Women, Particularly Those Without Diabetes, More at Risk of Undiagnosed Chronic Kidney Disease

Team A: Kersten Bartelt, RN; Simon Kirksey; Emily Higgs
Team B: Karen Wong, MD; Aaron Huber; Joe Deckert, PhD
Last updated 27 February 2025 • Check for updates at EpicResearch.org

Key Findings:

- Female patients, particularly those without diabetes, are at the highest risk of undiagnosed chronic kidney disease (CKD), with 20% showing lab evidence of CKD stage 3 or higher but lacking a formal diagnosis.
- Of patients who have diagnosed CKD, nearly 40% are diagnosed with a lower stage than what their lab values indicate (for example, a patient's labs indicate stage 5 while their diagnosis is stage 4), which could delay treatment.

Chronic kidney disease (CKD) is a progressive condition characterized by declining kidney function. It is often undetected until later stages when dialysis or kidney failure becomes imminent.[1] An estimated 35.5 million U.S. adults have CKD, yet many remain undiagnosed, partly due to asymptomatic early stages and inconsistent screening practices.[1] Identifying CKD early can mitigate the risk of cardiovascular disease, acute kidney injury, and progression to kidney failure.[2] Despite these benefits, missed and discordant CKD diagnoses remain common.[1] CKD staging for stages 3a and greater are based on the patient's estimated glomerular filtration rate (eGFR), with lower values indicating higher stages of CKD.[3]

We examined how often patients whose eGFR levels indicate they have stage 3 or higher CKD do not have a documented CKD diagnosis. We studied 681,583 patients with multiple creatinine labs at least 90 days apart whose calculated eGFR classified them as stage 3 or higher. Patients diagnosed with end-stage renal disease (ESRD) or those with a kidney transplant were excluded from this study, as transplant or dialysis procedures can interfere with eGFR values.

We found that, while most patients had a CKD diagnosis documented when their eGFR results reflect CKD, females were nearly twice as likely to be undiagnosed as males, as seen in Figure 1. The highest undiagnosed rate was among women without diabetes (20.0%).

