



CHAPTER five

MORTALITY

The silence of a falling star,
Lights up a purple sky.
And as I wonder where you are,
I'm so lonesome I could cry.
I'm so lonesome I could cry.

HANK WILLIAMS, "I'M SO LONESOME I COULD CRY"

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Assessing mortality in the ESRD population is a unique challenge, in that two sources of death records are available to the USRDS Coordinating Center (CC).

Universal reporting to CMS of ESRD patient deaths is required as a condition of coverage for dialysis units and transplant centers. Since all ESRD patients have Social Security numbers, the CC can also link these patients to the National Death Index files, updated every quarter and in the public domain. The USRDS was formerly able to report deaths only from day 90 of treatment, as Medicare did not cover services for those younger than 65; now, however, the comprehensive tracking of all ESRD patient deaths allows the USRDS to identify all deaths occurring after the first outpatient dialysis session.

Between 1993 and 2003 there was little improvement in first-year death rates in the ESRD population. Between 2004 and 2008, however, these rates fell more than 10 percent. And over similar intervals, second- to fifth-year death rates decreased 12–14 percent. Month-by-month mortality rates in the first year of hemodialysis have shown similar improvements, overall and for mortality due to cardiovascular disease and infection. Mortality due to other causes,

in contrast, has increased since 1998, a finding which requires further investigation. Still striking are the high rates of all-cause mortality in the early months of therapy.

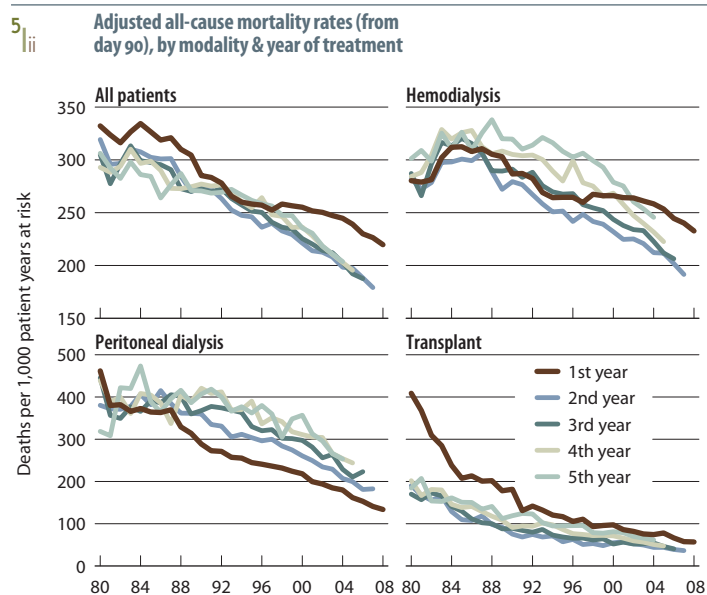
Rates of mortality in the prevalent population have also declined — nearly 25 percent over the last two decades, and 19 percent since 1999.

Despite these improvements, however, only 50 percent of dialysis patients, and 82 percent of those who receive a preemptive transplant, are still alive three years after the start of ESRD therapy — numbers that help illustrate the extreme vulnerability of these patients when compared to the general population. Among dialysis patients age 65 and older, for example, mortality is twice as high as for patients in the general population who have diabetes, cancer, congestive heart failure, CVA/TIA, or AMI.

