

## Supplementary Online Content

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### **eMethods.** Expanded Methodology

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This supplementary material has been provided by the authors to give readers additional information about their work

## **eMethods. Expanded Methodology**

### Validation of ICD-9 claims for kidney failure not treated with dialysis

To determine the accuracy of International Classification of Diseases, Ninth Revision (ICD-9) claims for identifying cases of kidney failure not treated with dialysis, we assembled a claims validation cohort from a larger dataset which included all Veterans with chronic kidney disease (N=743,057), defined as an outpatient eGFR  $<60$  ml/min/1.73m<sup>2</sup> at any time between 2002 and 2009, and a random 5% sample of Veterans without chronic kidney disease (N=256,943) during the same period of time. From this sample, we identified 180,708 patients who were 67 years of age or older on January 1, 2009 who had at least two serum creatinine measurements in VA in 2009 that were at least 5 days apart, including one outpatient serum creatinine measurement. We excluded patients who received dialysis at any time prior to their second serum creatinine measurement using the USRDS and ICD9/CPT codes. We also excluded patients who died on the date of the second serum creatinine measurement, leaving 118,249 patients in the claims validation cohort. We ascertained all diagnosis codes from VA and Medicare claims from inpatient and outpatient visits for 12 months prior to the first eGFR measurement in 2009 (index eGFR), and 12 months after the index eGFR. If patients received dialysis after the second eGFR, claims were censored on the day prior to the first dialysis date.

We evaluated the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of five ICD-9 codes – 585.5 (chronic kidney disease stage 5), 585.6 (ESRD), 586 (renal failure unspecified), 403.01 (hypertensive chronic kidney disease stage 5 or ESRD), and 403.91 (hypertensive chronic kidney disease unspecified, with chronic kidney disease stage 5 or ESRD), using VA eGFR measurements as the gold standard. To meet the gold standard definition of kidney failure, we required two eGFR  $<15$  ml/min/1.73m<sup>2</sup> at least five days apart including one outpatient measurement. The accuracy of various combinations of claims, and of claims in combination with a single eGFR  $<15$  ml/min/1.73m<sup>2</sup> is presented in **eTable 1**.

### Estimating misclassification of kidney failure cases not treated with dialysis among Medicare patients

The definition of any Medicare or VA ESRD claim and an outpatient eGFR  $<15$  ml/min/1.73m<sup>2</sup> (hereafter the claims + lab method) had the highest sensitivity and positive predictive value, therefore we choose to employ this method in our analyses. We verified the accuracy of this definition among the subset Veterans who did not receive pre-ESRD VA nephrology care, and found similar sensitivity (77.0%) and positive predictive value (72.2%) (**eTable 1**). Among this subset of Veterans who met our gold standard definition of kidney failure not treated with dialysis, but whose kidney failure status was incorrectly classified by the claims + lab method (false negatives), 20.8% received pre-ESRD nephrology care in Medicare, 10.9% were dual-users, and 68.3% did not receive pre-ESRD nephrology care in either health care system. Using this information, we re-calculated the number of patients with kidney failure who were not treated with dialysis. From the cohort of 20,201 Veterans with incident kidney failure (**Figure 1**), 8432 patients were not treated with dialysis, and of these, 4919 patients received pre-ESRD nephrology care in Medicare, dual-use, or neither health care system. If the sensitivity of the claims + lab method of ascertaining kidney failure with no dialysis is 77.0%, then the total number of patients with kidney failure not treated with dialysis who were missed by this ascertainment method is N=1131. Of these 1131 patients, 235 ( $1131 * 0.208$ ) should be added to the Medicare no dialysis group, 123 to the dual use no dialysis group, and 772 to the neither VA nor Medicare no dialysis group. Assuming that patients who received pre-ESRD nephrology care in VA were captured by the two eGFR  $<15$  ml/min/1.73m<sup>2</sup> definition of kidney failure employed in the main analysis (i.e. no misclassification among VA patients), then the percentage of patients treated with dialysis could be recalculated as shown in **eTable 2**.

**eTable 1.** Prevalence, Sensitivity, Specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of Medicare and/or VA Diagnosis Claims Alone or in Combination With a Single eGFR Measurement <15 ml/min/1.73m<sup>2</sup>, for Identifying Patients With a Sustained eGFR <15 ml/min/1.73m<sup>2</sup>