CKD Diagnosis Rate Among Patients Whose eGFR Indicates Stage 3 or Higher CKD

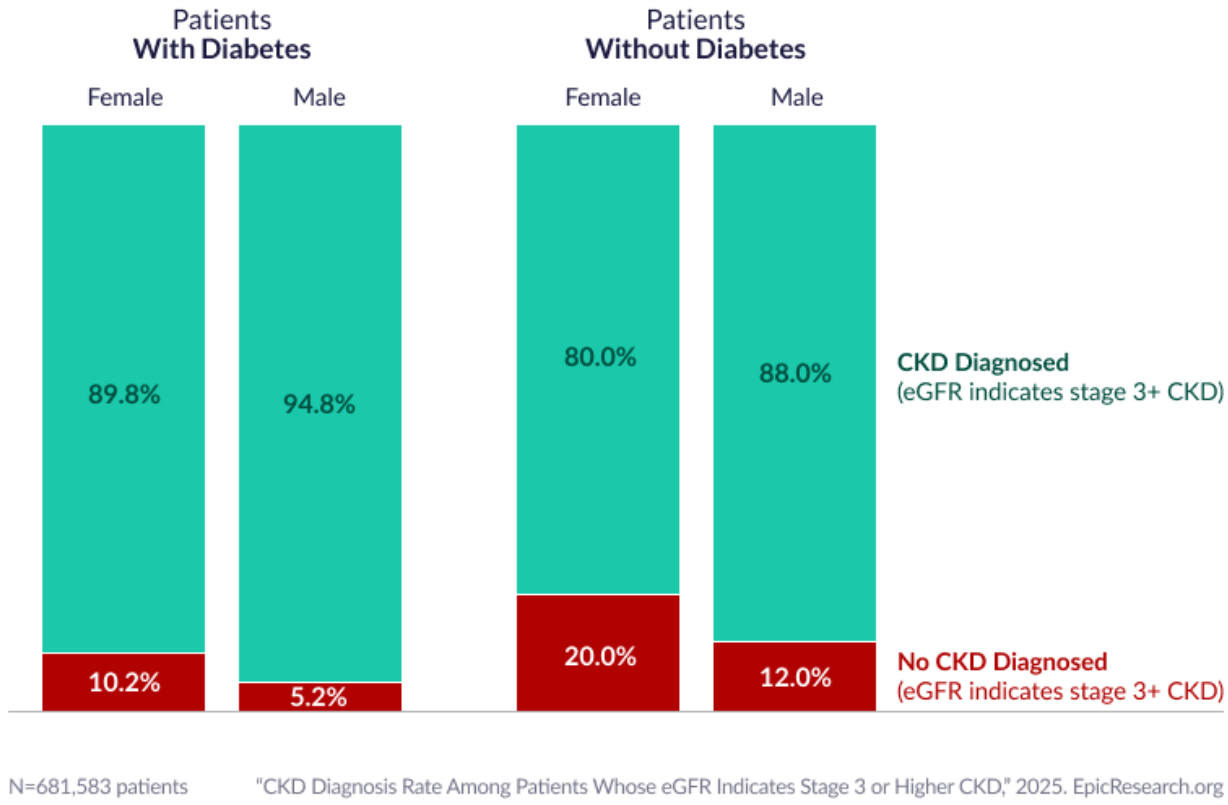

Figure 1. The rate of having a CKD diagnosis among patients whose eGFR results indicate they have stage 3 CKD or higher.

Next, we evaluated how often the stage of the CKD diagnosis differed from the stage indicated by a patient's eGFR results. We found that most patients have a diagnosed stage that matches their calculated stage, as seen in Figure 2. Patients classified as stage 5 were the least likely to have a staged diagnosis that matched their calculated stage. However, there were comparatively few patients with an eGFR indicating stage 5, and the exclusion of patients diagnosed with ESRD or who have had a transplant may disproportionately affect the rates observed among the stage 5 population.

Rate of CKD Diagnosis Aligning with Labs

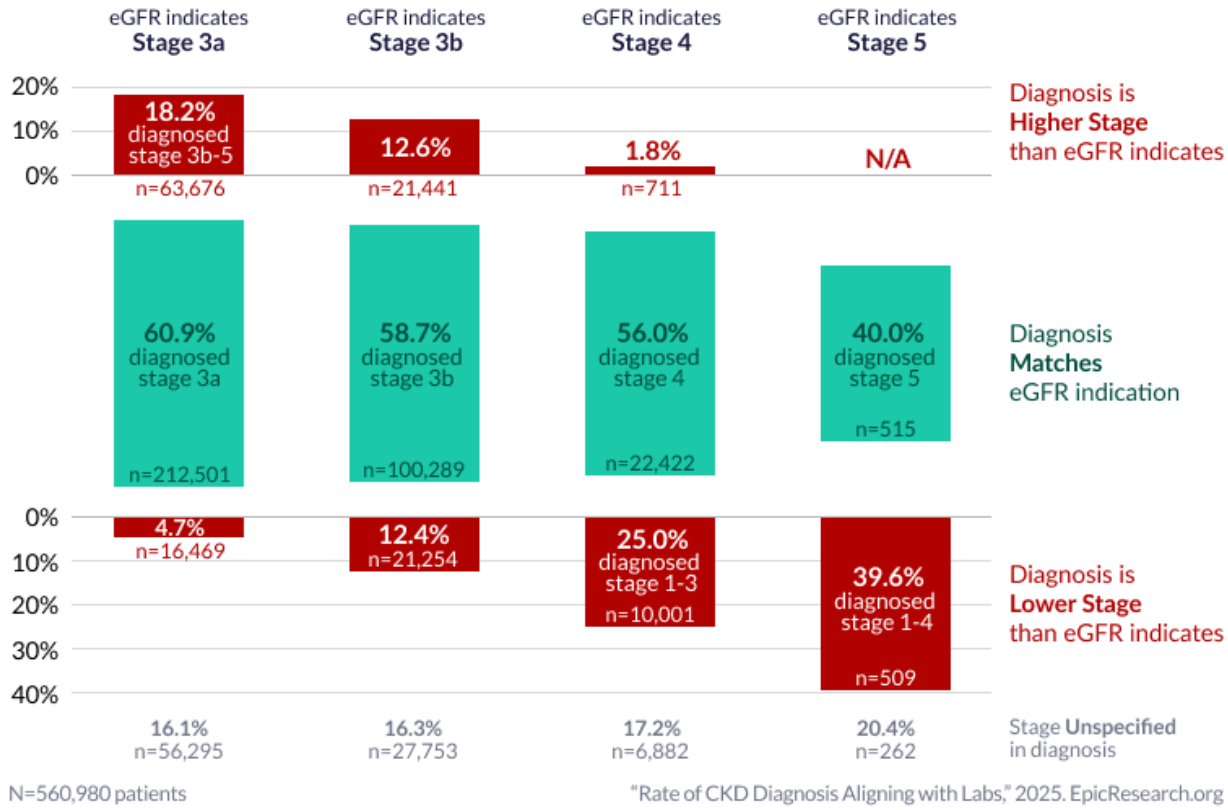

Figure 2. The rate of patients with a staged CKD diagnosis that aligns with their eGFR level's stage.

