

# Chapter 2: Identification and Care of Patients With Chronic Kidney Disease

## Introduction

The examination of care in patients with chronic kidney disease (CKD) is a significant challenge, as most large datasets lack the biochemical data (serum creatinine and urine protein) required to definitively identify the disease. A random survey sample such as the National Health and Nutrition Examination Survey (NHANES) dataset contains the necessary biochemical information, as shown in Chapter 1, to estimate the true prevalence of CKD in the population. However, the cross-sectional nature of the NHANES study and relatively small sample of patients (compared to large administrative datasets) limits the evaluation of long-term outcomes, adverse events, and quality of care delivered to patients with CKD as well as the ability to conduct analyses on subsets of patients.

Analyses of USRDS data for this chapter utilize the general Medicare 5 percent sample, with an average of 1.2 million individuals each year, to assess the recognized CKD population. Analyses were restricted to patients age 65 and older given that age is the main criterion for Medicare eligibility. The term “recognized CKD” is used because patients are identified based on the presence of a relevant diagnosis code in the Medicare billing claims, meaning that either a provider or billing coder in the health care system recognized the presence of CKD and submitted a claim. As such, any observed trends may not necessarily relate to a true change in disease prevalence, but rather could represent changes in awareness or recognition of CKD, or of billing practices in general.

### Prevalence of Recognized CKD and Odds of a CKD Diagnosis Code

The mean age of the period prevalent Medicare population age 65 and older is 75.9 overall, and 77.9 for those with CKD. Recognized CKD in the Medicare

population is 10 percent and is more common among persons with hypertension (HTN) and diabetes mellitus (DM), at 16 percent and 21 percent, respectively. These data illustrate the importance of screening and detection programs to target those with DM and HTN, populations in need of testing for evidence of kidney disease.

The definition of the total recognized CKD population includes a variety of ICD-9-CM diagnosis codes, some of which are sub-codes under related comorbidities such as DM (250.4x) and HTN (403.9x), and some of which are more kidney disease specific, such as glomerular disease (583.x). In 2005, new stage-specific CKD codes (585.x) were introduced, providing an opportunity to track trends in the severity of CKD over time. Since their introduction, the CKD stage-specific codes have represented the majority of CKD diagnosis codes utilized, and overall there is evidence of a growing recognition of CKD over time. We include here a brief description of the CKD-related ICD-9-CM codes.

**Table A. ICD-9-CM Codes**

<b>585.1</b>	Chronic kidney disease, Stage 1
<b>585.2</b>	Chronic kidney disease, Stage 2 (mild)
<b>585.3</b>	Chronic kidney disease, Stage 3 (moderate)
<b>585.4</b>	Chronic kidney disease, Stage 4 (severe)
<b>585.5</b>	Chronic kidney disease, Stage 5 (excludes 585.6: Stage 5, requiring chronic dialysis <sup>a</sup> )

*CKD unspecified identified by multiple codes including 585.9, 250.4x, 403.9xm & others. CKD stage estimates are from a single measurement. For clinical case definition, abnormalities should be present  $\geq$  3 months. <sup>a</sup>In USRDS analyses, patients with ICD-9-CM code 585.6 & with no ESRD 2728 form or other indication of end-stage renal disease (ESRD) are considered to have code 585.5. See the CKD Analytical Methods chapter for details.*

## Laboratory Testing of Patients With and Without CKD

Assessing the care of patients at high risk for kidney disease has long been a focus of the USRDS, and is now part of the Healthy People 2020 goals developed by the Department of Health and Human Services (see the *Healthy People 2020* chapter in Volume 2). Urine testing for albumin in patients with DM has been recommended for some time by the American Diabetes Association. The 2012 Kidney Disease Improving Global Outcomes (KDIGO) guidelines on CKD evaluation and management recommend risk stratification of CKD patients using both the urine albumin/creatinine ratio and the estimated glomerular filtration rate, emphasizing that both tests are needed to fully assess kidney disease and its associated risks of death and progression to end-stage renal disease (ESRD) (Matsushita et al., 2010; *Kidney Disease: Improving Global Outcomes* (KDIGO) CKD Work Group, 2012). Analysis of Medicare data from 2012 shows that urine albumin testing has increased over time, but the proportion of patients with recognized CKD who were tested still remains low. Among patients with recognized CKD, 43 percent with DM alone, and 20 percent with HTN alone, received a urine albumin test; for patients with both DM and HTN, the proportion tested was still under 50 percent. By contrast, serum creatinine testing was used in 90 percent of patients. However, because the serum creatinine test is usually part of a panel of tests, its use may not indicate an active assessment of kidney function. Because urine albumin testing must be ordered separately, it may represent true intent to assess kidney disease. It will be of interest to note whether additional uptake of urine albumin testing will occur in future years, possibly in response to the 2012 KDIGO guidelines.

