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Distribution of survival times among a real-world cohort of older adults with chronic kidney disease: the median may not be the message

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The population based approach to chronic kidney disease (CKD) recommended in clinical practice guidelines relies on level of estimated glomerular filtration rate (eGFR) and proteinuria to define the disease and stratify patients according to their risk for adverse outcomes such as mortality and end-stage renal disease.¹ Commonalities in relative risk for these outcomes within strata defined by level of eGFR and proteinuria then serve as the foundation for stratum-specific treatment recommendations.^{1, 2}

From the patient and provider perspective, life expectancy may serve as a more intuitive measure of prognosis than relative and absolute risk.^{3, 4} In general, patients with lower eGFR levels and higher proteinuria levels have a shorter average life expectancy.^{5, 6} However, measures of average life expectancy do not capture heterogeneity in life expectancy among patients with similar levels of eGFR and proteinuria. We describe the distribution of survival time for a large real-world cohort of older adults stratified by level of eGFR and proteinuria.

Methods

Our analytic cohort consisted of 357,632 Veterans aged 70 years and older with at least one outpatient serum creatinine measure within the Department of Veterans Affairs (VA) healthcare system in Fiscal Year 2001, who were not receiving long-term dialysis, had not received a kidney transplant, and who had at least one urine protein dipstick measurement.⁷ We used the Chronic Kidney Disease Epidemiology Collaboration equation to estimate GFR. Patients were classified by eGFR and proteinuria levels based on the classification system recommended in current guidelines with the exception that we used an eGFR cut

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point of 75 ml/min/1.73 m² to define the highest eGFR strata because less than 1% (n= 126) of cohort members 85 years had an eGFR 89 ml/min/1.73 m².¹ CKD was defined as an eGFR < 60 ml/min/1.7 m² or 1+ proteinuria. We calculated age-stratified median survival and interquartile range (25th – 75th percentiles) separately for those with and without CKD. Additionally we calculated median survival stratified by age group, eGFR category and level of proteinuria. Vital status was current through July 23, 2013.

Results

When stratified by age group, level of eGFR and proteinuria, there were large differences in survival time across disease-based risk strata both within and across age groups (Table). For example, among those 75 – 79 years old, median survival time ranged from 3.4 years among those with the lowest levels of eGFR and highest levels of proteinuria to 8.3 years among those with an eGFR 75 ml/min/1.73 m² and negative to trace proteinuria. Across age groups, median survival ranged from a low of 1.9 years for those aged 85 years or older with the lowest levels of eGFR and highest levels of proteinuria to a high of 11.0 years for those aged 70 – 74 years with the highest levels of eGFR and lowest levels of proteinuria. Overall, median survival was more limited for those with CKD than for other cohort members (6.5 vs. 9.1 years).

For patients in the same age group with similar levels of eGFR and proteinuria, the interquartile range in survival time rivaled differences in median survival across strata. For example, among those aged 80 to 84 years with an eGFR 30 – 44 ml/min/1.73 m² and negative/trace proteinuria, median survival time was 5.3 years with an interquartile range of more than 6 years (2.6 to 8.7 years). Interquartile differences in survival were greatest for younger patients with higher levels of eGFR and lower levels of proteinuria. Overall, one third of cohort members with CKD had a survival time at or above the median value of 9.1 years for those without CKD. A similar proportion of those without CKD had a survival time below the median value of 6.5 years for those with CKD. With increasing age, a progressively larger percentage of those without CKD had a survival time lower than the median value for cohort members with CKD.

Discussion

Substantial overlap in survival times among this real-world cohort of older adults with and without CKD and heterogeneity in survival times among patients belonging to the same disease-based risk strata highlight potential limitations of population-based summary risk measures for defining CKD, framing discussions about prognosis and informing treatment decisions among older adults in the clinical setting. Acknowledging and quantifying heterogeneity in life expectancy within -- as well as between -- disease-based risk strata in real-world populations could help to convey information on the degree of uncertainty surrounding estimates of prognosis and treatment recommendations.

