Chapter 1: Incidence, Prevalence, Patient Characteristics, and Treatment Modalities

Incidence

- The number of incident (newly reported) ESRD cases in 2014 was 120,688; the unadjusted (crude) incidence rate was 370 per million/year (Table 1.1). Since 2011, both the number of incident cases and the unadjusted incidence rate have begun rising again (Figure 1.1).
- The age-gender-race-ethnicity adjusted incidence rate of ESRD in the United States rose sharply in the 1990s, leveled off in the early 2000s, and has declined slightly since its peak in 2006 (Figure 1.1).
- In 2014, the adjusted ESRD incidence rate ratios for Blacks/African Americans, Native Americans, and Asians/Pacific Islanders, compared with Whites, were 3.1, 1.2, and 1.2, respectively; the rate ratio for Hispanics versus non-Hispanics was 1.3 (Figures 1.5 and 1.6).

Prevalence

- On December 31, 2014, there were 678,383 prevalent cases of ESRD; the unadjusted prevalence (crude proportion) was 2,067 per million in the U.S. population (Table 1.3).
- While the number of ESRD incident cases plateaued in 2010, the number of ESRD prevalent cases continues to rise by about 21,000 cases per year (Figure 1.11).
- Compared to Whites, ESRD prevalence in 2014 was about 3.7 times greater in Blacks, 1.4 times greater in Native Americans, and 1.5 times greater in Asians (Figure 1.14).

Treatment modalities

- In 2014, 87.9% of all incident cases began renal replacement therapy with hemodialysis, 9.3% started with peritoneal dialysis, and 2.6% received a pre-emptive kidney transplant (Figure 1.2).
- On December 31, 2014, 63.1% of all prevalent ESRD cases were receiving hemodialysis therapy, 6.9% were being treated with peritoneal dialysis, and 29.6% had a functioning kidney transplant (Figure 1.11). Among hemodialysis cases, 88.0% used in-center hemodialysis, and 1.8% used home hemodialysis (Figure 1.19).

Characteristics of incident ESRD cases

- Up to 38% of incident ESRD cases in 2014 received little or no pre-ESRD nephrology care (Table 1.7).
- Mean eGFR at initiation of dialysis in 2014 was 10.2 ml/min/1.73m^2. The percent of incident ESRD cases starting with eGFR at ≥10 ml/min/1.73 m^2 rose from 13% in 1996 to 43% in 2010, but had decreased to 39% in 2014 (Table 1.22).

Introduction

The focus of this chapter is the incidence and prevalence of end-stage renal disease (ESRD) in the U.S. population. It should be noted that the terms ESRD incidence and prevalence, as used throughout the ADR, refer to treated cases of ESRD, i.e., patients started *or* currently on renal replacement therapy (dialysis or transplantation); they do not refer exclusively to disease occurrence (biological constructs). Although ESRD is often equated with treatment (i.e., renal replacement therapy with dialysis or transplantation) and usually commences in Stage 5 CKD (GFR <15 ml/min), it should be noted

that some patients with eGFR <15 may not receive (or choose to forego) dialysis or transplantation. In addition, there are a number of "ESRD treated" patients on renal replacement therapy who are initiated on dialysis at an eGFR greater than 15. In short, the definition of ESRD incidence and prevalence used throughout the USRDS is a treatment-based definition, not a purely physiological or biological construct. Thus, although the terms "incident ESRD" and "prevalent ESRD" are used throughout this chapter, they should always be interpreted as "treated ESRD."

Incidence refers to the occurrence or detection of new (incident) cases of a disease during a given period. In this chapter, ESRD incidence is expressed as a count (number of incident cases in one year) and as a rate (number of incident cases in one year, divided by person-years at risk, which is approximated by the mid-year census for the population in that year). Incidence rates are expressed as per million population per year. They are used to describe the occurrence or burden of new cases of ESRD in the population, to identify risk factors for ESRD in etiologic studies, and to evaluate the impact of interventions for reducing ESRD risk in primary-prevention studies.

Prevalence refers to the presence of existing (prevalent) cases of a disease at a point in time (point prevalence) or during a specific period (period prevalence). In this chapter, ESRD (point) prevalence is expressed as a count (number of prevalent cases) and as a proportion (number of prevalent cases, divided by the size of the population from which those cases were identified). ESRD prevalences at the end of each year are expressed per million population. It should be noted that ESRD prevalence depends on both the incidence rate of ESRD and the duration of the disease from the start of renal replacement therapy to death.

Both incidence rates and prevalences in this chapter are presented without adjustment for other factors (i.e., crude measures) and with adjustment for age, gender, and race by using a method known as "standardization." This method involves stratification of the population by those three variables and calculation of a weighted average of stratum-specific rates or prevalences, where the weights are the numbers of persons in strata of a "standard population," which, since the 2014 ADR, has been the U.S. population in 2011. Each standardized (adjusted) incidence rate or prevalence for a specific group or year is interpreted as the expected (crude) rate or prevalence if that group or year had exhibited the age-gender-race distribution of the standard population. Since we are not adjusting for other major ESRD risk factors such as diabetes, hypertension, or cardiovascular disease, interpreting comparisons of incidence rates or prevalences between groups or years should be done with caution.

Primary cause of ESRD: A cautionary note

The "primary cause of renal failure," as assessed by individual physicians and reported on the CMS 2728 form, has been used for many years in nephrology to compare populations and assess temporal trends. In the ADR, it allows us to estimate the ESRD incidence rate and prevalence for different subtypes of chronic kidney disease, i.e., those with the primary cause listed as diabetes, hypertension, glomerulonephritis, or cystic kidney disease. It should be noted, however, that this approach is not the same as stratifying on comorbidity status. For example, in this chapter we are not estimating adjusted incidence rates of ESRD among diabetics and non-diabetics because we do not have data on laboratory-based diabetes status in the total U.S. population by strata of age, gender, and race. In Reference Table A.11, however, incidence rates of ESRD are estimated for self-reported diabetics in the U.S. population. Those estimates should be interpreted with caution as many persons with diabetes either do not report their condition or are not aware that they have diabetes.

Another issue is that the reliability of clinician-assigned "primary-cause" of ESRD has not been well established. Because causation for some diagnoses cannot be definitively established on the basis of clinical judgment or testing, and because many patients arrive at ESRD without benefit of prior nephrology care, establishing the validity of these etiologic subtypes of ESRD remains a challenge. In diabetics with CKD, for example, kidney biopsies are rarely performed. Moreover, though authorities such as KDIGO provide guidance for assigning a diagnosis of diabetic CKD (diabetes as the primary cause), it is

likely in reality that this judgment is quite variable among nephrologists completing the CMS 2728 form.

Methods

This chapter uses data from the Centers for Medicare & Medicaid Services (CMS). Findings were primarily drawn from special analyses based on the USRDS ESRD Database. See the section on Chapter 1 in the *ESRD Analytical Methods* chapter for a more detailed description of the analytical methods used to generate the study cohorts, figures, and tables in this chapter.

Incidence of ESRD: Counts, Rates, and Trends

Overall Incidence Counts and Rate

The number of incident (newly reported) ESRD cases in 2014 was 120,688 (Table 1.1 and Figure 1.2). The unadjusted (crude) incidence rate in 2014 was 370 per million/year. After a year-by-year rise in the number of incident ESRD cases over two decades from 1980 through 2000, the increase leveled off between 2001 and 2012, but rose again in 2013 and 2014. Table 1.1 and Figure 1.1 provide the unadjusted and age-gender-race-adjusted incidence rates of ESRD each year from 1996 through 2014. While the unadjusted and adjusted rates are the same in 2011 because the standard population is the 2011 U.S. population, the trends for these two rates are different. The unadjusted ESRD incidence rate approximates the change in the incident count (the numerator of the unadjusted rate); it increased steadily from 1996 through 2006, then remained relatively stable until 2011, and has increased again since 2011. The implication of this trend is that the burden of kidney failure in the United States — with respect to the expected impact on health-care utilization and costs — continues to increase.

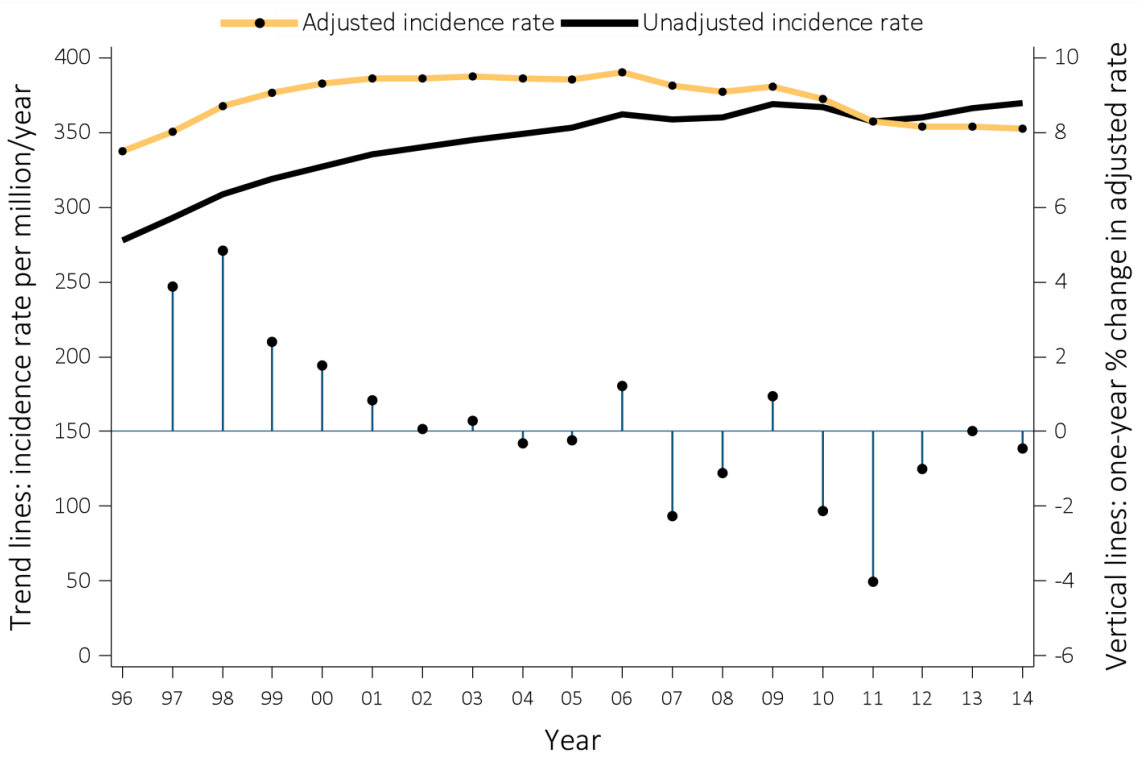
In contrast, the adjusted ESRD incidence rate increased from 1996 through 2000, leveled off through 2006, then declined slightly in most years through 2014 (the exceptions are 2009 and 2013; Table 1.1). The specific implication of this recent downward trend is more difficult to interpret, as suggested above, but it likely reflects improvements in the prevention of ESRD. Thus, even though the population is aging and the prevalence of obesity and diabetes are increasing, which probably accounts for the increasing number of incident ESRD cases and the increasing unadjusted incidence rate, the recent decline in the adjusted rate may reflect successful efforts to prevent or postpone kidney failure in the United States.

vol 2 Table 1.1 Trends in annual number of ESRD incident cases, unadjusted and adjusted* incidence rates (per million/year) of ESRD, and annual percent change, in the U.S. population, 1996-2014