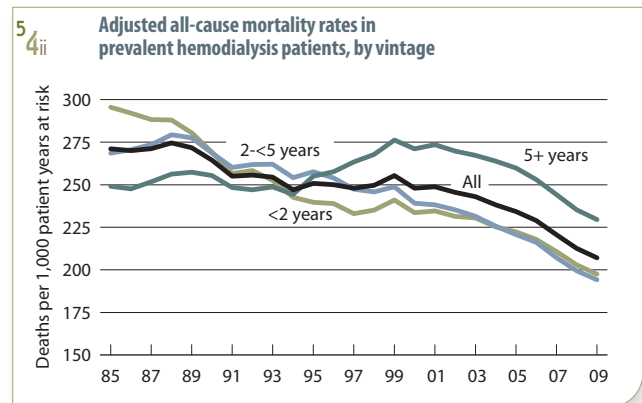
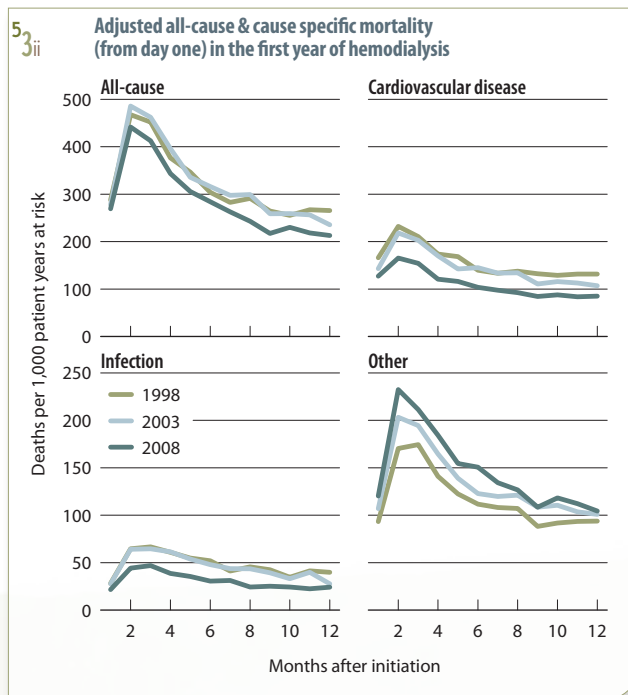
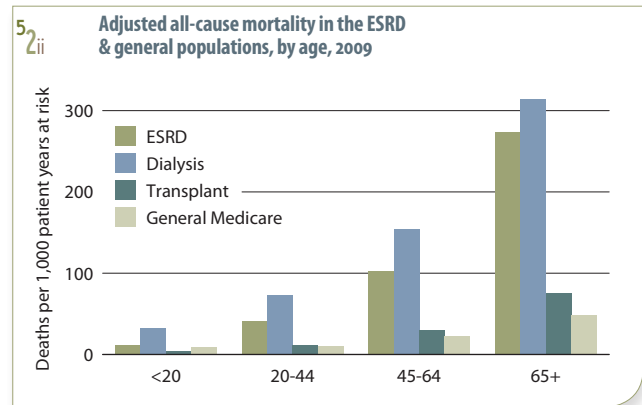
Patients with kidney disease are clearly at a high risk of death and, as shown in the hospitalization data, have very high event rates as well. Thrice-weekly treatment may be inadequate for addressing the critical problems

of persistent fluid overload, hypertension, left ventricular hypertrophy, and recurrent vascular access infections and complications. Recent publication of the Frequent Hemodialysis Trial (NEJM Nov 2010), comparing treatment of three days per week to that of six days, demonstrated significant reductions in left ventricular hypertrophy and hyperphosphatemia among patients receiving more frequent therapy. Mortality comparisons still need to be considered, as do questions of how more frequent sessions might be implemented across the country. In the meantime, there should be a focus on improving care and outcomes through medication interventions and reductions in the use of dialysis catheters, with their high rates of associated complications.

>> **Figure 5.1;** see page 386 for analytical methods. *Incident ESRD patients. Adj: age/gender/race/primary diagnosis; ref: incident ESRD patients, 2005.*



Adjusted rates of all-cause mortality are 6.5–7.4 times greater for dialysis patients than for individuals in the general population. For renal transplant patients, rates approach those of the general population, yet remain 1.1–1.6 times higher. Rates rise by age, reaching 274 per 1,000 patient years at risk for ESRD patients age 65 and older, and 313 for dialysis patients of the same age. >> **Figure 5.2**; see page 386 for analytical methods. *Prevalent ESRD & general Medicare (non-ESRD) patients. Adj: gender/race; ref: Medicare patients, 2009.*



Through the 1980s, patients newer to dialysis had higher mortality rates than those on treatment for five years or more. This trend began to change in the early 1990s, and in 2009 the rate of 230 per 1,000 patient years in patients on therapy for five or more years was 16 percent higher than the rate of 198 in patients treated with hemodialysis for less than two years. >> **Figure 5.4**; see page 386 for analytical methods. *Period prevalent hemodialysis patients. Adj: age/gender/race/primary diagnosis; ref: dialysis patients, 2005.*