### Visits With a Physician After CKD Diagnosis

Data on physician care show that patients are far more likely to visit a primary care physician or cardiologist than a nephrologist after a CKD diagnosis. This may relate in part to the fact that most guidelines (including KDIGO) only suggest referral to nephrology for advanced CKD (eGFR <30 or Stage 4 CKD) unless there are other concerns, such as rapid progression of disease. It is also unclear whether the U.S. nephrology workforce

is large enough to handle management of the very large population of patients with earlier stages of CKD. Regardless of the possible reasons, less than one-third of all patients with a CKD claim in 2011 were seen by a nephrologist over the subsequent year. Among those with more advanced CKD (Stage 3 or higher), in contrast, 40–56 percent visited a nephrologist. Whether the involvement of a nephrologist, and at what stage of CKD, improves outcomes, is a matter of ongoing interest.

### Analytical Methods

See the *CKD Analytical Methods* chapter for an explanation of analytical methods used to generate the figures and tables in this chapter.

## Prevalence of Recognized CKD

Table 2.1 provides the prevalence of coded CKD, DM, and often related cardiovascular comorbid conditions among patients in the Medicare population. Over one-third of the Medicare population has at least one of the comorbid conditions, and over 10 percent have two or more comorbid conditions.

**vol 1 Table 2.1 Prevalence of coded DM, CKD, CHF & CVA among Medicare patients age 65+, 2012**

	Medicare 5% Sample	Distribution
All	1,230,285	100.0%
<b>Total CHF</b>	112,316	9.1
<b>Total DM</b>	299,052	24.3
<b>Total CKD</b>	127,941	10.4
<b>Total CVA</b>	107,026	8.7
<b>DM &amp; CHF</b>	21,429	1.7
<b>DM &amp; CKD</b>	33,392	2.7
<b>DM &amp; CVA</b>	20,143	1.6
<b>CHF &amp; CKD</b>	12,829	1.0
<b>CHF &amp; CVA</b>	8,471	0.7
<b>CKD &amp; CVA</b>	7,312	0.6
<b>CHF &amp; DM &amp; CVA</b>	5,818	0.5
<b>CKD &amp; DM &amp; CVA</b>	6,626	0.5
<b>CKD &amp; CHF &amp; CVA</b>	4,329	0.4
<b>DM &amp; CHF &amp; CKD</b>	15,273	1.2
<b>DM &amp; CHF &amp; CKD &amp; CVA</b>	6,148	0.5
<b>No DM, CKD, CHF &amp; CVA</b>	770,062	62.6

Data Source: Medicare 5 percent sample. Period prevalent patients, 2012, without ESRD, age 65 and older (Medicare). Abbreviations: CHF, congestive heart failure; CKD, chronic kidney disease; CVA, cerebrovascular accident; DM, diabetes mellitus.

Table 2.2 presents descriptive data on patients age 65 and older in the Medicare 5 percent sample. The high prevalence of comorbid conditions in the overall sample reflects the older age of these patients. For example, 61 percent and 24 percent have diagnoses of HTN and DM, respectively. Among patients with CKD, rates of comorbidity are even higher, with nearly half having a diagnosis of DM and over 90 percent having a diagnosis of HTN.

