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Early mortality in patients starting dialysis appears to go unregistered

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Clinical experience suggests a heightened risk associated with the transition to maintenance dialysis but few national studies have systematically examined early mortality trajectories. Here we calculated weekly mortality rates in the first year of treatment for 498,566 adults initiating maintenance dialysis in the United States (2005–2009). Mortality rates were initially unexpectedly low, peaked at 37.0 per 100 person-years in week 6, and declined steadily to 14.8 by week 51. In both early (weeks 7–12) and later (weeks 13–51) time frames, multivariate mortality associations included older age, female, Caucasian, non-Hispanic ethnicity, end-stage renal disease (ESRD) from hypertension and acute tubular necrosis, ischemic heart disease, estimated glomerular filtration rate of 15 ml/min per 1.73 m^2 or more, shorter duration of nephrologist care, and hemodialysis, especially with a catheter. For early mortality risk, adjusted hazard ratios of 2 or more were seen with age over 65 (5.80 vs. under 40 years), hemodialysis with a catheter (2.73 vs. fistula), and age 40–64 (2.33). For later mortality risk, adjusted hazard ratios of 2 or more were seen with age over 65 (4.32 vs. under 40 years), hemodialysis with a catheter (2.10 vs. fistula), and age 40–64 (2.00). Thus, low initial mortality rates question the accuracy of data collected and are consistent with deaths occurring in the early weeks after starting dialysis not being registered with the United States Renal Data System.

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The initial weeks of maintenance dialysis treatment are a time of clinical uncertainty. Although end-stage renal disease (ESRD) is associated with high mortality in and of itself, initiation of dialysis often adds features that could also put patients at risk. For example, initiation of in-center hemodialysis could heighten the risk of blood-borne infection, dialysis-related hypotension, hypokalemia, and loss of intrinsic renal function. Similarly, initiation of dialysis remains the most common time for introducing typical treatments for ESRD that may be dangerous if used inappropriately, with overaggressive use of erythropoiesis-stimulating agents being a notable example.[1,2] Although it is not known with certainty whether mortality risks associated with noninitiation of dialysis outweigh those associated with the dialysis procedure itself, at least one large study of patients initiating hemodialysis in a large chain of dialysis units in the United States suggested that this may be the case, as weekly mortality rates were maximal at the time of dialysis initiation.[3]

Dialysis initiation is a period of great flux, and clinical experience suggests that successful navigation through this period has long-term ramifications; however, the evolution of mortality risk early in the course of dialysis treatment remains poorly studied. This lack of information is surprising, as more information could help with clinical decision making, especially for patients making judgments about when, whether, and how to initiate renal replacement therapy (RRT). Accurate knowledge of survival expectations early in the course of dialysis treatment could be especially enlightening. Regarding mortality patterns at that time, large national dialysis patient registries have inherent attractions and potential caveats. For example, registries are typically representative, and large sample size allows for precise risk estimates and examination of findings within subgroups. On the other hand, registries may encompass potential biases, especially in the period surrounding the transition to RRT. In particular, there is concern that an early ascertainment bias may be present, with ESRD patients who die soon after dialysis initiation not being registered in national registries. In this scenario, the desire to understand outcomes ever earlier in RRT would have to be tempered against the ever-increasing likelihood of invalid findings. In addition, the fact that Medicare coverage in the

United States requires 90 days to have elapsed from initiation of hemodialysis may have created the impression that survival rates in the first 90 days cannot be studied when, in actuality, registration in the United States Renal Data System (USRDS) has been required for all new RRT patients for decades. As few large national studies have systematically examined early mortality trajectories in dialysis patients, we set out to address this issue among adult patients in the USRDS data.