	Incident count		Unadjusted rate		Adjusted rate	
Year	No. cases	% Change from previous year	Unadjusted rate (per million/year)	% Change from previous year	Adjusted rate (per million/year)	% Change from previous year
1996	77,018	n/a	278	n/a	328	n/a
1997	82,116	6.6	293	5.3	343	4.4
1998	87,353	6.4	308	5.3	360	4.8
1999	91,431	4.7	319	3.4	368	2.4
2000	94,662	3.5	327	2.5	374	1.5
2001	98,005	3.5	336	2.6	380	1.8
2002	100,233	2.3	340	1.3	381	0.1
2003	102,770	2.5	345	1.5	382	0.3
2004	104,560	1.7	349	1.2	382	-0.1
2005	106,662	2.0	353	1.2	382	0.0
2006	110,342	3.5	362	2.5	387	1.4
2007	110,381	0.0	359	-0.9	379	-2.1
2008	111,899	1.4	360	0.3	375	-1.0
2009	115,508	3.2	369	2.5	379	1.1
2010	115,920	0.4	367	-0.6	372	-2.0
2011	113,796	-1.8	358	-2.5	358	-3.8
2012	115,602	1.6	360	0.7	355	-0.8
2013	118,119	2.2	366	1.7	355	0.2
2014	120,688	2.2	370	1.1	354	-0.3

*Data Source: Reference Tables A.1, A.2, A2.2 and special analyses, USRDS ESRD Database. *Adjusted for age, sex, and race. Abbreviations: ESRD, end-stage renal disease; n/a, not applicable.*

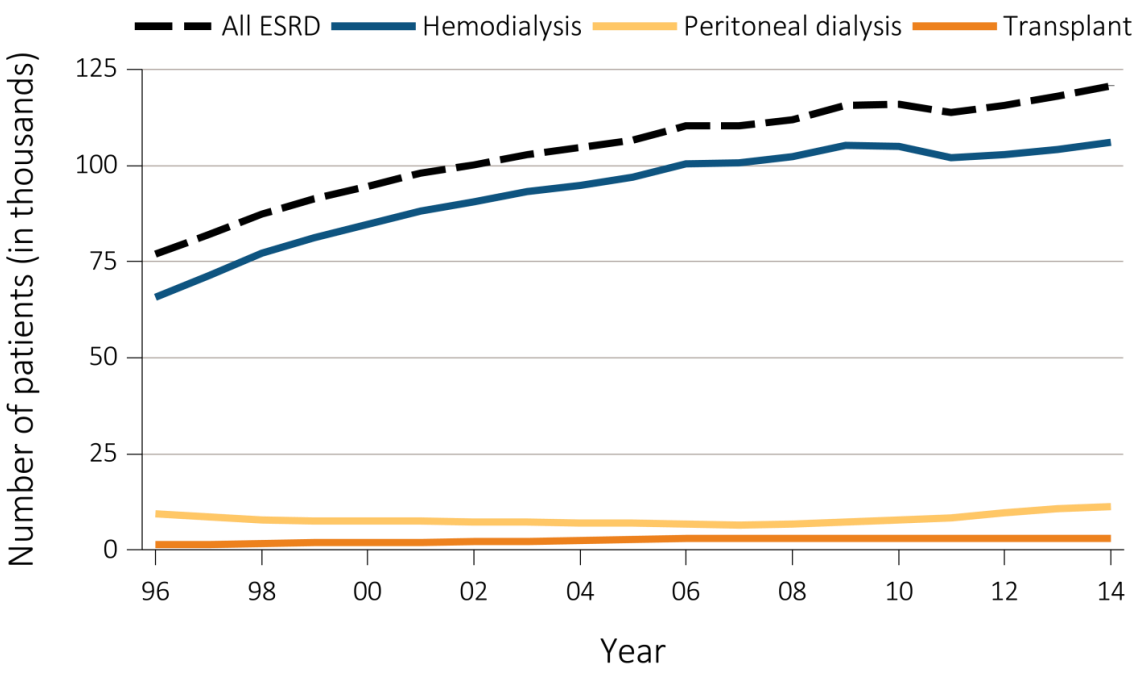
vol 2 Figure 1.1 Trends in the unadjusted and adjusted* incidence rates (per million/year) of ESRD (trend lines; scale on right), and annual percent (%) change in the adjusted* incidence rate of ESRD (vertical lines; scale on left) in the U.S. population, 1996-2014



*Data Source: Reference Table A.2.2 and special analyses, USRDS ESRD Database. *Adjusted for age, sex, race, and ethnicity. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

Among incident ESRD cases in 2014, 87.9% used hemodialysis, 9.3% used peritoneal dialysis, and 2.6% received a pre-emptive kidney transplant (Figure 1.2). The size of the incident hemodialysis population is now 25% larger than in 2000. The size of the incident peritoneal dialysis population is now 50% larger than in 2000. The size of the pre-emptive transplant population is now 63.2% larger than in 2000. By comparison, the U.S. population is also 13% larger than in 2000.

vol 2 Figure 1.2 Trends in the annual number of ESRD incident cases (in thousands), by modality, in the U.S. population, 1996-2014



Data Source: Reference Table D1. Abbreviation: ESRD, end-stage renal disease.

INCIDENCE RATE: BY REGION

Variation in ESRD incidence rates among the 18 ESRD Networks remains substantial (Table 1.2). Adjusting for differences in age, sex, and race, the lowest rate was 250 per million/year in Network 1 (CT, MA, ME, NH, RI, VT), while the rate in Network 14 (TX) was 73% higher at 432 per million/year. Much of the high incidence in Texas and Southern California is due to the high numbers of Hispanics in these States. Hispanics account for 38% of the populations in Texas and California, compared to 18% nationwide. Renal replacement therapy (RRT) modality use by region, also presented in Table 1.2., is discussed in the section *Modality of Renal Replacement Therapy: Incident ESRD Cases* later in this chapter.

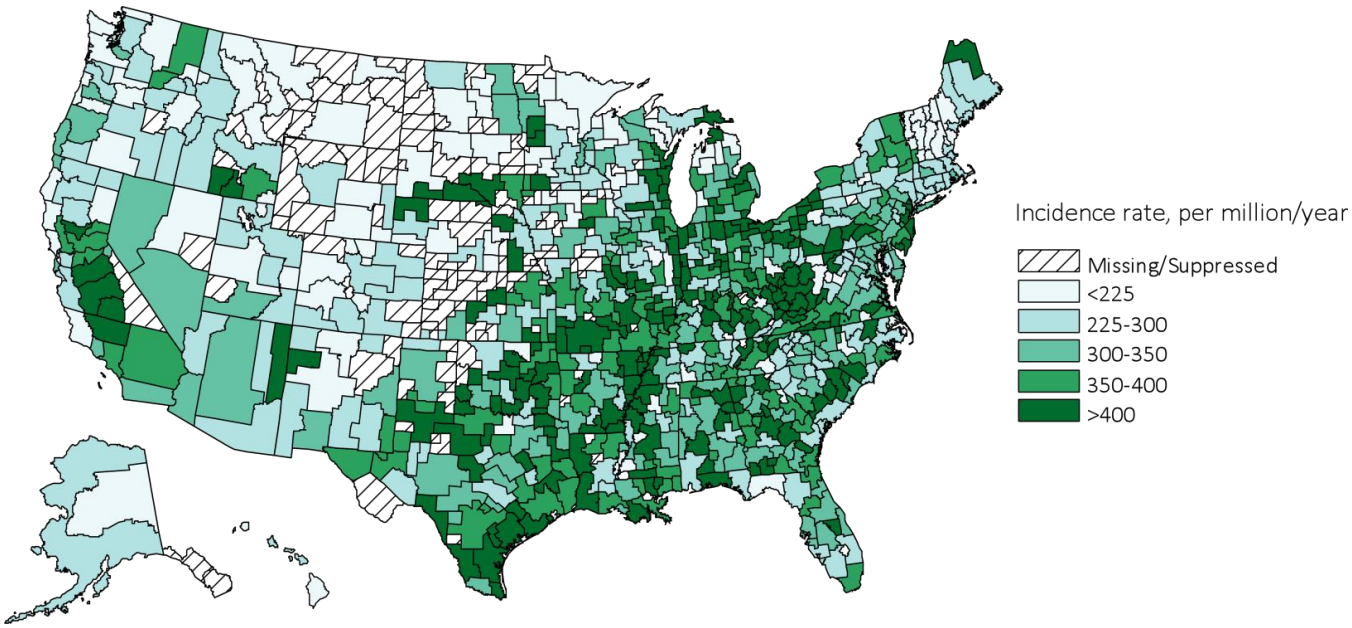
vol 2 Table 1.2 Unadjusted and adjusted* incidence rates of ESRD (per million/year) and annual number of ESRD incident cases, by modality (hemodialysis, peritoneal dialysis, transplantation) and ESRD Network, in the U.S. population, 2014

Network	States** in Network	Total ESRD			Hemodialysis		Peritoneal dialysis		Transplant	
		No. of cases	Adjusted incidence rate (per million/year)	Unadjusted incidence rate (per million/year)	No. of cases	% of network	No. of cases	% of network	No. of cases	% of network
14	TX	10585	432	391	9451	89.3	922	8.7	183	1.7
18	S. CA	9396	430	386	8396	89.4	857	9.1	129	1.4
3	NJ, PR	5451	395	429	3524	91.4	236	6.1	89	2.3
9	IN, KY, OH	9293	390	410	8213	88.4	835	9.0	202	2.2
10	IL	5217	384	403	4517	86.6	536	10.3	143	2.7
13	AR, LA, OK	4982	383	431	4402	88.4	488	9.8	90	1.8
8	AL, MS, TN	6567	364	455	5701	86.8	757	11.5	100	1.5
4	DE, PA	5368	352	390	4730	88.1	471	8.8	159	3.0
5	MD, DC, VA, WV	7045	343	418	6289	89.3	560	7.9	177	2.5
11	MI, MN, ND, SD, WI	7517	343	330	6624	88.1	561	7.5	310	4.1
17	N. CA, HI, GU, AS	5871	341	350	4732	83.7	781	13.8	135	2.4
12	IA, KS, MO, NE	4428	336	316	3768	85.1	522	11.8	131	3.0
2	NY	7352	334	370	6772	92.1	332	4.5	245	3.3
6	NC, SC, GA	10359	326	415	8970	86.6	1176	11.4	204	2.0
7	FL	7890	319	395	6994	88.6	723	9.2	150	1.9
15	AZ, CO, NV, NM, UT, WY	5682	297	275	4852	85.4	608	10.7	216	3.8
16	AK, ID, MT, OR, WA	3599	268	248	3075	85.4	410	11.4	109	3.0
1	CT, MA, ME, NH, RI, VT	3751	250	255	3238	86.3	340	9.1	172	4.6
	All networks	120688	354	370	104248	87.9	11115	9.4	2944	2.5

*Data Source: Reference Table A.11 and special analyses, USRDS ESRD Database. *Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. Listed from highest to lowest adjusted rate per million/year. **Includes 50 states, Washington, D.C. (DC), Puerto Rico (PR), Guam (GU), and American Samoa (AS). Northern and Southern California (CA) split into Networks 17 and 18. Abbreviations: Af Am, African American; ESRD, end-stage renal disease; Hisp, Hispanic; N Am, Native American.*