Black/African Americans (15 percent) is roughly 50 percent higher than Whites, Native Americans, and other races (approximately 10 percent); the prevalence in Asians is 11 percent. The results from the adjusted analyses confirm greater odds of recognized CKD in older patients, Blacks, and those with comorbidities such as DM, HTN, and cardiovascular disease (CVD).

vol 1 Table 2.2 Characteristics of all patients, characteristics of CKD patients among Medicare patients age 65+, 2012

vol 1 Table 2.3 Prevalence of CKD, and adjusted odds ratios of CKD among Medicare patients age 65+, 2012

	Overall		Patients with CKD	
	N	Distribution of Characteristics (%)	N	Distribution of Characteristics (%)
All	1,230,285	100.0	127,941	100.0
65-74	654,860	53.2	47,139	36.8
75-84	403,494	32.8	51,577	40.3
85+	171,931	13.9	29,225	22.8
Male	522,684	42.5	60,194	47.0
Female	707,601	57.5	67,747	52.9
White	1,064,647	86.5	106,359	83.1
Black/African Am	93,195	7.6	14,091	11.1
Native Am	4,916	0.4	536	0.4
Asian	22,961	1.9	2,568	2.1
Other	40,193	3.3	4,114	3.2
Unknown	4,373	0.4	273	0.2
DM	299,050	24.3	61,439	48.1
HTN	751,550	61.1	118,129	92.3
CHF	112,316	9.1	38,579	30.1
Cancer	127,979	10.4	22,712	17.7

	Prevalence of CKD (% of overall)	Adjusted Odds Ratios of CKD
Overall	10.4	<sup>a</sup>
65-74	7.2	Ref.
75-84	12.8	1.4
85+	17.0	1.8
Male	11.5	Ref.
Female	9.6	0.8
White	9.9	Ref.
Black/African Am	15.1	1.4
Native Am	10.9	1.1
Asian	11.2	1.1
Other/Unknown	10.2	0.9
DM	20.5	2.1
HTN	15.7	3.7
CVD	18.4	2.3

Data Source: Medicare 5 percent sample. Period prevalent patients, 2012, without ESRD, age 65 and older (Medicare). Adjustments included are age, sex, race, and comorbidities. CVD is defined as either one of the following comorbidities being true: cerebrovascular accident, peripheral vascular disease, atherosclerotic heart disease, congestive heart failure, dysrhythmia or other cardiac comorbidities. <sup>a</sup> Not applicable. Abbreviations: African Am, African American; CKD, chronic kidney disease; DM, diabetes mellitus; HTN, hypertension; CVD, cardiovascular disease; Native Am, Native American.

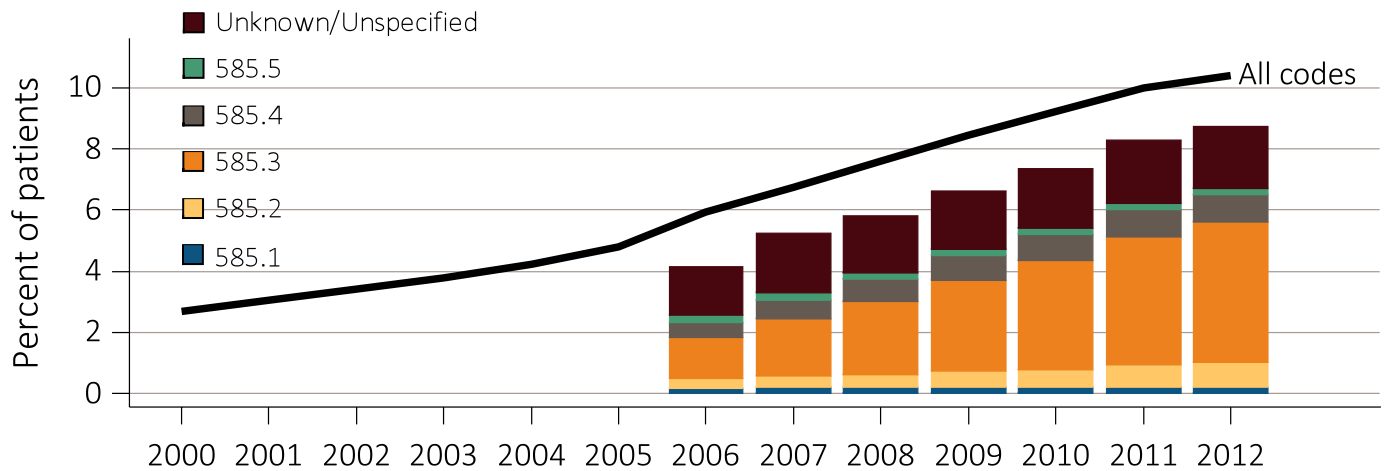
Data Source: Medicare 5 percent sample. Period prevalent patients, 2012, without ESRD, age 65 and older (Medicare). Abbreviations: African Am, African American; CKD, chronic kidney disease; CHF, congestive heart failure; DM, diabetes mellitus; HTN, hypertension; Native Am, Native American.

