

# Predialysis Kidney Function and Its Rate of Decline Predict Mortality and Hospitalizations After Starting Dialysis

Melissa Soohoo, MPH; Elani Streja, MPH, PhD; Yoshitsugu Obi, MD, PhD;  
Connie M. Rhee, MD, MSc; Daniel L. Gillen, MS, PhD; Keiichi Sumida, MD, MPH;  
Danh V. Nguyen, MS, PhD; Csaba P. Kovcsy, MD;  
and Kamyar Kalantar-Zadeh, MD, MPH, PhD

## Abstract

**Objective:** To determine whether kidney function level and its rate of decline in the immediate predialysis period among veterans transitioning to end-stage renal disease (ESRD) predict postdialysis mortality and hospitalization.

**Patients and Methods:** In 19,985 veterans transitioning to ESRD during the period October 1, 2007, to March 30, 2014, we examined kidney function and its slope over the final year of the pre-ESRD (prelude) period. Two categories of low vs high estimated glomerular filtration rate (eGFR, dichotomized at 10 mL/min/1.73 m<sup>2</sup>) and slow vs fast slope (dichotomized at -10 mL/min/1.73 m<sup>2</sup>/y) were combined into 4 groups. Their associations with 12-month post-ESRD all-cause and cardiovascular (CV) mortality and hospitalization rates were examined in adjusted models accounting for clinical characteristics and laboratory measurements at transition.

**Results:** Patients, 66±11 years old, and 34% blacks, had a median (interquartile range) eGFR at transition and slope of 9.7 (7.1-13.3) mL/min/1.73 m<sup>2</sup> and -10.5 (-18.8 to -5.9) mL/min/1.73 m<sup>2</sup>/y, respectively. Patients with a low eGFR and slow slope had the lowest 12-month all-cause and CV mortality risks and hospitalization rate. Conversely, patients with high eGFR and fast slope had the highest risk of all-cause and CV mortality and hospitalization rate compared with patients with a low eGFR and slow slope. This relationship persisted in sensitivity analyses, including propensity scoring.

**Conclusion:** A kidney profile of a low eGFR and slow slope in the prelude period is associated with favorable early dialysis outcomes in veteran patients. Trials to examine a more conservative approach to dialysis are warranted.

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More than 120,000 persons transition to end-stage renal disease (ESRD) each year in the United States, mostly with dialysis.<sup>1,2</sup> Mortality rates for dialysis patients are especially high in the first months after transition and a study investigating nursing home patients suggested that functionality in this early posttransition period was also substantially reduced.<sup>2,3</sup> Thus, discussions have emerged pertaining to the benefit of early initiation of dialysis therapy in older persons, especially those with slower progressing kidney disease. Ironically, estimated glomerular filtration rate (eGFR) at the time of transition has progressively become

higher, indicating a trend toward earlier transition, or a more aggressive dialysis initiation. As of 2014, the US average eGFR at initiation was 10.2 mL/min/1.73 m<sup>2</sup>.<sup>1</sup> Despite these trends, the optimal timing of ESRD transition still remains controversial. Although some studies and clinical guidelines have previously suggested that early initiation may be beneficial,<sup>4-9</sup> a clinical trial and other observational studies have suggested otherwise.<sup>10-15</sup> However, many of the latter studies were limited in data on the rate of disease progression and laboratory measures from the period before transition, which are important drivers of eGFR levels at transition.<sup>16</sup> As eGFR and its



From Harold Simmons Center for Kidney Disease Research and Epidemiology, Division of Nephrology and Hypertension, University of California Irvine Medical Center, Orange (MS, ES, YO, CMR, D.L.G., KK-Z.); Nephrology Section, Tibor Rubin Veterans Affairs Medical Center, Long Beach, CA (ES, CMR, KK-Z.); Department of Medicine, University of

*Affiliations continued at the end of this article.*

slopes have become more readily available in clinical practice,<sup>17</sup> it may be of importance to examine the use of both metrics in risk prediction.

In addition to the controversy of ESRD timing in the US population, it is uncertain whether this relationship is externally valid for the US veteran population. The veteran population is composed of predominately older males with likely different ailments compared with that of the greater US population. Preliminary data from the United States Renal Data System (USRDS) “Transition-of-Care-in-CKD” Special Study Center have shown that 11% of incident US ESRD patients each year are veterans, and that high mortality rates in the first months after transition also exist in this veteran population.<sup>1,2</sup> Moreover, it was suggested that veterans initiating ESRD with a Veterans Affairs (VA) health care provider may have better survival, and a lower probability of initiating at a higher eGFR, compared with those initiating with a non-VA provider.<sup>1,2,18</sup> Finally, a study investigating solely eGFR slope in the veteran population reported that a rapid decline was associated with higher long-term post-ESRD mortality.<sup>19</sup>

However, no study has examined whether veterans who transition to ESRD with both a lower eGFR and a less progressive disease have better or worse early post-ESRD outcomes. We sought to examine these outcomes in a contemporary cohort of US veteran patients transitioning to ESRD and hypothesized that the combination of a slower disease progression and lower kidney function level on transition is associated with better immediate post-ESRD outcomes.

## PATIENTS AND METHODS

### Study Population and Data Source

We retrospectively analyzed data from the Transition-of-Care-in-CKD study, which investigated veterans transitioning to ESRD between October 1, 2007, and March 30, 2014.<sup>1</sup> The source population comprised 85,505 veterans identified from the USRDS. We excluded 1958 patients for missing follow-up information, 32,280 patients with missing data on VA measured serum creatinine, and 29,724 with no available creatinine measurement within 31 days before transition. To calculate eGFR slope using a mixed-effects regression model during

the 12 months before ESRD, we further required that these patients have at least 2 eGFR measurements (including the measure within 31 days before transition) and over 30 days apart. After excluding patients without these criteria, and slope outliers at 0.5 and 99.5 percentiles, our final cohort comprised 19,985 veterans with both 31-day measured pre-ESRD (prelude) eGFR and 12-month prelude eGFR slope (Supplemental Figure 1, available online at <http://www.mayoclinicproceedings.org>).

This study was approved by the institutional review boards of the Memphis and Long Beach Veterans Affairs Medical Centers. Because of the large sample size, patient anonymity, and noninvasive nature of the research, the written consent requirement was exempt.

### Demographic, Clinical, and Laboratory Measurements

Data from 3 national databases—USRDS, VA, and Centers for Medicare & Medicaid Services (CMS)—were combined to determine baseline characteristics. Marital status was obtained from VA records. Receipt of pre-ESRD care was obtained from USRDS CMS 2728 Medical Evidence Form. Preexisting comorbidity information was extracted from VA and CMS data sets using *International Classification of Diseases, Ninth Revision* Diagnostic and Current Procedural Terminology codes. Charlson comorbidity index was calculated without renal disease. Presence of a comorbidity was assigned using a 1 inpatient or 2 outpatient visits algorithm.

Prelude laboratory measurements were sourced from VA databases only. Data on serum creatinine and other laboratory measurements were obtained from the VA Corporate Data Warehouse LabChem and Decision Support System National Data Extracts Laboratory Results files, respectively. Data on body mass index (BMI; calculated as the weight in kilograms divided by the height in meters squared) and blood pressure were obtained from the VA Corporate Data Warehouse Vital Signs file. The closest measurement to transition within the 31-day prelude period was used in analyses as baseline value.

### Exposure Measurement

The primary exposure was the combination of 31-day prelude eGFR and rate of kidney

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