In the first year of hemodialysis, all-cause mortality and mortality due to cardiovascular disease or to other causes peak in month two following initiation, then fall. For incident hemodialysis patients in 2008, for example, all-cause mortality reached 442 deaths per 1,000 patient year at risk in month two, then fell to 213 in month 12. For the same population, cardiovascular mortality peaked at 166, and decreased to 85. Mortality due to infection peaks in months 2–3. >> **Figure 5.3**; see page 386 for analytical methods. *Incident hemodialysis patients. Adj: age/gender/race/primary diagnosis; ref: incident hemodialysis patients, 2005.*

5 a ii		Adjusted survival probabilities, from day one, in the incident ESRD population					
		6 months	12 months	24 months	36 months	48 months	60 months
Dialysis							
1996		0.84	0.75	0.59	0.47	0.37	0.29
1998		0.84	0.74	0.59	0.47	0.38	0.30
2000		0.84	0.74	0.60	0.48	0.39	0.31
2002		0.84	0.74	0.60	0.49	0.40	0.33
2004		0.84	0.75	0.61	0.50	0.42	0.34
Hemodialysis							
1996		0.84	0.74	0.59	0.47	0.37	0.29
1998		0.84	0.74	0.59	0.47	0.38	0.30
2000		0.84	0.74	0.59	0.48	0.39	0.31
2002		0.83	0.74	0.60	0.49	0.40	0.32
2004		0.84	0.74	0.61	0.50	0.41	0.34
Peritoneal dialysis							
1996		0.89	0.79	0.61	0.47	0.37	0.29
1998		0.89	0.80	0.62	0.49	0.38	0.30
2000		0.90	0.81	0.64	0.51	0.40	0.32
2002		0.92	0.83	0.68	0.55	0.44	0.36
2004		0.93	0.85	0.71	0.59	0.48	0.40
Transplant							
1996		0.92	0.89	0.83	0.77	0.71	0.65
1998		0.93	0.90	0.84	0.79	0.73	0.68
2000		0.93	0.89	0.84	0.79	0.73	0.68
2002		0.94	0.91	0.86	0.81	0.76	0.71
2004		0.95	0.92	0.87	0.82	0.78	0.73
2004 incident patients							
Dialysis		0.84	0.75	0.61	0.50	0.42	0.34
Hemodialysis		0.84	0.74	0.61	0.50	0.41	0.34
Peritoneal dialysis		0.93	0.85	0.71	0.59	0.48	0.40
Transplant		0.95	0.92	0.87	0.82	0.78	0.73
0-19		0.94	0.91	0.83	0.77	0.74	0.70
20-44		0.95	0.90	0.82	0.75	0.68	0.63
45-64		0.90	0.83	0.71	0.61	0.52	0.43
65-74		0.82	0.72	0.57	0.44	0.34	0.26
75+		0.72	0.59	0.41	0.28	0.19	0.13
Male		0.84	0.75	0.61	0.51	0.42	0.34
Female		0.84	0.75	0.61	0.50	0.42	0.35
White		0.83	0.74	0.59	0.48	0.39	0.32
African American		0.86	0.77	0.64	0.54	0.45	0.38
Other		0.88	0.81	0.69	0.60	0.51	0.43
Diabetes		0.86	0.76	0.61	0.49	0.39	0.31
Hypertension		0.85	0.76	0.63	0.53	0.45	0.38
Glomerulonephritis		0.89	0.83	0.72	0.61	0.52	0.45
Other		0.77	0.67	0.54	0.45	0.38	0.32

While six- and twelve-month survival probabilities have remained stable since 1996 in the hemodialysis population, they have improved for both peritoneal dialysis and transplant patients. Five-year survival, in contrast, has improved across modalities—from 0.29 to 0.34 for hemodialysis, from 0.29 to 0.4 for peritoneal dialysis, and from 0.65 to 0.73 for transplant.