### Prevalence and Odds of a CKD Diagnosis Code

Figure 2.1 shows the temporal trend in prevalence of recognized CKD overall and by CKD stage-specific code, and Figure 2.2 shows the prevalence stratified by race, among Medicare patients age 65 and older. The prevalence of recognized CKD has risen each year, and is 3.8 times higher in 2012 than in 2000. Likewise, CKD prevalence has risen each year in each race group, with the exception of a recent leveling off among Native Americans.

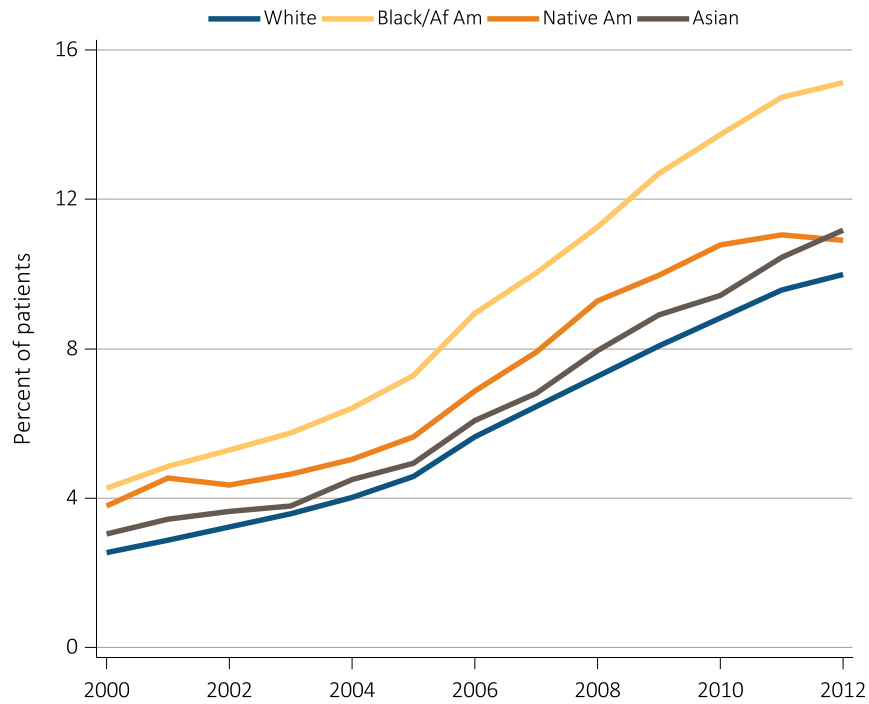
Table 2.3 presents the prevalence and adjusted odds ratio of recognized CKD in the Medicare population. Of Medicare patients age 65 and older, 10 percent have a coded diagnosis of CKD. The prevalence of CKD increases with age, from 7.2 percent at ages 65–74 to 17.0 percent at age 85 and older. Males have slightly higher prevalence than females. The prevalence among

vol 1 Figure 2.1 Temporal trends in CKD prevalence, overall and by CKD stage, among Medicare patients age 65+, 2000-2012



Data Source: Medicare 5 percent sample. Medicare 5 percent sample. See **Table A** at the beginning of this chapter for a description of ICD-9-CM codes and CKD stages. Abbreviation: CKD, chronic kidney disease.

vol 1 Figure 2.2 Temporal trends in CKD prevalence by race among Medicare patients age 65+, 2000-2012



Data Source: Medicare 5 percent sample. Abbreviations: Af Am, African American; CKD, chronic kidney disease; Native Am, Native American.

Table 2.4 compares the prevalence of CKD in the NHANES and Medicare populations among patients age 65 and older, according to demographic characteristics and comorbid conditions. In both datasets, there is a higher prevalence of CKD in older age groups, among Black/African American patients, and among patients with CVD compared to patients

with HTN or DM (but no diagnosed CVD). However, the absolute prevalence of CKD is substantially lower in Medicare versus NHANES, reflecting the capture of “recognized CKD” in Medicare data versus the systematic evaluation of kidney function by study design in NHANES.

**vol 1 Table 2.4 Percent of patients with CKD by demographic characteristics, among patients overall and with DM, HTN, or CVD, in NHANES (2011-2012) and Medicare (2012) datasets**

	Overall		DM (No HTN)		HTN (No DM)		Any CVD	
	NHANES	Medicare	NHANES	Medicare	NHANES	Medicare	NHANES <sup>a</sup>	Medicare <sup>b</sup>
<b>65-74</b>	26.4	7.2	7.5	9.3	31.4	12.4	40.9	21.1
<b>75-79</b>	50.4	12.8	*	12.6	45.4	17.7	66.7	25.8
<b>80+</b>	65.2	17.0	*	15.3	67.2	24.0	80.5	29.8
<b>White</b>	38.3	9.9	24.9	11.3	44.5	17.3	55.6	24.5
<b>Black/African Am</b>	49.9	15.1	*	11.9	46.6	21.4	68.3	35.2
<b>Native Am</b>	-	10.9	-	9.9	-	16.3	-	27.5
<b>Asian</b>	-	11.2	-	12.7	-	16.9	-	29.4
<b>Other/Unk</b>	42.4	10.2	18.3	11.5	47.0	15.5	70.1	27.2
<b>Male</b>	37.9	11.5	29.5	12.4	41.7	19.8	44.3	26.8
<b>Female</b>	41.3	9.6	20.7	10.2	47.2	15.9	75.9	24.3
<b>All</b>	39.7	10.4	26.6	11.3	44.9	17.5	58.5	25.4

Data Source: Medicare patients from the 5 percent sample, age 65 and older alive and eligible for all of 2012 and NHANES 2011-2012 participants, age 65 and older. CKD claims as well as other diseases identified in 2012. <sup>a</sup> CVD defined as any of the self-report diseases: angina, myocardial infarction, stroke, coronary heart disease, or congestive heart failure. <sup>b</sup> CVD defined as either one of the following comorbidities: cerebrovascular accident, peripheral vascular disease, atherosclerotic heart disease, congestive heart failure, dysrhythmia or other cardiac comorbidities. \* Values for cells with 10 or fewer patients are suppressed. - No available data. Abbreviations: African Am, African American; CKD, chronic kidney disease; CVD, cardiovascular disease; DM, diabetes mellitus; HTN, hypertension; Native Am, Native American; Unk, Unknown.

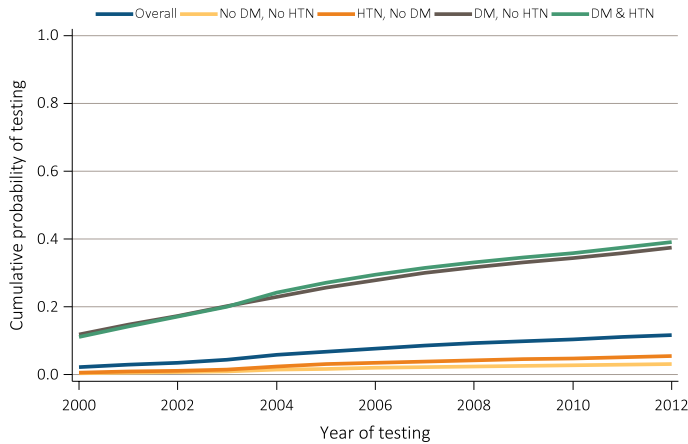
## Laboratory Testing of Patients With and Without CKD

Individuals at risk for CKD should be screened periodically for kidney disease, and those with CKD should be monitored for progression of disease. Urine albumin and creatinine tests are valuable laboratory markers to detect signs of kidney damage, as well as to evaluate for progressive decline in kidney function. As shown in Figure 2.3, 79 percent of Medicare patients without diagnosed CKD received serum creatinine testing in 2012, while only 11 percent received a urine albumin test (which must be ordered separately from serum creatinine and other standard blood tests). Thirty-seven percent of patients with DM alone had urine albumin testing, compared to 5 percent in

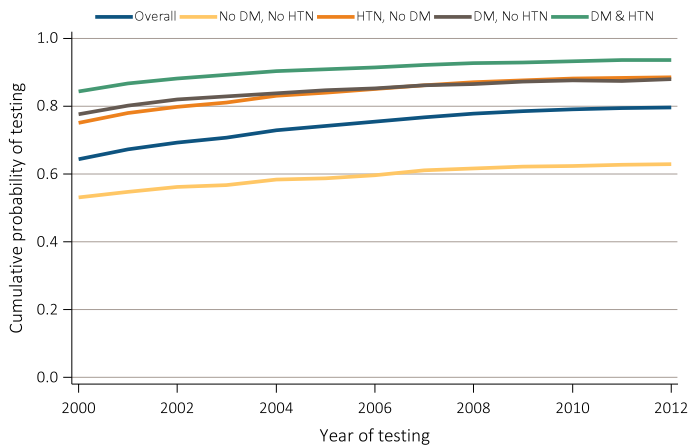
patients with HTN alone. Having both DM and HTN greatly increases the likelihood of developing CKD: 93 percent of patients with both conditions had serum creatinine testing in 2012, while 39 percent had urine albumin testing. Because urine albumin testing must be ordered separately from standard blood tests, it may represent true intent to assess kidney disease. There has been a steady rise in use of urine albumin testing over time, particularly in those with DM. As shown in Figure 2.4, among patients with a diagnosis of CKD, patterns of testing were similar, though at somewhat higher rates than among patients without CKD. For example, in 2012, in patients with a diagnosis of CKD, 47 percent had urine albumin testing and 96 percent had serum creatinine testing among patients who also had both DM and HTN.

vol 1 Figure 2.3 Unadjusted cumulative probability for urine albumin & serum creatinine testing, among Medicare patients age 65+ WITHOUT a diagnosis of CKD, 2000-2012

(a) Urine albumin



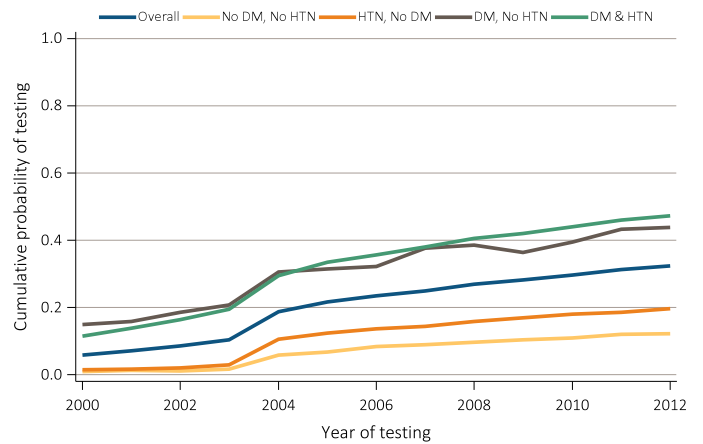
(b) Serum creatinine



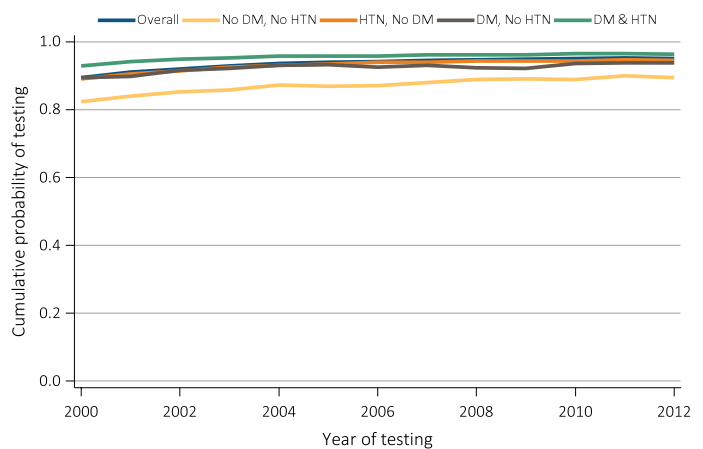
Data Source: Medicare patients from the 5 percent sample, age 65 and older with Part A & B coverage in the prior year. Tests tracked during each year. Abbreviations: CKD, chronic kidney disease DM, diabetes mellitus; HTN, hypertension.

vol 1 Figure 2.4 Unadjusted cumulative probability of urine albumin & serum creatinine testing, among Medicare patients age 65+ WITH a diagnosis of CKD, 2000-2012

(a) Urine albumin



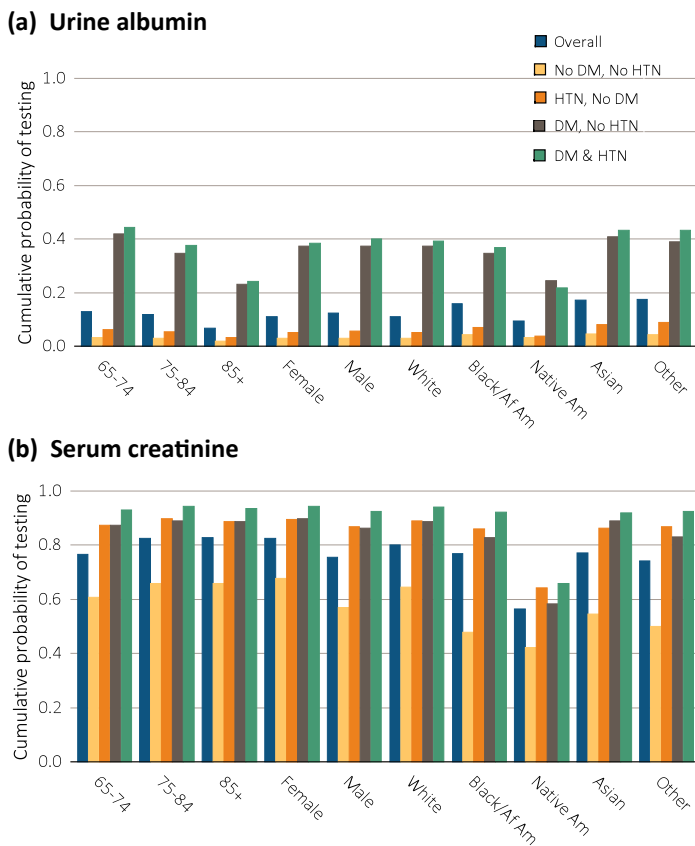
(b) Serum creatinine



Data Source: Medicare patients from the 5 percent sample, age 65 and older with Part A & B coverage in the prior year. Tests tracked during each year. Abbreviations: CKD, chronic kidney disease DM, diabetes mellitus; HTN, hypertension.

Figure 2.5 shows the adjusted cumulative probability of urine albumin (a) & serum creatinine (b) testing by demographic characteristics, among Medicare (age 65 and older) patients without a diagnosis of CKD. Generally, the cumulative probability of serum creatinine testing was about 2-3 times higher than urine albumin testing. Patients with HTN and no DM have a much higher probability of serum creatinine testing than urine albumin testing (~0.85 vs. ~0.05, across all demographics).

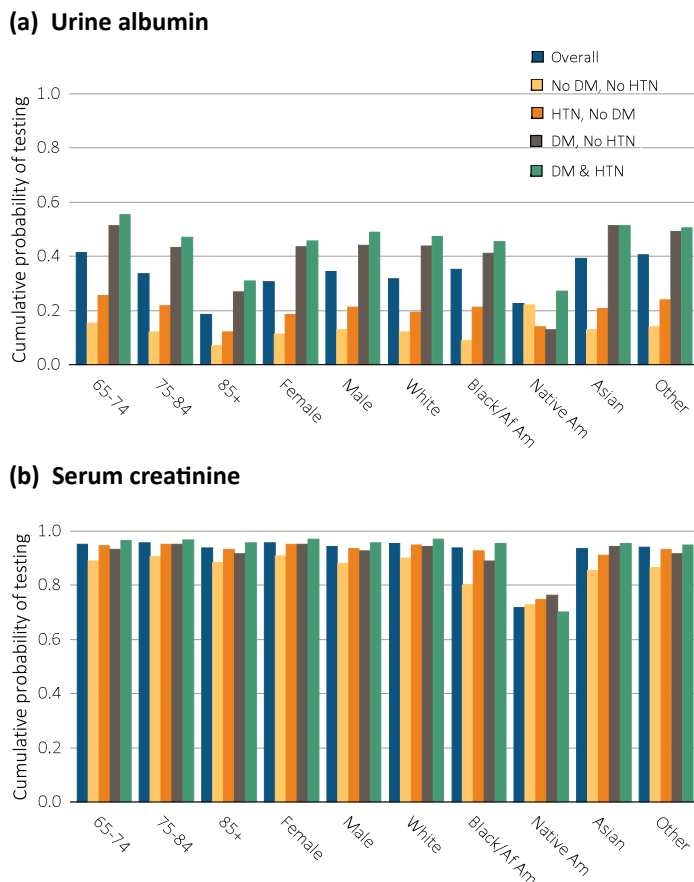
vol 1 Figure 2.5 Adjusted cumulative probability of urine albumin (a) & serum creatinine (b) testing by demographic characteristics, among Medicare patients age 65+ WITHOUT a diagnosis of CKD, 2000-2012



Data Source: Medicare 5 percent sample. Models are adjusted for age, race, and sex. Abbreviations: Af Am, African American; CKD, chronic kidney disease; CVD, cardiovascular disease; DM, diabetes mellitus; HTN, hypertension; Native Am, Native American; HTN, hypertension.

Figure 2.6 shows the adjusted cumulative probability of urine albumin (a) & serum creatinine (b) testing by demographic characteristics, among Medicare (age 65 and older) patients with a diagnosis of CKD. These trends are similar to those in Figure 2.5, with cumulative probability of serum creatinine testing about 2-3 times higher than urine albumin testing. Patients with HTN and no DM have a much higher probability of serum creatinine testing than urine albumin testing (~0.9 vs. ~0.2, across all demographics).

vol 1 Figure 2.6 Adjusted cumulative probability of urine albumin (a) & serum creatinine (b) testing by demographic characteristics, among Medicare patients age 65+ WITH a diagnosis of CKD, 2000-2012



Data Source: Medicare 5 percent sample. Models are adjusted for age, race and sex. Abbreviations: CKD, chronic kidney disease; DM, diabetes mellitus; HTN, hypertension.

Figures 2.5 and 2.6 demonstrate lower rates of urine albumin testing with older age, among patients with and without recognized CKD. Serum creatinine testing appears uniformly high, regardless of CKD status, presence of other comorbidities, or demographics, with the possible exception of Native Americans. This again may relate to the fact that serum creatinine is usually included with standard panels of routinely ordered blood tests.

### Visits With a Physician After CKD Diagnosis

As indicated in Table 2.5, the probability of at least one primary care visit over the next year, among Medicare (age 65 and older) patients was 0.91, and 0.62 for at least one cardiologist visit over the next year. These probabilities varied little across demographic categories or CKD diagnostic category. By contrast, among patients with any CKD diagnosis the probability of at least one nephrologist visit over

the next year was 0.31. With more advanced CKD (diagnosis code 585.3 or higher), this probability increased nearly two-fold to 0.55. Notably, CKD patients age 85 and older were as likely to have a cardiologist visit as younger patients, but they were much less likely to have a nephrologist visit than younger patients.

**vol 1 Table 2.5 Cumulative probability of a physician visit at month 12 after CKD diagnosis in 2011 among Medicare patients age 65+**

	Any CKD Diagnosis			CKD Diagnosis Code of 585.3 or Higher		
	Primary Care	Cardiologist	Nephrologist	Primary Care	Cardiologist	Nephrologist
65-74	0.88	0.54	0.31	0.89	0.55	0.56
75-84	0.90	0.61	0.29	0.90	0.62	0.51
85+	0.90	0.60	0.22	0.91	0.61	0.39
Male	0.90	0.55	0.27	0.91	0.56	0.48
Female	0.88	0.62	0.29	0.89	0.64	0.52
White	0.89	0.59	0.28	0.90	0.60	0.49
Black/ African Am	0.89	0.56	0.33	0.89	0.57	0.55
Other	0.88	0.54	0.29	0.88	0.55	0.49
Overall	0.91	0.62	0.31	0.92	0.64	0.55

*Data Source: Medicare 5 percent sample. Patients alive & eligible all of 2011. CKD diagnosis is at date of first CKD claim in 2011; claims for physician visits were searched during the 12 months following that date. CKD diagnosis code of 585.3 or higher represents CKD Stages 3-5. Abbreviations: African Am, African American; CKD, chronic kidney disease.*

## References

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