Across 677 Health Service Areas in 2014, the adjusted incidence rate of ESRD ranged from 83 per million/year to 4,172 per million/year (interquartile range: 264 to 406 per million/year) (Figure 1.3). Although specific geographic patterns are difficult to identify based on these HSA-level data without further geospatial analyses, the rates were generally highest in parts of the Ohio and Mississippi River valleys, the Southeast, Texas, and California, and lowest in parts of New England, the Northwest, and certain Upper Midwest and Rocky Mountain states.

vol 2 Figure 1.3 Map of the adjusted* incidence rate (per million/year) of ESRD, by Health Service Area, in the U.S. population, 2014

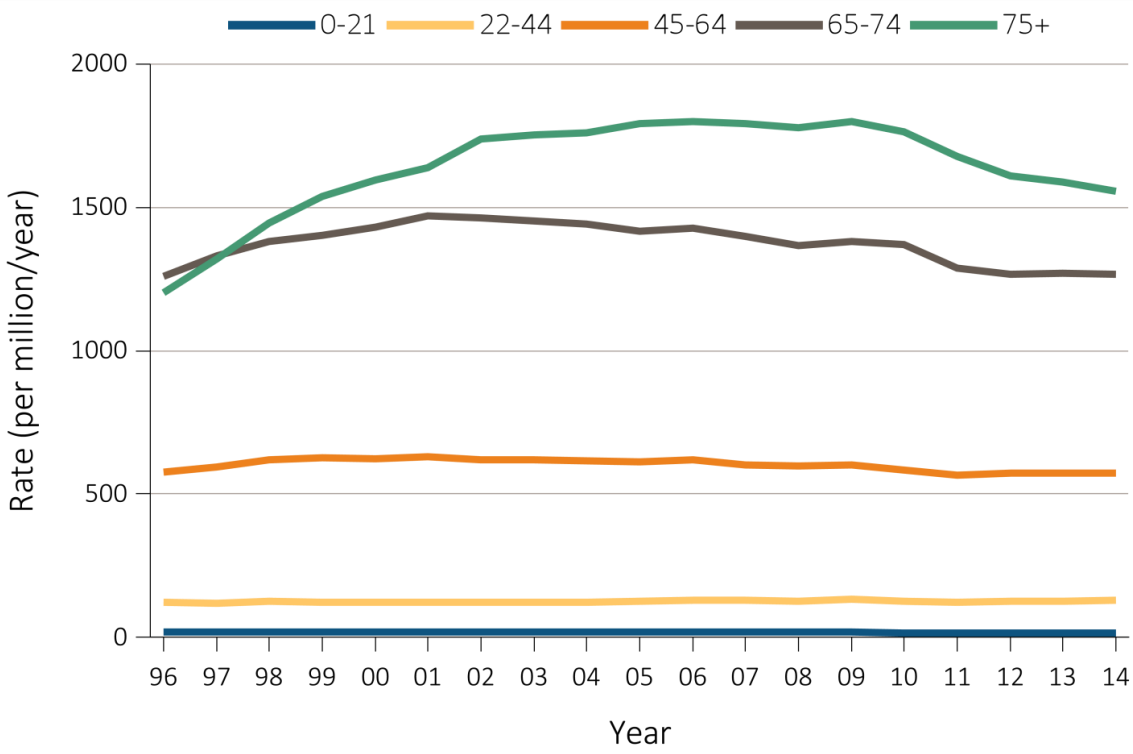


*Data Source: Special analyses, USRDS ESRD Database. *Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. Values for cells with 10 or fewer patients are suppressed. Abbreviation: ESRD, end-stage renal disease.*

INCIDENCE RATE: BY AGE

Across age groups, adjusted ESRD incidence rates have been generally stable or fallen for a decade or more (Figure 1.4). Pronounced declines have been seen recently among those aged 65 and over: among ages 65-74, the ESRD incidence rate is the lowest since 1997; and among ages 75 and over, the rate is the lowest since 2000.

vol 2 Figure 1.4 Trends in adjusted* ESRD incidence rate (per million/year), by age group, in the U.S. population, 1996-2014

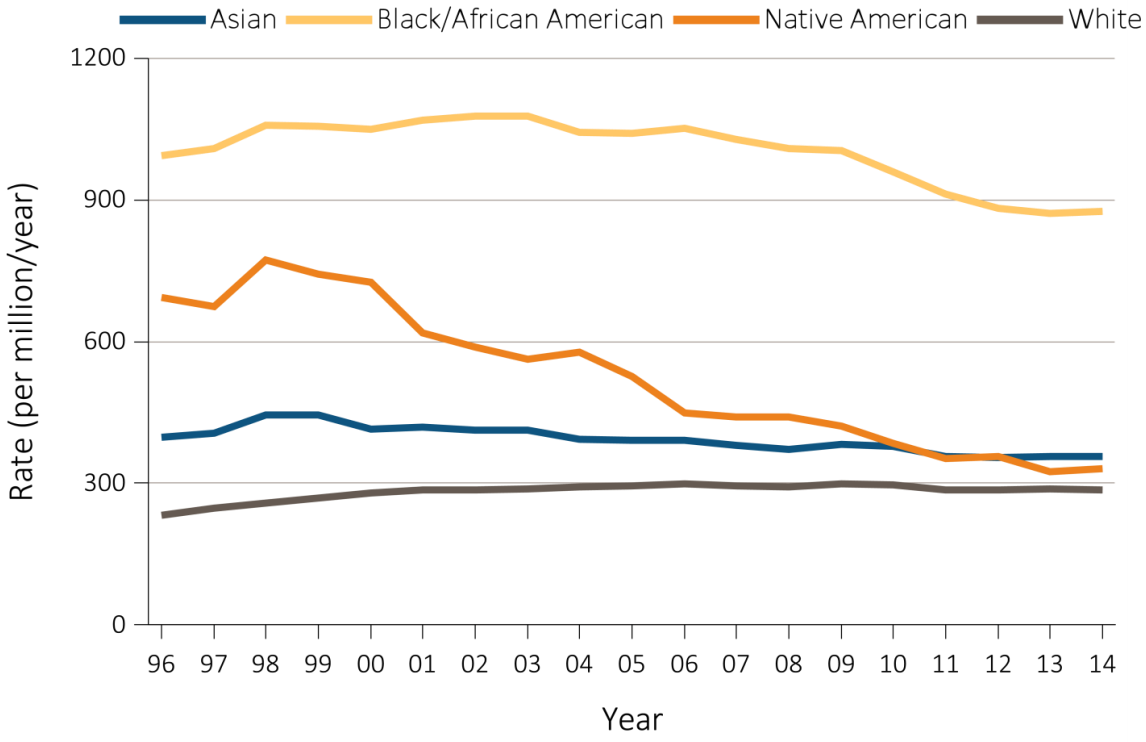


*Data Source: Reference Table A.2.2 and special analyses, USRDS ESRD Database. *Adjusted for sex and race. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

INCIDENCE RATE: BY RACE AND ETHNICITY

The adjusted ESRD incidence rates for Blacks/African Americans (hereafter, Blacks), Native Americans, and Asians have declined over the nearly 20-year period shown in Figure 1.5. The decline has been greatest (over 2-fold) among Native Americans. Over the same period, the rate initially rose among Whites but has been generally stable since around 2000. The ratio of adjusted incidence rates for Blacks versus Whites decreased from 3.8 in 2000 to 3.1 in 2014. Similarly, the ratio of incidence rates for Asians versus Whites decreased from 1.5 to 1.2 during the same period; and the ratio of incidence rates for Native Americans versus Whites decreased from 2.6 to 1.2.

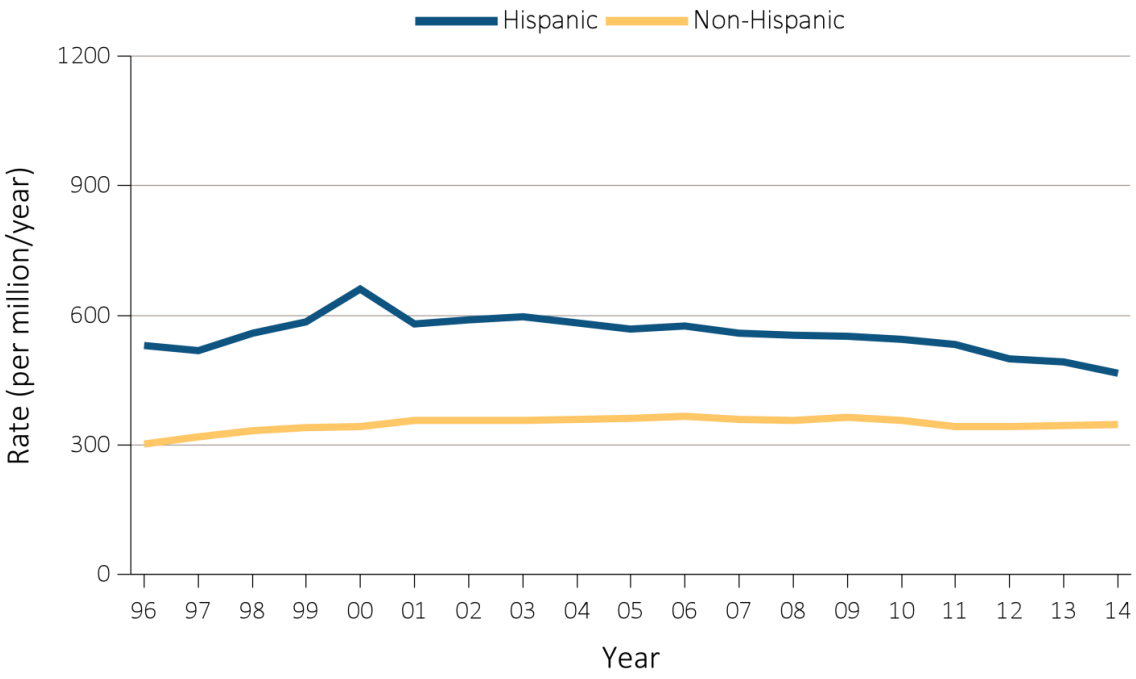
vol 2 Figure 1.5 Trends in adjusted* ESRD incidence rate (per million/year), by race, in the U.S. population, 1996-2014



*Data Source: Reference Table A.2.2 and special analyses, USRDS ESRD Database. *Adjusted for age and sex. The standard population was the U.S. population in 2011. Abbreviations: Af Am, African American; ESRD, end-stage renal disease.*

Among both Hispanic and non-Hispanic populations, the adjusted ESRD incidence rates have been stable or somewhat declining since 2001 (Figure 1.6). Although the absolute difference in adjusted rates between the two ethnic groups has declined since 2000, the ESRD incidence rate in 2014 remained nearly 35% higher among Hispanics than non-Hispanics.

vol 2 Figure 1.6 Trends in adjusted* ESRD incidence rate (per million/year), by Hispanic ethnicity, in the U.S. population, 1996-2014