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Median survival in years (interquartile range) for 357,632 Veterans 70 years and older stratified by age, level of estimated glomerular filtration rate (eGFR) and level of proteinuria*

Table

		70 – 74 years (n=135,360)			75 – 79 years (n=137,401)		
		Dipstick Proteinuria Measurement			Dipstick Proteinuria Measurement		
eGFR, ** ml/min/1.73 m ²		Negative or trace (n=117,912)	1 + (n=9,178)	2 + (n=8,270)	Negative or trace (n=118,593)	1 + (n=10,188)	2 + (n=8,620)
75 (n=38,095)		11.0 (5.5 – -)	7.3 (3.1 – -)	6.4 (2.8 – 10.9)	8.3 (4.1 – -)	5.5 (2.4 – 9.8)	4.6 (1.9 – 8.5)
60 – 74 (n=45,792)		- (6.3 – -)	8.1 (4.0 – -)	6.5 (2.9 – 11.1)	9.0 (4.8 – -)	6.2 (3.0 – 10.6)	5.4 (2.5 – 9.3)
45 – 59 (n=35,733)		10.3 (5.4 – -)	7.2 (3.6 – -)	6.2 (3.0 – 10.0)	8.3 (4.3 – -)	5.9 (3.0 – 9.8)	4.9 (2.4 – 8.6)
30 – 44 (n=12,145)		7.5 (3.6 – -)	5.8 (2.7 – 10.0)	5.0 (2.3 – 8.6)	6.6 (3.2 – 10.8)	5.1 (2.4 – 8.6)	4.3 (2.0 – 7.2)
15 – 29 (n=3,595)		4.7 (2.0 – 8.9)	4.2 (2.1 – 7.3)	3.6 (1.7 – 6.2)	4.3 (2.0 – 7.8)	3.6 (1.8 – 6.6)	3.4 (1.7 – 5.7)
		80 – 84 years (n=67,405)			85 years (n=17,466)		
		Dipstick Proteinuria Measurement			Dipstick Proteinuria Measurement		
eGFR, ml/min/1.73 m ²		Negative or trace (n=57,512)	1 + (n=5,524)	2 + (n=4,369)	Negative or trace (n=14,424)	1 + (n=1,765)	2 + (n=1,277)
75 (n=9,920)		6.1 (3.0 – 10.0)	4.0 (1.6 – 7.6)	3.3 (1.3 – 6.6)	4.4 (2.0 – 7.5)	2.3 (0.7 – 5.5)	3.0 (0.9 – 5.5)
60 – 74 (n=19,512)		6.8 (3.5 – 10.6)	4.7 (2.3 – 8.2)	4.0 (1.8 – 7.1)	4.6 (2.4 – 7.7)	3.2 (1.5 – 6.0)	3.2 (1.3 – 5.6)
45 – 59 (21,769)		6.5 (3.4 – 10.2)	4.8 (2.3 – 7.9)	4.0 (1.9 – 6.9)	4.4 (2.2 – 7.4)	3.3 (1.6 – 6.0)	2.4 (1.2 – 4.8)
30 – 44 (12,502)		5.3 (2.6 – 8.7)	4.0 (1.9 – 7.2)	3.4 (1.5 – 6.0)	3.8 (1.9 – 6.5)	2.8 (1.3 – 5.0)	2.6 (1.2 – 4.5)
15 – 29 (3,702)		3.4 (1.6 – 6.4)	3.2 (1.6 – 5.5)	2.6 (1.3 – 4.6)	2.7 (1.2 – 4.7)	1.9 (0.8 – 4.1)	1.9 (0.7 – 3.5)

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* Analysis included Veterans aged 70 years and older with at least one serum creatinine measure within the VA system in Fiscal Year (FY) 2001. The cohort was predominantly male (98%).

eGFR, estimated glomerular filtration rate based on the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation

For some categories, fewer than 75% of Veterans had died at the time of mortality follow-up. For these groups, the 75th percentile of survival is represented by dashes.

Because albumin-to-creatinine ratio was not available for most patients, dipstick proteinuria was used.