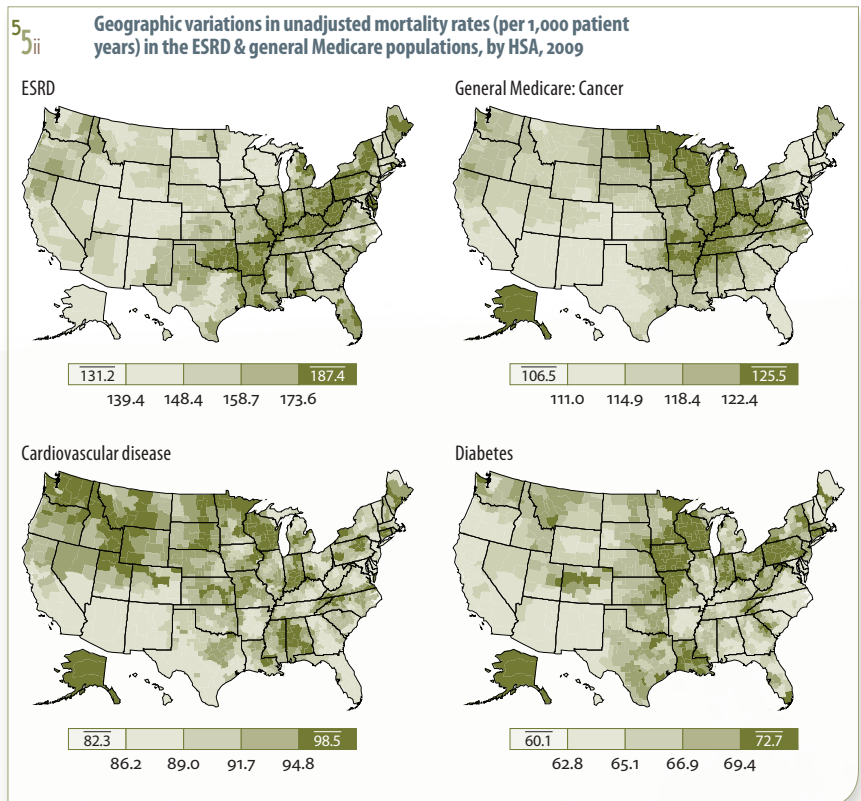
In the 2004 incident cohort, survival over the first five years of therapy is consistently highest in the transplant population and among younger patients, African Americans (compared to whites), and patients with a primary diagnosis of glomerulonephritis (compared to patients with diabetes or hypertension). >> Table 5.a; see page 386 for analytical methods. *Incident ESRD patients. Adj: age/gender/race/primary diagnosis; ref: incident hemodialysis patients, 2005.*

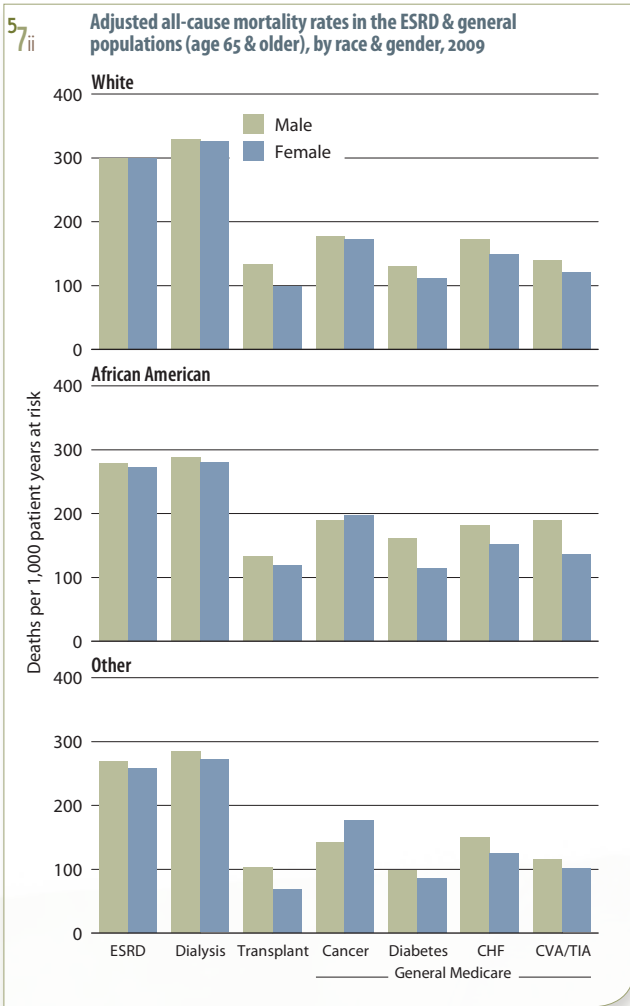
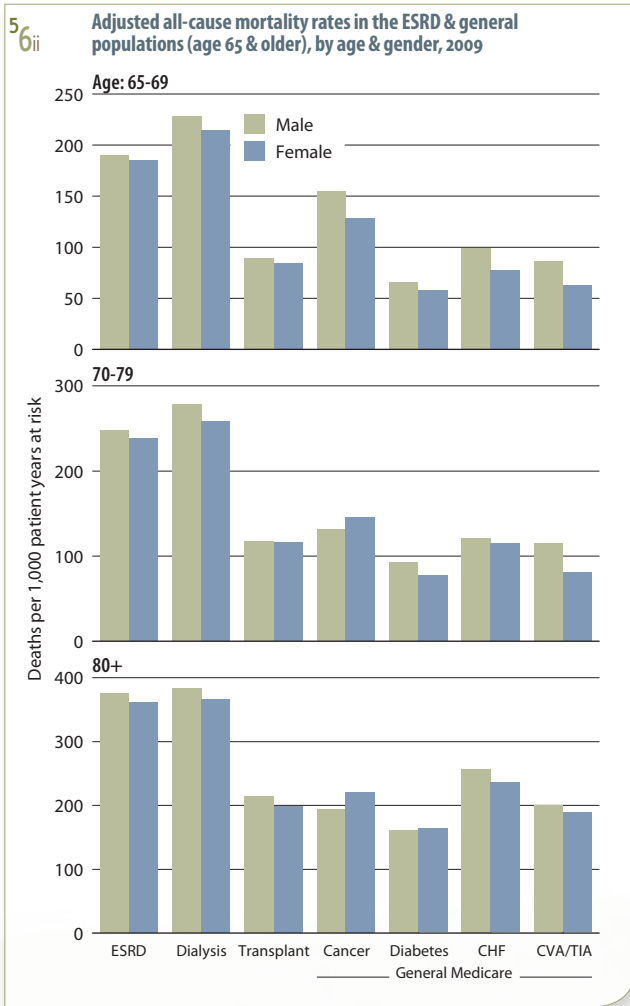
Since 1995, unadjusted mortality among prevalent ESRD patients has fallen 20.7 percent, to 254 deaths per 1,000 patient years. Mortality adjusted for age, gender, race, and comorbidity (defined in the previous year), however, has fallen nearly 26 percent, to 281. In the dialysis population, the unadjusted rate has fallen 13 percent, to 292, while the adjusted rate is now 21.3 percent lower than in 1996, reaching 304 in 2009. >> **Table 5.b**; see page 386 for analytical methods. *January 1 point prevalent ESRD & general Medicare patients age 65 & older. Adj: age/gender/race/comorbidity; ref: ESRD patients, 2005.*