<b>Criteria</b>	<b>Prevalence</b>	<b>Sensitivity</b>	<b>Specificity</b>	<b>PPV</b>	<b>NPV</b>
<i>VA claims</i>					
VA inpatient claim	1.2%	37.5%	99.3%	38.6%	99.2%
VA outpatient claim	6.6%	63.2%	94.1%	11.4%	99.5%
VA inpatient or outpatient claim	7.1%	68.3%	93.6%	11.5%	99.6%
Two or more VA claims	3.7%	55.9%	96.9%	18.0%	99.5%
<i>Medicare claims</i>					
Medicare inpatient claim	0.6%	10.2%	99.6%	22.3%	98.9%
Medicare outpatient claim	1.1%	8.7%	99.0%	9.4%	98.9%
Medicare inpatient or outpatient claim	1.6%	15.9%	98.6%	12.3%	99.0%
Two or more Medicare claims	0.4%	6.9%	99.6%	19.1%	98.9%
<i>VA or Medicare claims</i>					
Any inpatient claim	1.6%	43.37%	98.87%	31.85%	99.31%
Any outpatient claim	7.5%	65.2%	93.2%	10.5%	99.5%
Any claim	8.2%	71.4%	92.5%	10.4%	99.6%
<i>Claims + lab</i>					
Medicare claim + lab (outpatient eGFR <15)	0.3%	15.9%	99.9%	72.7%	99.0%
VA claim + lab (outpatient eGFR <15)	1.1%	68.3%	99.8%	77.3%	99.6%
Any claim + lab (outpatient eGFR <15)	1.1%	71.4%	99.7%	75.9%	99.7%
<b>Excluding patients with VA-only pre-ESRD nephrology care</b>					
<i>Claims + lab</i>					
<b>Any claim + lab (outpatient eGFR &lt;15)</b>	<b>0.8%</b>	<b>77.0%</b>	<b>99.8%</b>	<b>72.2%</b>	<b>99.8%</b>

Abbreviations: VA – Veterans Affairs, eGFR – estimated glomerular filtration rate, ESRD – end-stage renal disease

**eTable 2.** Percentage of Incident Kidney Failure Patients Treated With Dialysis, Assuming Differential Misclassification Among Patients Who Received pre-ESRD Nephrology Care in Medicare or in Neither Health Care System

Site of pre-ESRD nephrology care	Incident kidney failure, received dialysis	Incident kidney failure, did not receive dialysis	Estimated number of patients with incident kidney failure and did not receive dialysis misclassified	Total number of patients with incident kidney failure who did not receive dialysis, accounting for misclassification	% treated with dialysis  1- ((B+C)/(A+B+C))
	A	B	C	B + C	
VA	3818	3423	0	3423	54.1%
Medicare	3253	721	235	956	77.3%
Dual-use	652	251	123	374	63.5%
Neither	4136	3947	773	4720	46.7%

**eTable 3.** Dialysis Treatment Within Two Years of Incident Kidney Failure in VA Versus Medicare, Among Patient Subgroups

Cohort	% treated with dialysis	Adjusted Risk Difference (95% CI)	Adjusted Relative Risk (95% CI)
All patients with incident kidney failure(N=11,215)			
VA	53	<i>Referent</i>	<i>Referent</i>
Medicare	82	23 (22,25)	1.45 (1.41, 1.49)
Patients with ≥2 pre-ESRD nephrology visits (N=9508)			
VA	53	<i>Referent</i>	<i>Referent</i>
Medicare	82	27 (25, 30)	1.51 (1.47, 1.56)
Patients with sustained low eGFR (N=7841)			
VA	45	<i>Referent</i>	<i>Referent</i>
Medicare	56	12 (10, 15)	1.28 (1.21, 1.35)

**eTable 4.** Dialysis Treatment Within Two Years Of Incident Kidney Failure Among Patients Receiving pre-ESRD Nephrology Care in VA, Medicare, Dual-Users, and Those Who Received Nephrology Care in Neither Health Care System.

Setting of pre-ESRD nephrology care	% treated with dialysis	Adjusted Risk Difference (95% CI)	Adjusted Relative Risk (95% CI)	% who died within 2 years	Adjusted Risk Difference (95% CI)	Adjusted Relative Risk (95% CI)
VA	53	<i>Referent</i>	<i>Referent</i>	44	<i>Referent</i>	<i>Referent</i>
Medicare	82	23 (22,25)	1.45 (1.41, 1.49)	53	6 (4, 8)	1.13 (1.08, 1.18)
Dual-use	72	14 (11, 17)	1.27 (1.22, 1.33)	42	-3 (-6, 1)	0.94 (0.87, 1.02)
Neither	51	1 (0, 3)	1.03 (1.00, 1.06)	55	9 (7, 11)	1.20 (1.16, 1.24)

Models adjusted for age, sex, race, marital status, zip code median income, urban residence, diabetes, ischemic heart disease, congestive heart failure, peripheral arterial disease, cerebrovascular disease, paralysis, chronic pulmonary disease, chronic liver disease, connective tissue disease, peptic ulcer disease, malignancy, metastatic solid tumor, dementia, depression, post-traumatic stress disorder, and rate of eGFR decline, driving distance, VA co-pay, and year

Abbreviations: VA – Veterans Affairs, ESRD – end-stage renal disease, eGFR – estimated glomerular filtration rate