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Recognition and Management of CKD in Primary Care

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To the editor

Primary care physicians care for the majority of patients with chronic kidney disease (CKD)¹ and bear much of the responsibility for optimizing early management.² In 2002, guidelines were issued by the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI) for the classification of CKD based on estimated glomerular filtration rate (eGFR)³ and for the management of patients with CKD. The impact of these guidelines on primary care has not been well studied. Here we report adherence to these guidelines in a large nationwide sample of primary care practices.

This descriptive study was performed in the Practice Partner Research Network, a practice-based research network of primary care providers that use a common electronic medical record (EMR)⁴, comprising 120 practices submitting data as of March 31, 2009. These practices represent 481 physicians and 141 mid-level providers in 38 U.S. states; of these practices, 72% are family medicine, 20% internal medicine, and 8% combined primary care practices. All active patients over 18 years of age with a serum creatinine, age and gender documented in their EMR within a year as of March 31, 2009 were included. The Institutional Review Board at the Medical University of South Carolina approved the study. Age, gender, race (if available), and most recent measurement of serum creatinine, blood pressure, and low density lipoprotein cholesterol were obtained from the database. Diagnoses of hypertension, diabetes mellitus and CKD either obtained from documentation on a progress note title, problem list, or diagnosis code in the EMR were ascertained. We also determined whether an ACE inhibitor, ARB, lipid-lowering medication or non-steroidal anti-inflammatory drug had been recorded in the EMR medication list in the past year.

eGFR was calculated using the four variable Modification of Diet in Renal Disease (MDRD) Study equation.^{3, 5} If a patient's race was not available, he/she was assumed to be non-black for the eGFR calculation. For these analyses, patients were considered to have CKD if their calculated eGFR was <60 ml/min/1.73 m², and were further categorized as stage 3a (eGFR 45–59 ml/min/1.73 m²), 3b (eGFR 30–44 ml/min/1.73 m²), 4 (eGFR 15–29 ml/min/1.73 m²) or 5 (eGFR < 15 ml/min/1.73 m²) CKD.

All statistical analyses were performed using SAS v9.1 (www.sas.com). Comparisons between patient subgroups were performed using generalized linear mixed models, which accounted for the clustering of patients within practices.

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Among 518,531 active adult patients in 120 practices, 237,906 patients met inclusion criteria; demographics and clinical characteristics are detailed in Table 1. Among the 26.9% of patients with race recorded, 83.1% were white and 8.4% were black. 34,644 (14.6%) had eGFR <60. Compared to patients with eGFR ≥60, patients with eGFR <60 were significantly more likely to be older (70.9±12.8 vs 52.9±15.8 years, $p<0.001$), female (66.6% vs. 55.3%, $p<0.001$), have a diagnosis of hypertension (67.9% vs. 38.8%, $p<0.001$), or have a diagnosis of diabetes (28.9% vs. 15.2%, $p<0.001$). The majority of patients with eGFR <60 had stage 3a or 3b CKD, did not have a documented diagnosis of diabetes, and had serum creatinine values in the near normal range. There was significant ($p<0.001$) variation among practices with regard to diagnoses of CKD recorded in the EMR. Adherence to recommended practice guidelines and achievement of therapeutic targets is detailed in Table 2. Over half of all patients with eGFR <60 had been prescribed an ACE inhibitor or ARB or a lipid lowering medication, yet a minority of patients met treatment goals for blood pressure or lipid control.

Our study has several limitations. By using a patient's most recent creatinine to calculate eGFR, we may be misclassifying some patients with acute kidney injury as having CKD. Second, we did not obtain data regarding the presence of proteinuria, and we were unable to include an assessment of albuminuria or other markers of kidney damage that may indicate the presence of CKD. Furthermore, because race was only available for 26.9% of our population, patients for whom race was not recorded were assumed to be non-black for the eGFR calculation, potentially leading to underestimation of eGFR and over-diagnosis of CKD in some black patients. Lastly, there is some debate about the validity of using the MDRD Study equation to define CKD, particularly for older female patients.⁶ There is also uncertainty associated with the estimation in the equation.^{7, 8}

CKD is common in primary care practices. Although the KDOQI guidelines were designed to improve early detection and management, CKD continues to be under-recognized by primary care physicians. Suboptimal achievement of therapeutic targets may be due to under-diagnosis of CKD in this sample. Interventions to improve the recognition and management of patients with CKD in primary care could have a major public health impact.