These data come from Cosmos, a dataset created in collaboration with a community of Epic health systems representing more than 295 million patient records from 1,600 hospitals and more than 37,000 clinics from all 50 states, Lebanon, and Saudi Arabia. This study was completed by two teams that worked independently, each composed of a clinician and research scientists. The two teams came to similar conclusions. Graphics by Brian Olson.

References

1. Chronic kidney disease in the United States, 2023. U.S. Centers for Disease Control and Prevention. May 15, 2024. https://www.cdc.gov/kidney-disease/php/data-research/index.html?. Accessed January 30, 2025.
2. Fraser SD, Blakeman T. Chronic kidney disease: identification and management in primary care. Pragmat Obs Res. 2016;7:21-32. Published 2016 Aug 17. doi:10.2147/POR.S97310
3. Testing for Chronic Kidney Disease. U.S. Centers for Disease Control and Prevention. May 15, 2024. https://www.cdc.gov/kidney-disease/testing/index.html. Accessed February 6, 2025.

Data Definitions

Term	Definition
Study period	1/1/2022 to 10/9/2023
Study population – inclusion criteria	Patients with a known sex (female or male) and at least two **creatinine labs** during the **study period** results at least 90 days apart

Study population – exclusion criteria	Patients with a history of **kidney transplant** or **ESRD**
Outcomes	**Undiagnosed CKD** **Diagnosis-lab mismatched CKD**
Stratifications	Legal sex **Type 2 diabetes**
Creatinine lab	A lab with LOINC code 2160-0 or 38483-4 with: • Units of mg/dl • A positive value • Within .1 and 99.9 percentiles Result exclusions: • Tests within 90 days before or after an acute kidney injury (**AKI**) diagnosis • Tests during an encounter while pregnant or overlapping with a pregnancy episode • Tests during emergency or inpatient type encounters
Kidney Transplant	At least one of the following criteria: • An episode for a kidney transplant • A diagnosis with ICD-10-CM code T86.1* or Z94.0 • A procedure with CPT code 50360 or 50365
ESRD	A diagnosis with ICD-10-CM code N18.6
Undiagnosed CKD	Percentage of those with a **calculated CKD stage** of 3 or higher without a **diagnosed CKD stage**

Diagnosis-lab mismatched CKD	Patients with a different **diagnosed CKD stage** than the **calculated CKD stage**
	• When there were multiple diagnoses, prioritized in order:
	  ○ Following second lab (closest to lab by start date)
	  ○ Preceding second lab (closest to lab by start date)
	  ○ No start date
	• Excludes diagnoses from problem list
	• If multiple **eGFR** results on same day, used the lowest

Type 2 diabetes	A diagnosis with ICD-10-CM code E11*
AKI	A diagnosis with ICD-10-CM code S37.0*
Calculated CKD stage	A pair of **creatinine** labs at least 90 days apart. Patients were then grouped into the following stages based on the lowest stage within the pair: • CKD stage 1: **eGFR** 90 or higher • CKD stage 2: **eGFR** 60 to 89 • CKD stage 3a: **eGFR** 45 to 59 • CKD stage 3b: **eGFR** 30 to 44 • CKD stage 4: **eGFR** 15 to 29 • CKD stage 5: **eGFR** Under 15

Diagnosed CKD stage	A diagnosis with the following ICD-10-CM codes:
	• CKD stage 1: N18.1*
	• CKD stage 2: N18.2*CKD stage 3 (overall): N18.3*
	  ○ CKD stage 3a: N18.31
	  ○ CKD stage 3b: N18.32
	• CKD stage 4: N18.4*
	• CKD stage 5: N18.5*

	• CKD stage unspecified: N18.9*
eGFR	Calculated from the **creatinine** lab result using the equation defined here: https://www.kidney.org/ckd-epi-creatinine-equation-2021

Table 1: CKD Diagnosis Rate Among Patients Whose eGFR Indicates Stage 3 or Higher CKD

Sex & Diabetes Status	Count	Count Diagnosed	Percent Diagnosed	Percent Undiagnosed
Female Diabetic	194,579	174,826	89.8%	10.2%
Male Diabetic	173,238	164,233	94.8%	5.2%
Female No Diabetes	182,586	146,156	80.0%	20.0%
Male No Diabetes	131,180	115,421	88.0%	12.0%

Table 2: Rate of CKD Diagnosis Aligning with Labs

eGFR Indicated Stage	Diagnosis at Lower Stage	Diagnosis at Same Stage	Diagnosis at Greater Stage	Unspecified Stage
3a	4.7%	60.9%	18.2%	16.1%
3b	12.4%	58.7%	12.6%	16.3%
4	25.0%	56.0%	1.8%	17.2%
5	39.6%	40.0%	N/A	20.4%