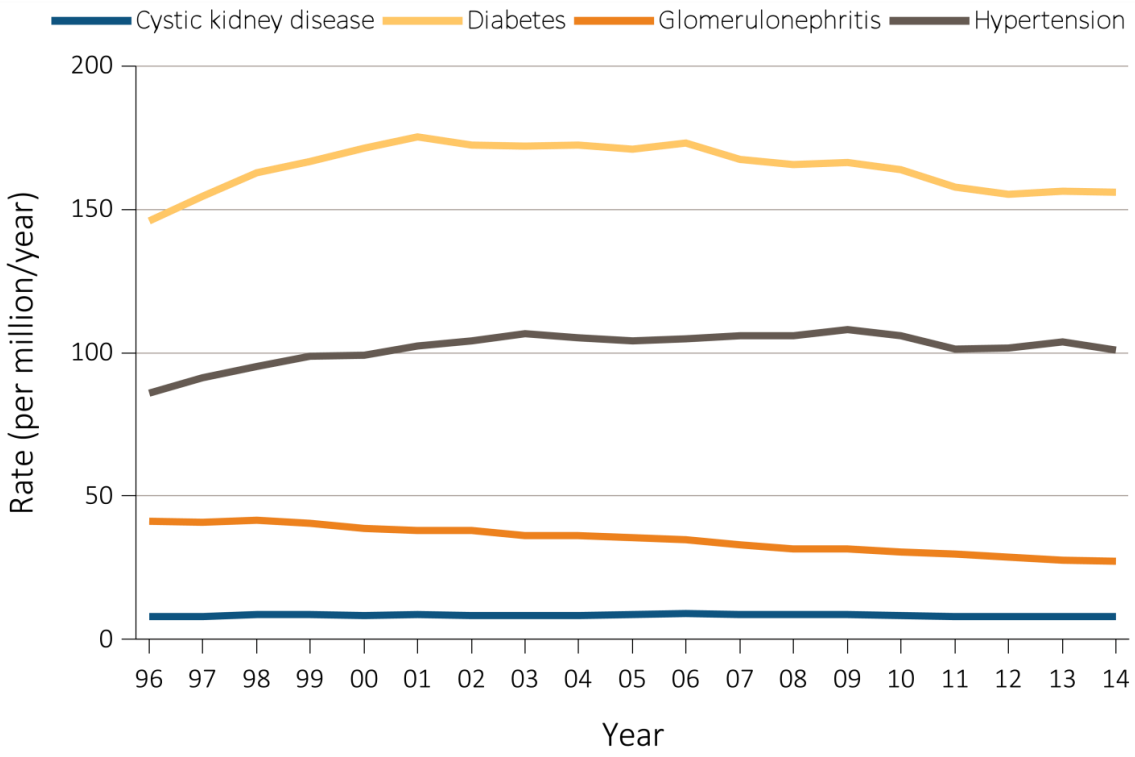


*Data Source: Reference Tables A.2.2. *Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

INCIDENCE RATE: BY PRIMARY CAUSE OF ESRD

The adjusted incidence rate of ESRD with diabetes listed as the primary cause plateaued in 2001 and has declined in most subsequent years, with the lowest rate in 2013 (Figure 1.7). The rate with ESRD due to hypertension plateaued in 2003 and has been stable since then. The rate due to glomerulonephritis has fallen steadily since the 1990s, while the rate due to cystic disease has remained stable. Whether these trends reflect a true changing etiology of ESRD or a changing labeling of primary cause is not clear (see the section titled *Primary cause of ESRD: A cautionary note* in this chapter).

vol 2 Figure 1.7 Trends in adjusted* ESRD incidence rate (per million/year), by primary cause of ESRD, in the U.S. population, 1996-2014



*Data Source: Reference Table A.2(2) and special analyses, USRDS ESRD Database. *Adjusted for age, sex and race. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

DIABETES AS PRIMARY CAUSE OF ESRD, BY PATIENT CHARACTERISTICS

While the gender-race adjusted incidence rate of ESRD is highest for those aged 75 and older (Figure 1.4), the sex-adjusted rate of ESRD due to diabetes is highest for ages 65-74 in Whites, Blacks, and Hispanics (Figures 1.8.a-c), presumably because type 2 diabetes tends to occur before age 75 (contrast with Figure 1.9). The adjusted incidence rate of ESRD due to diabetes is, as expected, substantially higher for ages 65 and older than for younger age groups. Rates have been generally stable or slightly increased among individuals aged 20-44 years, but have declined in older age groups.

Sex-adjusted incidence rates of ESRD due to diabetes were several-fold higher in Blacks within each age category compared to Whites, though they are generally declining more quickly in Blacks than in Whites. Diabetes is 60% more common among Blacks than among Whites (http://www.cdc.gov/diabetes/statistics/prev/national/figbyrace.htm). These racial differences are generally similar to those seen for overall ESRD incidence rates. Among Hispanics, the incidence rates of ESRD due to diabetes compared to Whites are similar for ages 22-44 years, but much higher for ages 44 and over. Across age categories, incidence rates in Hispanics are lower than in Blacks.

vol 2 Figure 1.8 Trends in the sex-adjusted incidence rate (per million/year) of ESRD due to diabetes as the primary cause, by age and race (a & b), and by age and ethnicity (c), in the U.S. population, 1996-2014

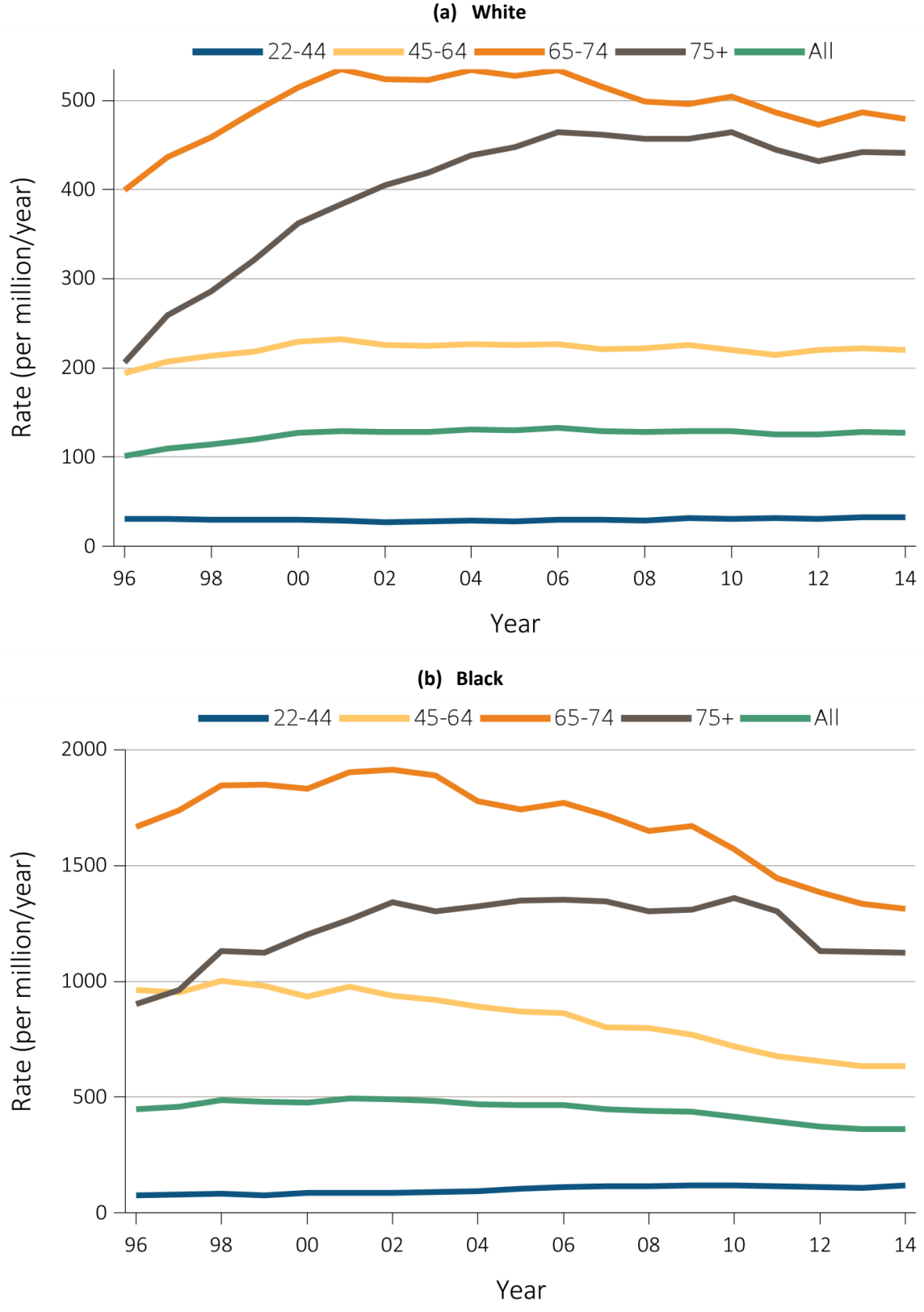
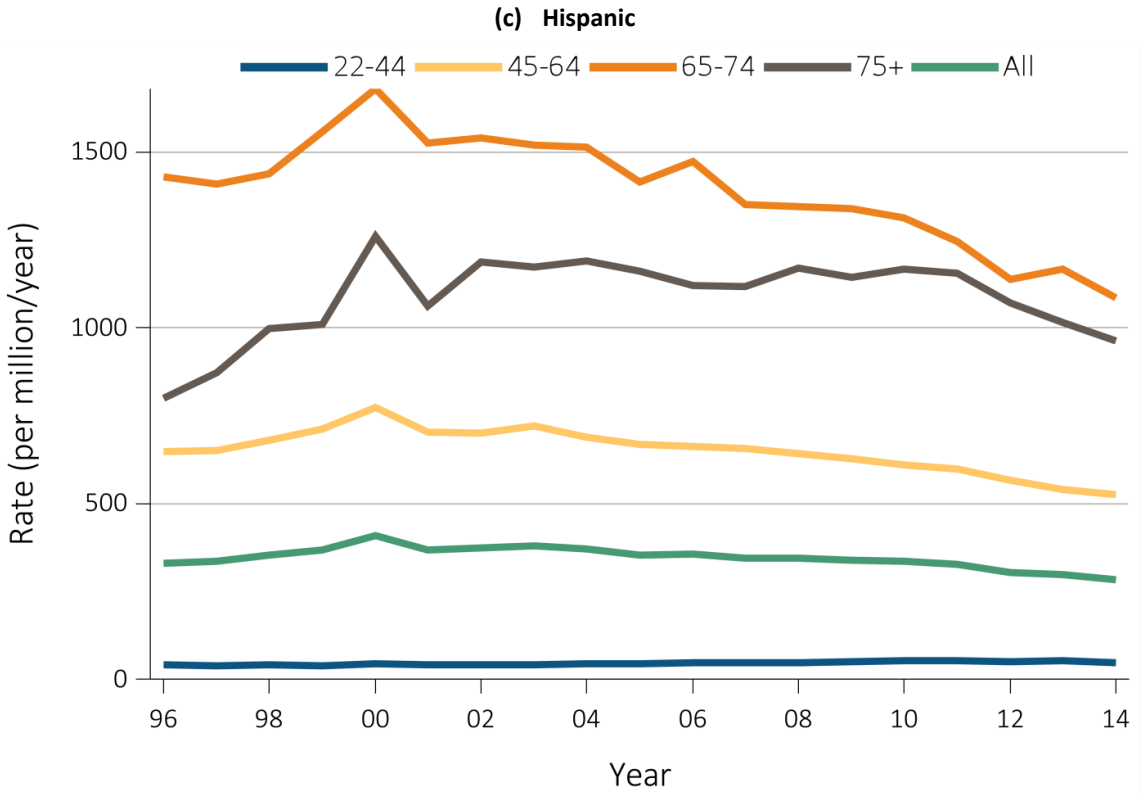


Figure 1.8 continued on next page.

vol 2 Figure 1.8 Trends in the sex-adjusted incidence rate (per million/year) of ESRD due to diabetes as the primary cause, by age and race (a & b), and by age and ethnicity (c), in the U.S. population, 1996-2014 *(continued)*



*Data Source: Special analyses, USRDS ESRD Database. *Adjusted for sex. The standard population was the U.S. population in 2011. Abbreviations: ESRD, end-stage renal disease.*

HYPERTENSION AS PRIMARY CAUSE OF ESRD, BY PATIENT CHARACTERISTICS

The sex-adjusted incidence rate of ESRD with hypertension listed as the primary cause has remained higher among older age categories (Figures 1.9.a-c). In contrast to incidence rates of ESRD with diabetes listed as the primary cause, these rates remain substantially higher at age 75 and older than at 65-74 years of age.

Within each age category, the incidence rate of ESRD with hypertension listed as the primary cause is dramatically higher among Blacks than among Whites or Hispanics. Compared to Whites in each age category, incident rates among Blacks in 2014 were 8.9-fold higher at ages 22-44, 6.7-fold higher at ages 45-64, 4.4-fold higher at ages 65-74, and 2.7-fold higher at age 75 and over. Part of the higher rates of hypertensive ESRD among Blacks could be due to ascertainment bias among nephrologists. Although hypertension is almost universal among all ESRD patients, it is generally believed that nephrologists are more likely to ascribe it as the causative factor for Blacks than for Whites.

vol 2 Figure 1.9 Trends in the sex-adjusted incidence rate (per million/year) of ESRD due to hypertension as the primary cause, by (a & b) age and race, and by (c) age and ethnicity, in the U.S. population, 1996-2014

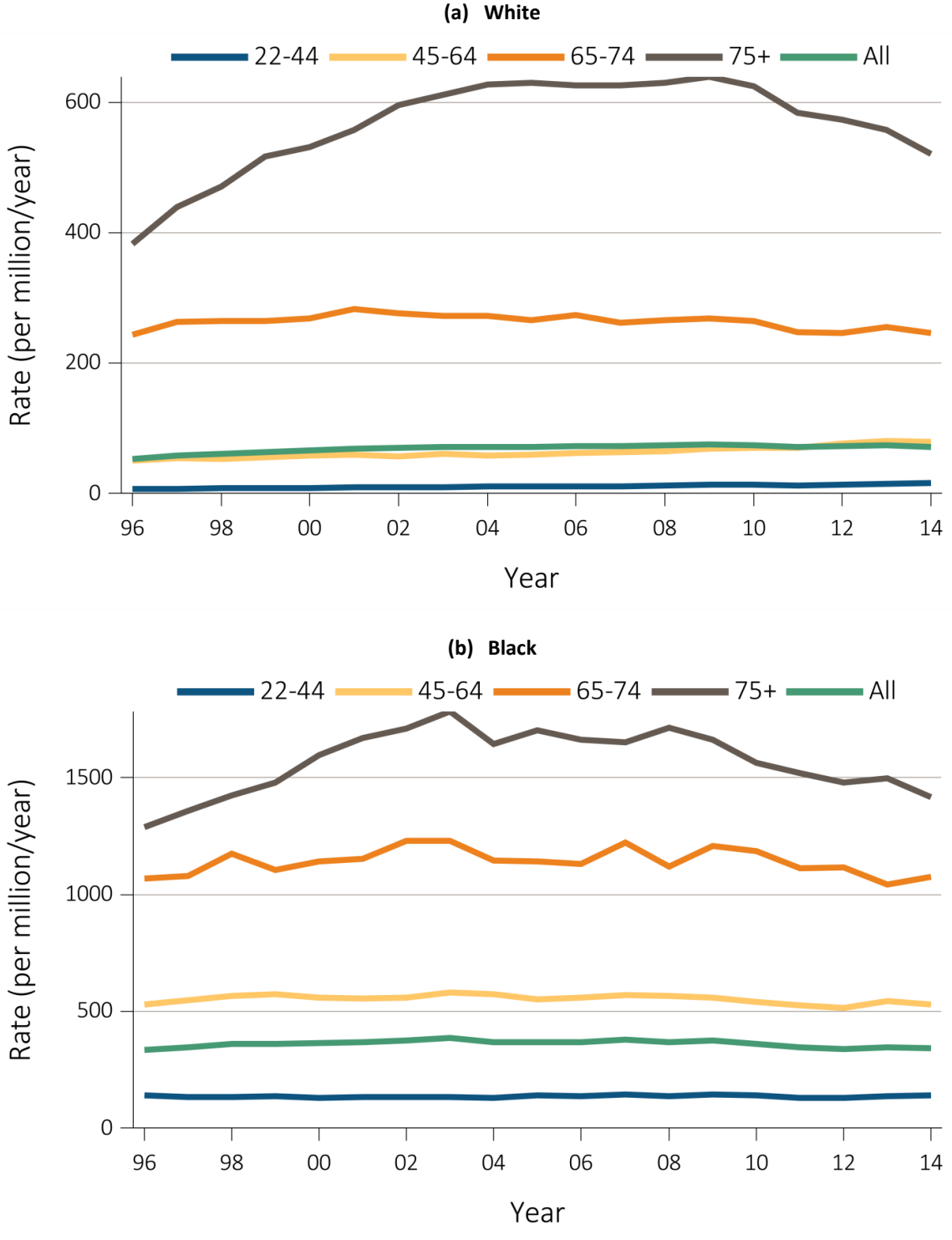
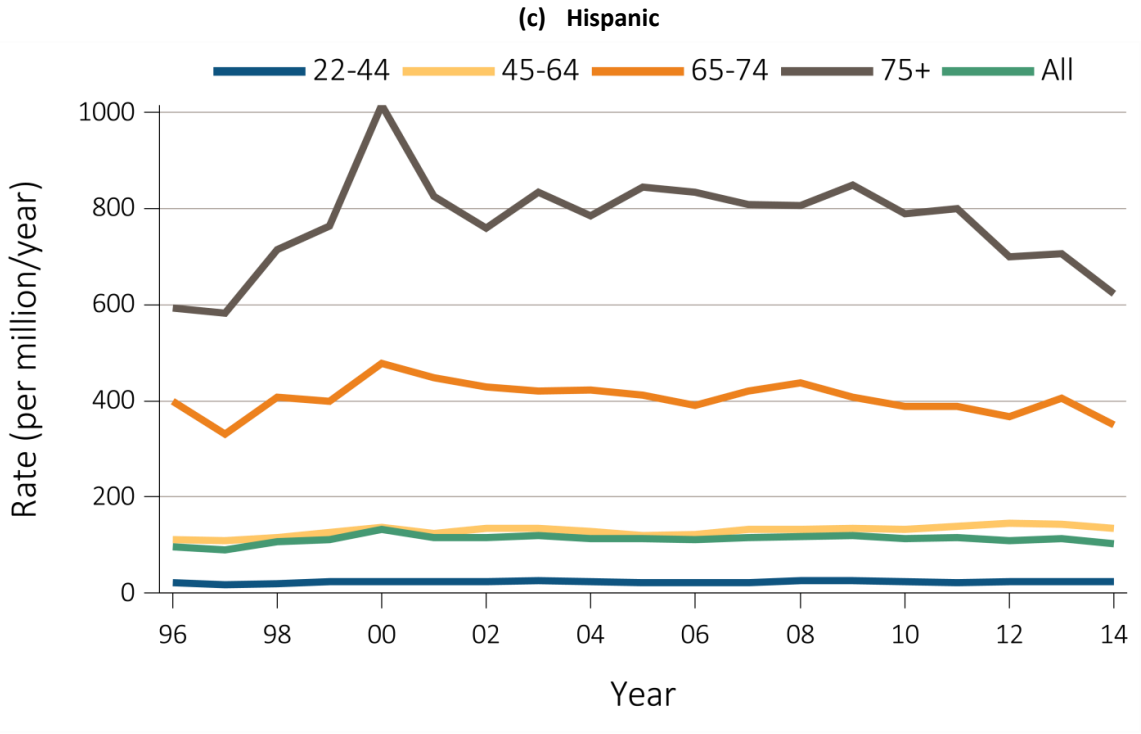


Figure 1.9 continued on next page.

vol 2 Figure 1.9 Trends in the sex-adjusted incidence rate (per million/year) of ESRD due to hypertension as the primary cause, by (a & b) age and race, and by (c) age and ethnicity, in the U.S. population, 1996-2014 *(continued)*



*Data Source: Special analyses, USRDS ESRD Database. *Adjusted for sex. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

Prevalence of ESRD: Counts, Prevalence, and Trends

OVERALL PREVALENCE

On December 31, 2014, there were 678,383 prevalent cases of ESRD in the United States, an increase of 3.5% over 2013 and an increase of 74% since 2000 (Table 1.3 and Figure 1.11). The unadjusted ESRD prevalence reached 2,067 per million (~0.21%), an increase of 2.6% over 2013 and an increase of 54.1% since 2000 (Table 1.3).

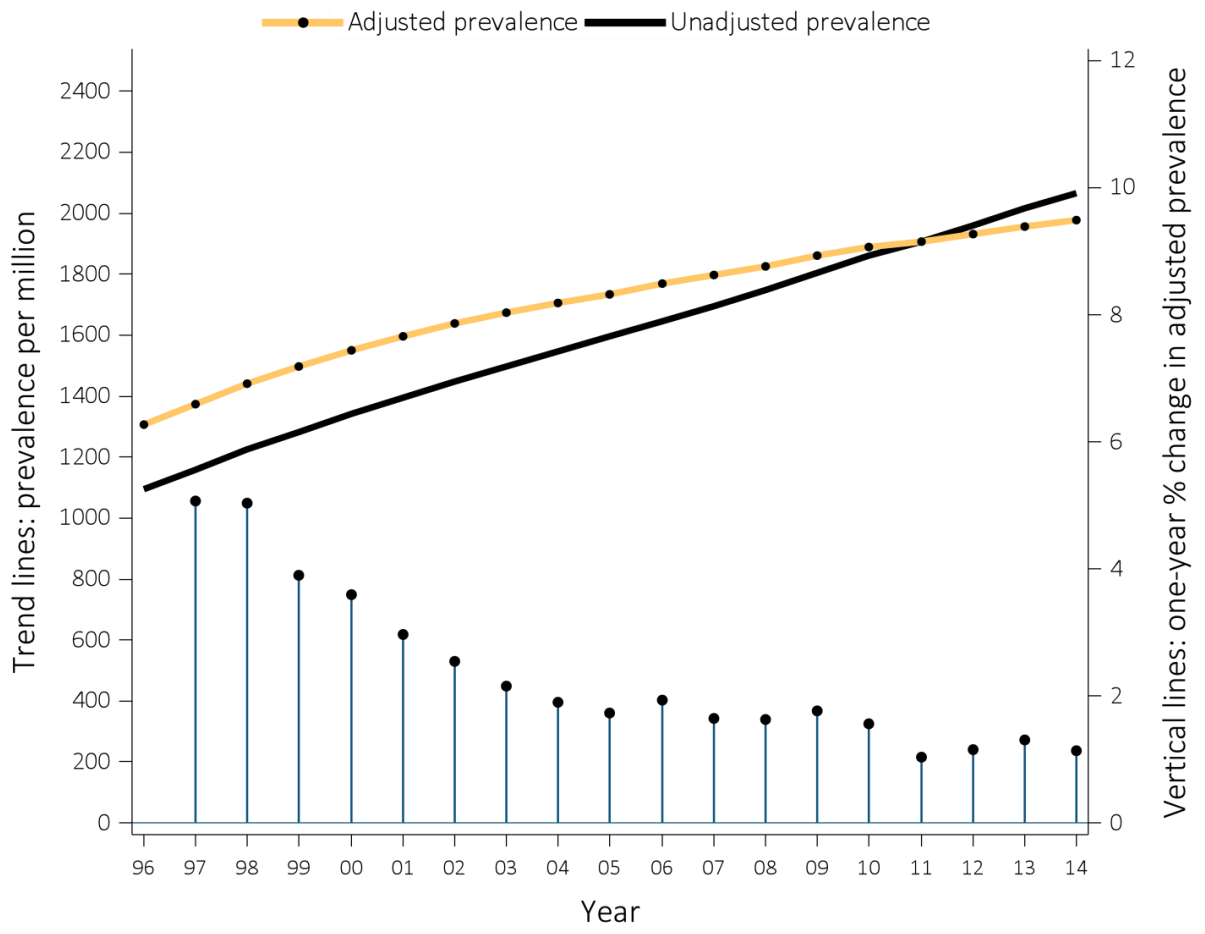
As shown in Table 1.3 and Figure 1.10, both unadjusted (crude) and adjusted prevalence of ESRD increased steadily between 1996 and 2014. In general, however, the absolute and proportional yearly changes were a little greater for the unadjusted prevalence than for the adjusted prevalence, especially after 2000 (Table 1.3). The increasing prevalent count and unadjusted prevalence reflect the need for more resources to manage ESRD in the U.S. population as demonstrated in *Chapter 11: Medicare Expenditures for Persons With ESRD*. Because prevalence reflects both the incidence and course of the disease (see explanation in the *Introduction*), these ESRD prevalence trends reflect not only the increasing number of incident cases (Table 1.1), but also longer survival among ESRD patients, which is encouraging news regarding efforts to manage kidney failure in the United States. This interpretation is demonstrated by the fact that the adjusted ESRD prevalence has continued to increase while the adjusted ESRD incidence rate has declined in recent years (Table 1.1).

vol 2 Table 1.3 Trends in annual number of ESRD prevalent cases, unadjusted and adjusted* prevalence (per million) of ESRD, and annual percent change, in the U.S. population, 1996-2014

Year	Prevalent count		Unadjusted prevalence		Adjusted prevalence	
	No. cases	% Change from previous year	Unadjusted (per million)	% Change from previous year	Adjusted (per million)	% Change from previous year
1996	303,311	n/a	1,095	n/a	1,283	n/a
1997	326,067	7.5	1,159	5.8	1,348	5.1
1998	348,578	6.9	1,225	5.7	1,415	5.0
1999	369,375	6.0	1,283	4.8	1,471	4.0
2000	390,158	5.6	1,341	4.5	1,524	3.6
2001	409,963	5.1	1,396	4.1	1,572	3.2
2002	429,172	4.7	1,449	3.8	1,614	2.7
2003	447,667	4.3	1,499	3.4	1,651	2.3
2004	466,013	4.1	1,547	3.2	1,685	2.1
2005	484,935	4.1	1,595	3.1	1,717	1.9
2006	505,715	4.3	1,647	3.3	1,753	2.1
2007	525,866	4.0	1,696	3.0	1,785	1.8
2008	546,918	4.0	1,748	3.0	1,817	1.8
2009	569,547	4.1	1,805	3.3	1,852	1.9
2010	591,776	3.9	1,860	3.1	1,884	1.8
2011	611,456	3.3	1,908	2.6	1,908	1.2
2012	632,806	3.5	1,960	2.7	1,934	1.4
2013	655,435	3.6	2,015	2.8	1,964	1.5
2014	678,383	3.5	2,067	2.6	1,990	1.3

*Data Source: Reference Tables B.1, B.2, B2(2) and special analyses, USRDS ESRD Database. *Adjusted for age, sex, and race. Abbreviations: ESRD, end-stage renal disease; n/a, not applicable.*

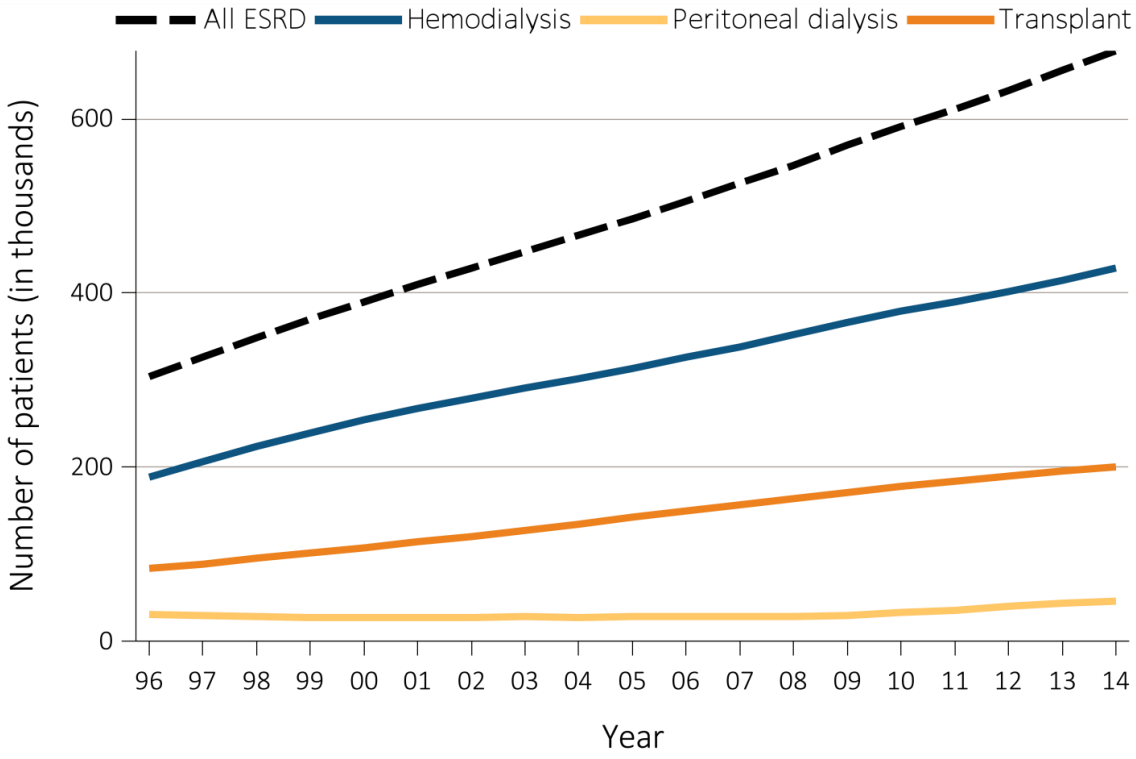
vol 2 Figure 1.10 Trends in the unadjusted and adjusted* ESRD prevalence (per million) (trend lines; scale on left), and annual percent (%) change in adjusted* prevalence of ESRD (vertical lines; scale on right), in the U.S. population, 1996-2014



*Data Source: Reference Table B.2(2) and special analyses, USRDS ESRD Database. *Adjusted for age, sex, race, and ethnicity. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

Among prevalent ESRD cases on December 31, 2014, 63.1% used hemodialysis, 6.9% used peritoneal dialysis, and 29.6% had a functioning kidney transplant (Figure 1.11). The size of the prevalent hemodialysis population is now 69% larger than in 2000 (Figure 1.11). The size of the prevalent peritoneal dialysis population is now 71% larger than in 2000. The size of the transplant population is now 87% larger than in 2000.

vol 2 Figure 1.11 Trends in the number of ESRD prevalent cases (in thousands) by modality, in the U.S. population, 1996-2014



Data Source: Reference Table D.1. Abbreviation: ESRD, end-stage renal disease.

PREVALENCE: BY REGION

Among the 18 ESRD Networks, the age-sex-race-adjusted prevalence of ESRD ranged from 2,339 per million in Network 8 (AL, MS, TN) to 1,419 per million in Network 16 (AK, ID, MT, OR, WA) (Table 1.4). RRT modality use by region, also presented in Table 1.4., is discussed in the *Modality of Renal Replacement Therapy: Incident ESRD Cases* section later in this chapter.

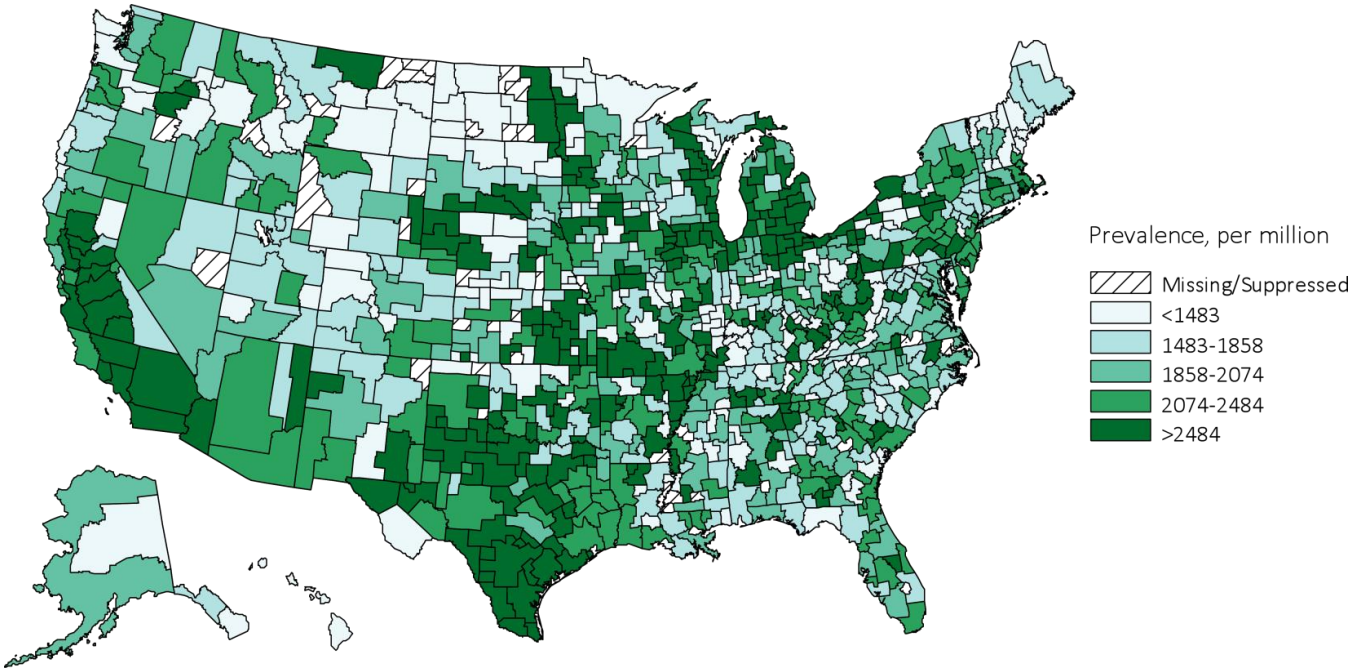
vol 2 Table 1.4 Unadjusted and adjusted* prevalence of ESRD (per million) and annual number of ESRD prevalent cases, by modality (hemodialysis, peritoneal dialysis, and transplantation) and ESRD Network, in the U.S. population, 2014

Network	States** in network	Total ESRD			Hemodialysis		Peritoneal dialysis		Transplant	
		No. of cases	Adjusted prevalence (per million)	Unadjusted prevalence (per million)	No. of cases	% of network	No. of cases	% of network	No. of cases	% of network
8	AL, MS, TN	35140	2339	2428	23808	67.8	2802	8.0	8410	23.9
6	NC, SC, GA	59380	2260	2365	40533	68.3	4917	8.3	13774	23.2
5	MD, DC, VA, WV	39245	2231	2317	25003	63.7	2400	6.1	11700	29.8
10	IL	30102	2228	2317	18301	60.8	1917	6.4	9758	32.4
18	S. CA	55698	2177	2274	37558	67.4	4343	7.8	13661	24.5
14	TX	59670	2116	2187	41281	69.2	3926	6.6	14208	23.8
17	N. CA, HI, GU, AS	36668	2112	2195	21879	61.3	3077	8.6	10650	29.8
3	NJ, PR	27205	2103	2184	12712	64.2	877	4.4	6163	31.1
13	AR, LA, OK	24766	2075	2141	16609	67.1	2045	8.3	6015	24.3
2	NY	42624	2047	2119	28040	65.8	1528	3.6	12982	30.5
4	DE, PA	29182	2039	2116	17832	61.1	1843	6.3	9421	32.3
9	IN, KY, OH	46204	1962	2032	28985	62.7	3401	7.4	13561	29.4
7	FL	40258	1926	1997	25976	64.5	2914	7.2	11211	27.8
11	MI, MN, ND, SD, WI	44363	1867	1941	24774	55.8	2434	5.5	17025	38.4
12	IA, KS, MO, NE	24584	1695	1750	13625	55.4	1980	8.1	8893	36.2
15	AZ, CO, NV, NM, UT, WY	34342	1581	1653	20092	58.5	2522	7.3	11596	33.8
1	CT, MA, ME, NH, RI, VT	23127	1498	1560	12563	54.3	1394	6.0	9116	39.4
16	AK, ID, MT, OR, WA	21512	1419	1474	11648	54.1	1801	8.4	7975	37.1
	All networks	678383	1990	2067	421219	63.3	46121	6.9	196119	29.5

*Data Source: Special analyses, USRDS ESRD Database. *Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. Listed from lowest to highest prevalence per million. **Includes 50 states, Washington, D.C. (DC), Puerto Rico (PR), Guam (GU), and American Samoa (AS). Northern and Southern California (CA) split into Networks 17 and 18. Abbreviations: Af Am, African American; ESRD, end-stage renal disease; Hisp, Hispanic; N Am, Native American.*

Across 786 Health Service Areas, the adjusted prevalence of ESRD in 2014 ranged from 339 per million to 7,134 per million (interquartile range: 1,545 to 2,501 per million) (Figure 1.12). Although specific geographic patterns are difficult to identify without further geospatial analyses, examples of high ESRD prevalence in 2014 include parts of the Ohio and Mississippi River valleys, Michigan, northern Illinois and parts of Wisconsin along Lake Michigan, Texas, and California. Lower prevalence was observed in northern New England, the Northwest, and certain Upper Midwest and Rocky Mountain regions. These patterns are roughly similar to patterns of ESRD incidence shown earlier in this chapter in Figure 1.3.

vol 2 Figure 1.12 Map of the adjusted* prevalence (per million) of ESRD, by Health Service Area, in the U.S. population, 2014**

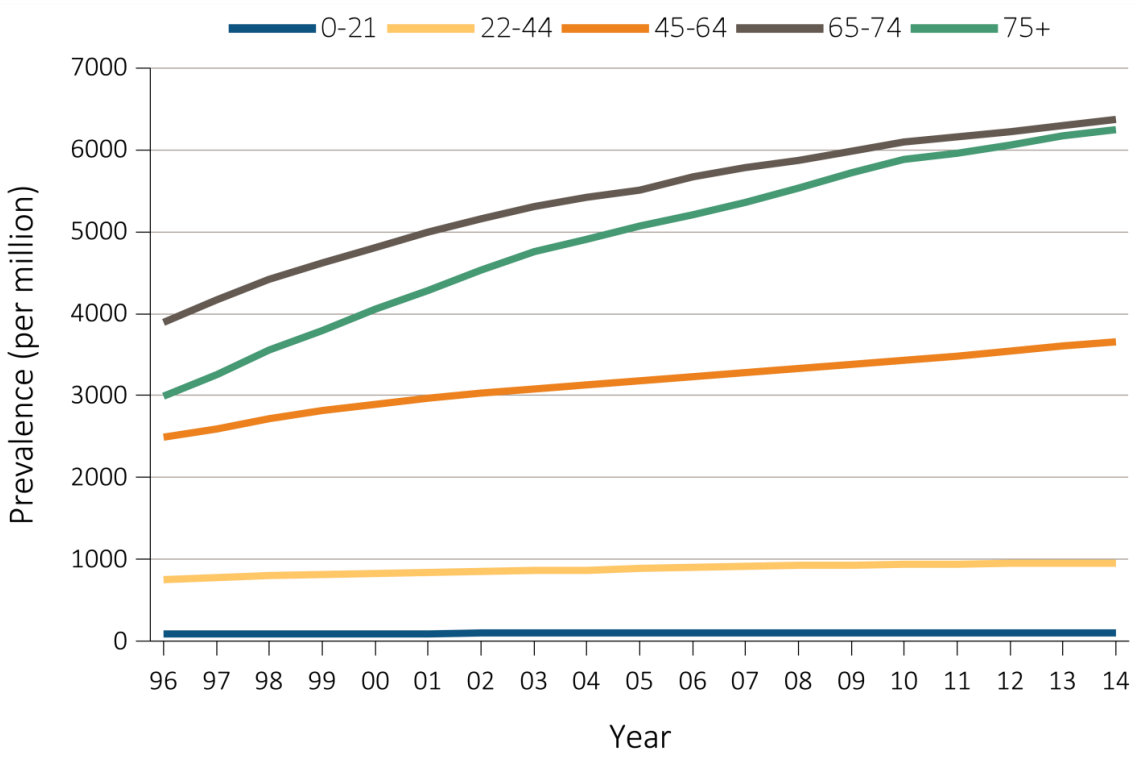


*Data Source: Special analyses, USRDS ESRD Database. *Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. **Three Health Service Areas were suppressed because the ratio of unadjusted rate to adjusted rate or adjusted rate to unadjusted rate was greater than 3. Values for cells with 10 or fewer patients are suppressed. Abbreviation: ESRD, end-stage renal disease.*

PREVALENCE: BY AGE

Across age groups, adjusted ESRD prevalence has risen over time, with steeper increases among older age groups (Figure 1.13). These increases over time contrast with the ongoing declines in adjusted ESRD incidence rate across age groups (Figure 1.4), and thus are likely due to longer survival among ESRD patients as well as the fact that patients who are in one age group at incidence necessarily age into older age groups. Among the age groups, ESRD prevalence per million is highest at 65-74 years. Although those aged 75 and older have the highest ESRD incidence rate, lower prevalence per million is presumably due to higher mortality among ESRD patients in this age group.

vol 2 Figure 1.13 Trends in the adjusted* prevalence (per million) of ESRD, by age group, in the U.S. population, 1996-2014

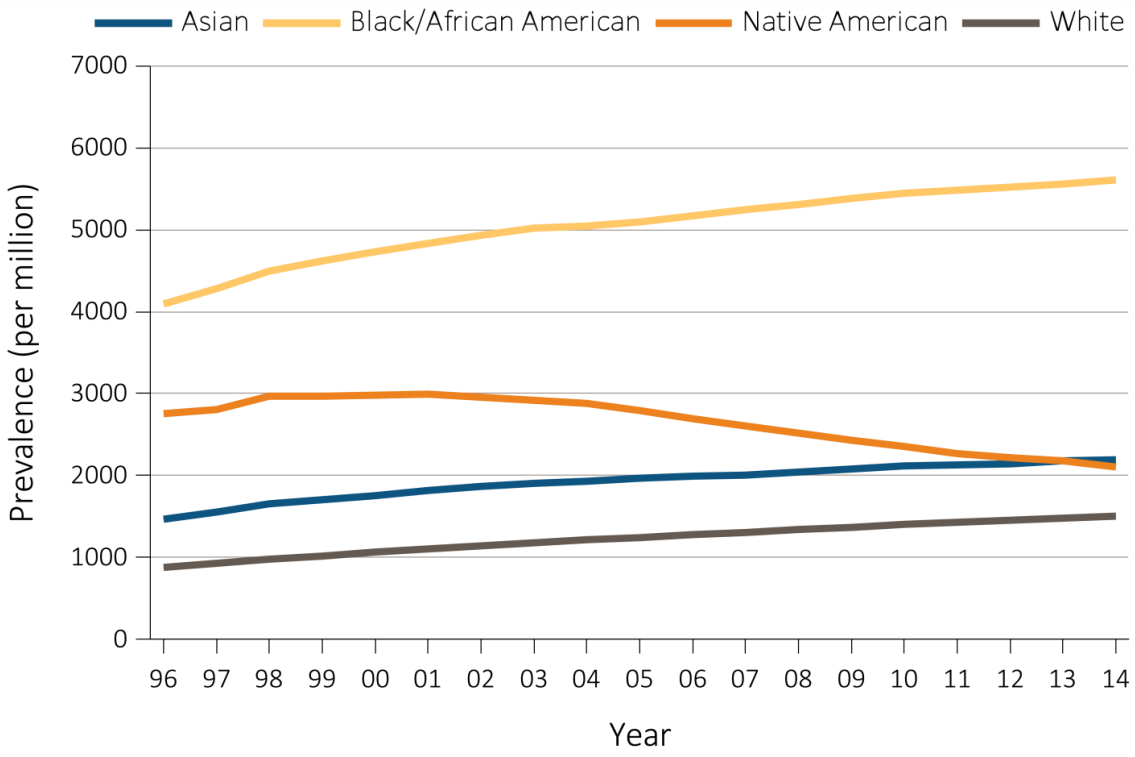


*Data Source: Reference Table B.2(2) and special analyses, USRDS ESRD Database. *Point prevalence on December 31 of each year. Adjusted for sex and race. The standard population was the U.S. population in 2011. Abbreviations: ESRD, end-stage renal disease.*

PREVALENCE: BY RACE AND ETHNICITY

The adjusted prevalence of ESRD continues to rise among Whites, Blacks, and Asian Americans (Figure 1.14). However, the remarkable decline in incidence rates among Native Americans has resulted in a decline in the prevalence of ESRD in this population over the past decade, from a peak of 2,991 in 2001 to 2,101 in 2014, a 50% decline. In 2014, the prevalence per million was 5,605 among Blacks, 2,101 among Native Americans, 2,198 among Asians, and 1,507 among Whites (Figure 1.14). The prevalence of ESRD remains much higher in Blacks than in other racial groups, at nearly 2.6-fold higher than Native Americans and Asians, and nearly 3.7-fold higher than Whites.