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Table 1

Sample Demographic and Clinical Characteristics Stratified by eGFR

	eGFR (mL/min/1.73m ²)				
	≥60	45–59	30–44	15–29	<15
No. (%) of patients	203,262 (85.4)	25016 (10.5)	7489 (3.2)	1702 (0.7)	437 (0.2)
Age (y)	52.9 ±15.8	69.3±12.6	75.3±11.8	76.1 ± 12.8	65.9 ±15.6
Women	112405 (55.3)	16528 (66.1)	5178 (69.1)	1117 (65.6)	231 (52.9)
SCr (mg/dL)	0.88 ±0.17	1.19±0.17	1.55±0.25	2.37±0.53	6.25± 2.60
eGFR	87.3±19.8	53.9±4.23	39.0±4.10	24.6±3.98	9.64±3.20
Most recent LDL-C value (mg/dL)	110.5±33.7	105.5±35.7	98.8±35.9	97.1±37.7	88.0±38.4
Most recent SBP (mmHg)	125.4±15.7	129.5±16.9	130.8±18.6	131.2±19.4	130.8±20.9
Most recent DBP (mmHg)	76.5±9.98	74.3±10.5	71.6±10.9	70.9±12.1	71.7±13.1
Diagnosis of DM	30,790 (15.2)	6349 (25.4)	2707 (36.2)	721 (42.4)	217 (49.7)
Diagnosis of HTN	78,889 (38.8)	16193 (64.7)	5705 (76.2)	1,304 (76.6)	312 (71.4)
Diagnosis of CKD	2,239 (1.1)	2323 (9.3)	2290 (54.1)	920 (54.1)	275 (62.9)

Values given as mean ± SD or number (percent).

Abbreviations: eGFR, estimated glomerular filtration rate; SCr, serum creatinine; LDL-C, low-density lipoprotein cholesterol; SBP, systolic blood pressure; DBP, diastolic blood pressure; DM, diabetes mellitus; HTN, hypertension; CKD, chronic kidney disease.

Conversion factors for units: eGFR in mL/min/1.73m² to mL/s/1.73 m², x 0.0167; SCr in mg/dL to μmol/L, x88.4; LDL-C in mg/dL to mmol/L, x0.0259.

Table 2
Adherence to Practice Guidelines and Achievement of Therapeutic Targets in Patients with eGFR <60

	Stage of CKD				Total (all CKD) (n=34,644)
	Stage 3a (n=25,016)	Stage 3b (n=7489)	Stage 4 (n=1,702)	Stage 5 (n=437)	
Most recent BP<130/80 mmHg	9866 (39.4)	3033 (40.5)	669 (39.3)	169 (38.7)	13,737 (39.7)
Prescription for ACEi or ARB in last year	12401 (49.6)	4549 (60.7)	966 (56.8)	182 (41.7)	18,098 (52.2)
Prescription for lipid lowering medication in last year	14852 (59.4)	4968 (66.3)	1121 (65.9)	305 (69.8)	21246 (61.3)
Most recent LDL-C <100 mg/dl	10953 (43.8)	3791 (50.6)	853 (50.1)	245 (56.1)	15,842 (45.7)
NSAID recorded in chart in last year	3569 (14.3)	918 (12.3)	128 (7.5)	34 (7.8)	4,649 (13.4)

Values given as number (percent).

Abbreviations: ACEi, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; LDL-C, low-density lipoprotein cholesterol; NSAID, nonsteroidal anti-inflammatory drug; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate.