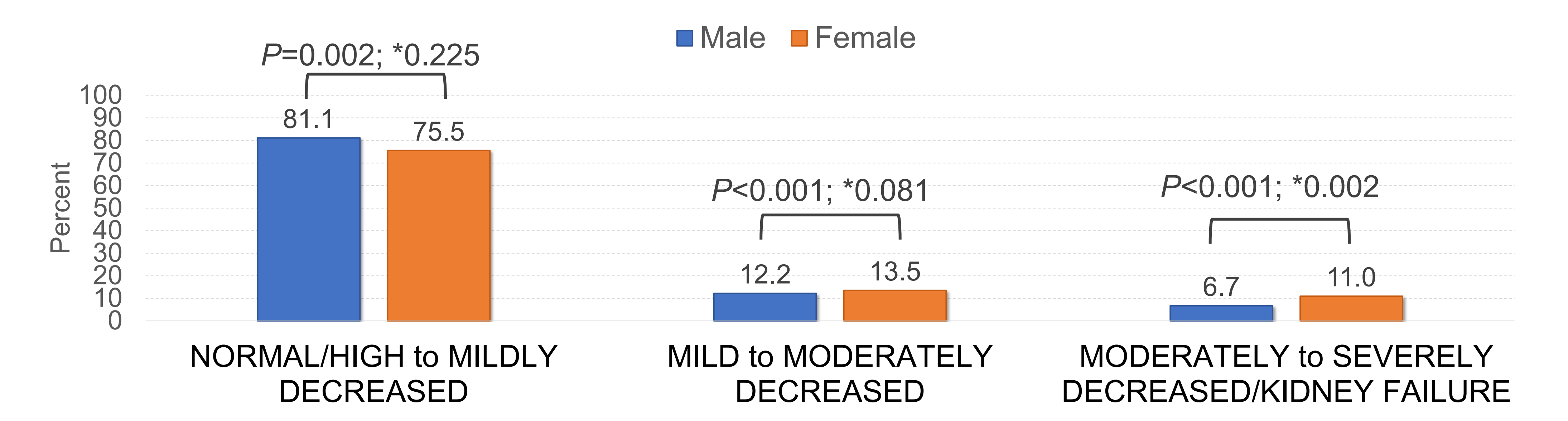
eGFR categories <sup>6</sup>	ml/min/1.73 m <sup>2</sup>
Normal/High to Mildly Decreased	≥60
Mild to Moderately Decreased	30-59
Moderately to Severe/Kidney Failure	≤29

**Statistical analysis:** HRS sampling weights were used to calculate frequencies.

**REFERENCES:**  
 1. Kovesdy et al. (2022) PMID: 35529086; 2. Murphy et al. (2016) PMID: 27476614; 3. Carrero et al. (2018) PMID 29355169; 4. 2016 VBS Blood Study, sensitive dataset: <https://hrs.isr.umich.edu/>; 5. Inker et al. (2021) PMID: 34554658; 6. KDIGO-CKD Guidelines: <https://kdigo.org/>

## RESULTS

	Total		Male		Female		P-value
<b>N, %</b>	9,108	100	4,176	45.8	4,932	54.2	<0.001
<b>Race/ethnicity</b>							0.230
Non-Hispanic White	7,039	77.3	3,244	77.7	3,795	76.9	
Non-Hispanic Black	914	10.0	394	9.4	520	10.5	
Hispanic	826	9.1	375	9.0	451	9.1	
Other	329	3.6	163	3.9	166	3.4	
<b>Hypertension, yes</b>	6,891	75.7	3,242	77.6	3,649	74.0	<0.001
<b>Diabetes status</b>							<0.001
Normal	4,657	51.1	1,972	47.2	2,685	54.4	
Pre-diabetes	1,874	20.6	947	22.7	927	18.8	
Prevalent diabetes	2,577	28.3	1,257	30.1	1,319	26.7	
	<b>Mean and Standard Error</b>						
<b>Age at blood collection, years</b>	68.7	0.26	68.0	0.28	69.3	0.29	<0.001
<b>Body mass index, kg/m<sup>2</sup></b>	29.9	0.09	29.9	0.09	29.9	0.16	0.693
<b>Creatinine, mg/dL</b>	0.95	0.01	1.07	0.01	0.85	0.01	<0.001
<b>Cystatin C, mg/L</b>	1.17	0.01	1.17	0.01	1.17	0.01	0.872
<b>eGFRcr-cys</b>	75.5	0.42	77.4	0.49	74.0	0.50	<0.001



\*Adjusted for age, race/ethnicity, diabetes, hypertension, and BMI

Between group comparisons:  
 NORMAL/HIGH to MILDLY DECREASED vs. MILD to MODERATELY DECREASED: P=0.019; \*0.246  
 NORMAL/HIGH vs SEVERE DECREASED/KIDNEY FAILURE: P=0.002; \*<0.001

## CONCLUSIONS

- Females demonstrated a higher proportion of mildly/moderately decreased and moderately to severely decreased eGFR/kidney failure.
- After adjusting for CKD risk factors, including age, race/ethnicity, diabetes, hypertension, and BMI, females had a higher likelihood of having moderately to severely decreased/kidney failure.
- Future directions: to investigate potential biological, lifestyle, and environmental factors contributing to these sex disparities.