RESULTS

Of the study population, 49.7% of subjects were aged 65 years or older, 28.8% were black, 13.7% were Hispanic, and diabetes was the cause of ESRD in 45.4% (Table 1). Peritoneal dialysis was the initial mode of RRT for 6.0% of patients, and in 77.7% hemodialysis was initiated with a catheter. Table 1 also compares patients according to duration of predialysis nephrologist care and mode of dialysis. With adjusted logistic regression, nephrologist care for <6 months was associated

Table 1 | Study population characteristics at initiation of dialysis ($n = 498{,}566$), compared by duration of predialysis nephrologist care and mode of dialysis therapy

		Predialysis nephrologist care, months			Mode of dialysis		
Characteristics	All	⩾6	0–5	AOR, 0–5 (vs. ⩾6)	HD	PD	AOR, PD (vs. HD)
Percent of population		45.6	54.4		94.0	6.0	
Age, years							
<40	7.9	7.2	8.9	1 (Referent)	7.6	13.0	1 (Referent)
40–64	42.4	43.1	43.0	0.88 (0.86–0.91)	41.8	51.6	0.70 (0.67–0.73)
⩾65	49.7	49.7	48.1	0.78 (0.76–0.80)	50.6	35.4	0.38 (0.36–0.39)
Sex							
Men	56.1	55.5	56.3	1 (Referent)	56.2	54.6	1 (Referent)
Women	43.9	44.5	43.7	0.94 (0.93–0.95)	43.8	45.4	1.10 (1.07–1.13)
Race							
White	65.7	65.8	64.0	1 (Referent)	65.3	72.1	1 (Referent)
Black	28.8	28.4	30.5	1.20 (1.19–1.22)	29.3	21.2	0.54 (0.53–0.56)
Other	5.5	5.9	5.5	1.20 (1.17–1.24)	5.4	6.7	0.96 (0.91–1.01)
Hispanic ethnicity							
No	86.3	85.5	85.1	1 (Referent)	86.2	88.4	1 (Referent)
Yes	13.7	14.5	14.9	1.35 (1.32–1.37)	13.8	11.6	0.67 (0.65–0.70)
Cause of ESRD							
Diabetes	45.4	49.8	41.8	1 (Referent)	45.6	42.7	1 (Referent)
Hypertension	28.4	26.9	29.6	1.34 (1.32–1.36)	28.6	24.6	1.10 (1.06–1.13)
Glomerulonephritis	6.5	7.6	5.6	0.93 (0.90–0.95)	6.1	13.1	1.80 (1.73–1.87)
Cystic disease	2.0	3.0	1.2	0.69 (0.66–0.72)	1.8	6.1	2.38 (2.25–2.52)
ATN	3.0	1.0	4.6	4.57 (4.36–4.79)	3.2	0.3	0.13 (0.11–0.17)
Other	14.7	11.7	17.2	1.67 (1.64–1.70)	14.8	13.3	0.97 (0.93–1.01)
Ischemic heart disease							
No	78.3	77.2	80.8	1 (Referent)	78	84.4	1 (Referent)
Yes	21.7	22.8	19.2	0.75 (0.74–0.76)	22	15.6	0.7 (0.68–0.72)
GFR, ml/min per 1.73 m^2							
<15	82.6	82.9	81.4	1 (Referent)	82.4	84.9	1 (Referent)
⩾15	17.4	17.1	18.6	1.17 (1.15–1.19)	17.6	15.1	1.03 (1.00–1.07)
Nephrologist care, months							
>12	23.2	50.9	0	—	22.1	40.4	1 (Referent)
6–12	22.4	49.1	0	—	22.0	29.5	0.77 (0.75–0.79)
0–5	54.4	0	100	—	55.9	30.1	0.32 (0.31–0.33)
Dialysis and access							
HD, fistula	12.7	15.9	5.8	1 (Referent)	13.6	0	—
HD, graft	3.5	4.5	2.3	1.64 (1.58–1.7)	3.8	0	—
HD, catheter	77.7	71.7	88.6	4.58 (4.49–4.67)	82.7	0	—
PD	6	7.9	3.4	1.29 (1.25–1.33)	0	100	—

Abbreviations: AOR, adjusted odds ratio; ATN, acute tubular necrosis; ESRD, end-stage renal disease; GFR, glomerular filtration rate; HD, hemodialysis; PD, peritoneal dialysis.
Note: Data are presented as column percent or odds ratio (95% confidence interval). Logistic regression was used to calculate odds ratios, with adjustment for all the variables shown in the first column. $P<0.001$ for all comparisons, except AOR of GFR >15 ml/min per 1.73 m^2 and association with mode of dialysis ($P=0.08$).
Missing data: dialysis and access, 1.1%; GFR, 1.9%.