5.0ii Unadjusted & adjusted mortality rates in the ESRD & general Medicare populations, age 65 & older (per 1,000 patient years at risk)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Unadjusted															
ESRD	321	322	318	322	325	318	315	310	303	297	293	282	272	262	254
Dialysis	336	339	337	342	347	340	340	336	330	327	325	316	307	299	292
Transplant	99	94	87	99	93	98	94	90	92	88	86	82	82	75	78
General Medicare															
Cancer	151	150	146	142	139	138	132	128	125	121	122	119	117	115	113
Diabetes	92	93	93	94	94	90	87	85	82	77	79	76	74	74	71
CHF	205	205	208	208	206	208	202	197	196	189	192	191	190	196	183
CVA/TIA	155	156	156	158	154	153	151	145	143	134	137	135	133	133	125
AMI	148	149	149	155	155	157	156	152	153	149	150	148	145	155	146
Adjusted															
ESRD	377	371	361	362	363	356	354	344	330	323	291	301	290	281	281
Dialysis	386	381	373	373	377	370	368	359	346	337	311	321	312	304	304
Transplant	186	188	198	204	174	208	184	174	175	177	139	151	138	127	151
General Medicare															
Cancer	246	240	228	228	225	215	204	204	190	184	183	180	174	166	169
Diabetes	164	158	155	158	151	143	140	134	131	119	120	118	111	112	107
CHF	198	193	193	190	184	180	174	168	165	154	155	154	153	152	144
CVA/TIA	160	162	157	158	155	151	153	144	141	132	133	129	132	127	120
AMI	157	154	149	156	160	148	149	141	140	131	130	135	134	134	127

In the ESRD population, the highest unadjusted mortality rates show a distinct geographic pattern, spanning an area from Oklahoma and northward into areas of New England, and average 187 deaths per 1,000 patient years in the upper quintile. Deaths in general Medicare patients with cancer are highest in areas of the upper Midwest and the Ohio Valley, averaging 126 in the upper quintile, while rates for patients with cardiovascular disease are highest in the upper tier of the country and in Alaska, averaging 98.5 in the upper quintile. Mortality rates in patients with diabetes are highest in the upper Midwest and in portions of New England, Louisiana, and Alaska, averaging 72.7 in the upper quintile. >> **Figure 5.5**; see page 386 for analytical methods. *Prevalent ESRD & general Medicare (non-ESRD) patients, 2009; unadjusted.*





Adjusted rates of mortality in the prevalent ESRD population age 65 and older rise, not surprisingly, by age, are commonly greater in men than in women, and are 1.8–2.6 times greater for dialysis patients than for those with a transplant. In the transplant population, rates among patients age 65–79 are lower than rates of mortality among patients with cancer in the general Medicare population.

By race, the contrast in mortality rates between dialysis and transplant patients is even more pronounced. Rates among white and African American women on dialysis, for example, are 3.3 and 2.4 times greater than those seen in their counterparts with a transplant. For African American transplant patients of both genders, mortality is most often lower than that among patients with cancer, diabetes, congestive heart failure, CVA/TIA, or acute myocardial infarction in the general population.

>> Figures 5.6–7; see page 386 for analytical methods. *January 1 point prevalent ESRD & general Medicare patients age 65 & older. Adj: age/gender/race/comorbidity; ref: 2009 ESRD patients.*

Adjusted all-cause first-year mortality from day 90 among incident patients, 2008 220
DEATHS PER 1,000 PATIENT YEARS AT RISK » HEMODIALYSIS 233 » PERITONEAL DIALYSIS 134 » TRANSPLANT 57 (FIG 5.I)

Adjusted all-cause fifth-year mortality from day 90 among incident patients, 2004 204
DEATHS PER 1,000 PATIENT YEARS AT RISK » HEMODIALYSIS 246 » PERITONEAL DIALYSIS 253 » TRANSPLANT 62 (FIG 5.I)

Adjusted all-cause mortality among prevalent patients, 2009
DEATHS PER 1,000 PATIENT YEARS AT RISK
AGE 45-64 » ESRD 103 » DIALYSIS 154 » TRANSPLANT 30 » GENERAL MEDICARE 22 (FIG 5.2)
AGE 65+ » ESRD 274 » DIALYSIS 313 » TRANSPLANT 75 » GENERAL MEDICARE 48 (FIG 5.2)

Adjusted mortality from day one in the first year of hemodialysis among incident patients, 2008
DEATHS PER 1,000 PATIENT YEARS AT RISK
MONTH TWO AFTER INITIATION » ALL-CAUSE 442 » CARDIOVASCULAR DISEASE 166 » INFECTION 44 (FIG 5.3)
MONTH 12 AFTER INITIATION » ALL-CAUSE 213 » CARDIOVASCULAR DISEASE 85 » INFECTION 24 (FIG 5.3)

Adjusted all-cause mortality in prevalent hemodialysis patients, by vintage, 2009
DEATHS PER 1,000 PATIENT YEARS AT RISK » <2 YEARS 198 » 2-5 YEARS 194 » 5+ YEARS 230 (FIG 5.4)

Adjusted five-year survival among incident ESRD patients, 2004
BY MODALITY » DIALYSIS 0.34 » HEMODIALYSIS 0.34 » PERITONEAL DIALYSIS 0.4 » TRANSPLANT 0.73 (TABLE 5.A)
BY AGE » 0-19 0.7 » 20-44 0.63 » 45-64 0.43 » 65-74 0.26 » 75+ 0.13 (TABLE 5.A)
BY GENDER » MALE 0.34 » FEMALE 0.35 (TABLE 5.A)
BY RACE » WHITE 0.32 » AFRICAN AMERICAN 0.38 » OTHER RACE 0.43 (TABLE 5.A)
BY PRIMARY DIAGNOSIS » DIABETES 0.31 » HYPERTENSION 0.38 » GLOMERULONEPHRITIS 0.45 » OTHER 0.32 (TABLE 5.A)

Mortality rates among prevalent patients age 65 and older, 2009
DEATHS PER 1,000 PATIENT YEARS AT RISK
UNADJUSTED » ESRD 254 » DIALYSIS 292 » TRANSPLANT 78 (TABLE 5.B)
ADJUSTED FOR AGE, GENDER, RACE, AND COMORBIDITY » ESRD 281 » DIALYSIS 304 » TRANSPLANT 151 (TABLE 5.B)