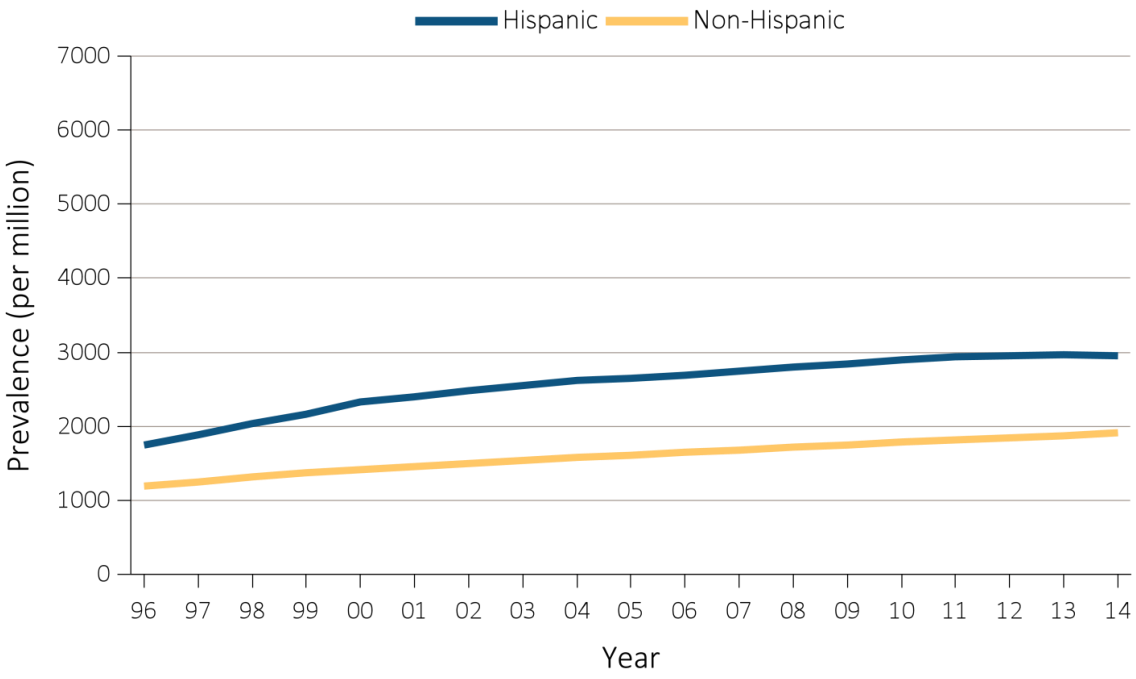
vol 2 Figure 1.14 Trends in adjusted* prevalence (per million) of ESRD, by race, in the U.S. population, 1996-2014



*Data Source: Reference Table B.2(2) and special analyses, USRDS ESRD Database. *Point prevalence on December 31 of each year. Adjusted for age and sex. The standard population was the U.S. population in 2011. Abbreviations: Af Am, African American; ESRD, end-stage renal disease.*

The adjusted ESRD prevalence has continued to rise for both non-Hispanics and Hispanics, though it may be plateauing among Hispanics since 2011 (Figure 1.15). In 2014, the adjusted prevalence was 1,912 per million among non-Hispanics and nearly 58% higher, at 2,958 per million, among Hispanics.

vol 2 Figure 1.15 Trends in the adjusted* prevalence (per million) of ESRD, by Hispanic ethnicity, in the U.S. population, 1996-2014

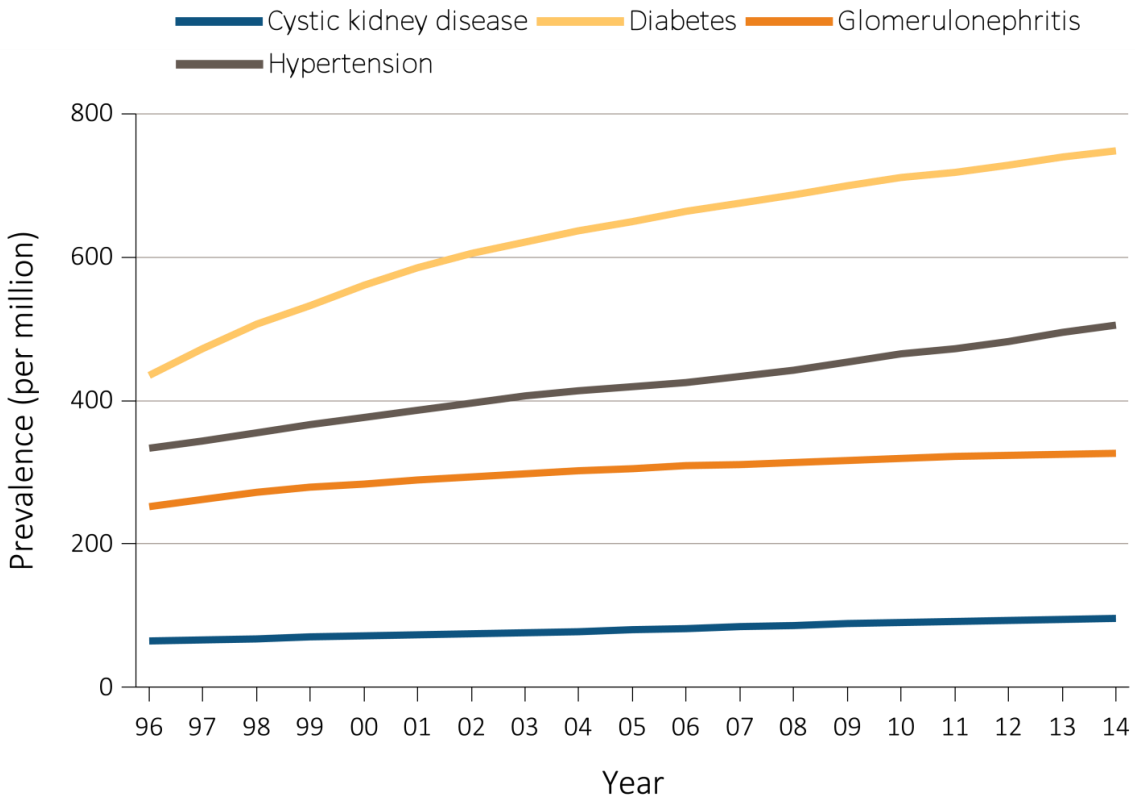


*Data Source: Reference Tables B.1, B.2(2). *Point prevalence on December 31 of each year. Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

PREVALENCE: BY PRIMARY CAUSE OF ESRD

The prevalence of ESRD with diabetes, hypertension, glomerulonephritis, or cystic kidney disease listed as the primary cause has continued to rise since 1996 (Figure 1.16), despite the recent stabilization of incidence rates. For diabetes as the primary cause, the increase in adjusted prevalence has been more gradual over the last 12 years than it had been previously.

vol 2 Figure 1.16 Trends in adjusted* prevalence (per million) of ESRD, by primary cause of ESRD, in the U.S. population, 1996-2014



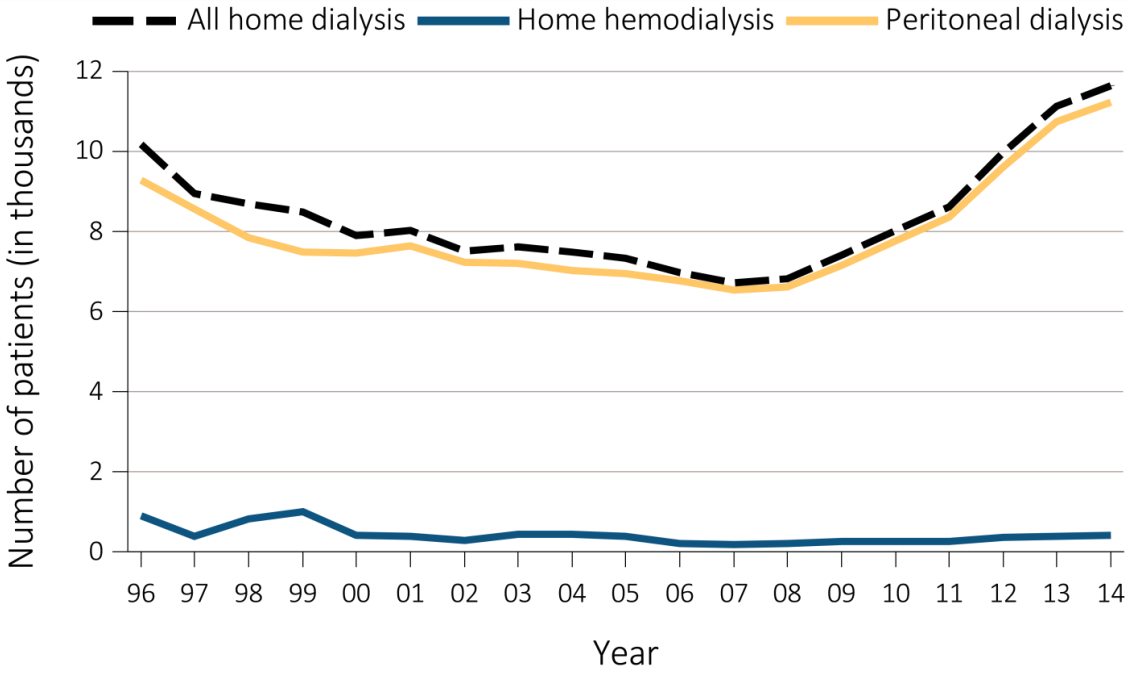
*Data Source: Reference Table B.2(2) and special analyses, USRDS ESRD Database. *Point prevalence on December 31 of each year. Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.*

Modality of Renal Replacement Therapy: Incident ESRD Cases

TRENDS IN INCIDENT COUNTS: BY RRT MODALITY

Use of home dialysis among incident ESRD patients has increased notably in recent years (Figure 1.17). Home dialysis use overall in 2014 was 73% higher than at its nadir in 2007. Use of peritoneal dialysis and home hemodialysis in 2014 were 72% and 120% higher, respectively, than in 2007. Despite the large relative rise in home hemodialysis, its overall use among incident ESRD patients is low, as only 3.4% of home dialysis patients were treated with hemodialysis in 2014. Peritoneal dialysis remains the dominant form of home dialysis.

vol 2 Figure 1.17 Trends in the number of incident ESRD cases (in thousands) using home dialysis, by type of therapy, in the U.S. population, 1996-2014



Data Source: Reference Table D.1. Abbreviations: ESRD, end-stage renal disease.

RRT MODALITY USE: BY PATIENT CHARACTERISTICS

Use of peritoneal dialysis and pre-emptive kidney transplants were markedly more common in younger groups and were somewhat less common among Black or Hispanic patients (Table 1.5). Use of peritoneal dialysis and pre-emptive kidney transplants were more common among patients with glomerular or cystic kidney disease, versus diabetes or hypertension, as the primary cause of ESRD. This difference may be attributed in part to age, as both glomerular and cystic kidney disease are more common in younger patients.

vol 2 Table 1.5 Number and percentage of incident cases of hemodialysis, peritoneal dialysis, and transplantation by age, sex, race, ethnicity, and primary cause of ESRD, in the U.S. population, 2014

	Total	HD		PD		Transplant	
		n	%	n	%	n	%
Age							
0-21	1,413	722	51.1	420	29.7	271	19.2
22-44	13,630	10,926	80.2	1,976	14.5	728	5.3
45-64	46,674	40,437	86.6	4,742	10.2	1,495	3.2
65-74	30,945	27,887	90.1	2,506	8.1	552	1.8
75+	27,773	26,125	94.1	1,592	5.7	56	0.2
Sex							
Male	69,968	61,612	88.1	6,580	9.4	1,776	2.5
Female	50,467	44,485	88.1	4,656	9.2	1,326	2.6
Race							
White	80,560	70,312	87.3	7,861	9.8	2,387	3.0
Black/African American	31,894	29,115	91.3	2,484	7.8	295	0.9
Asian	6,067	5,087	83.8	753	12.4	227	3.7
Native American	1,097	997	90.9	67	6.1	33	3.0
Other/Unknown	817	586	71.7	71	8.7	160	19.6
Ethnicity							
Hispanic	17,459	15,614	89.4	1,566	9.0	279	1.6
Non-Hispanic	102,976	90,483	87.9	9,670	9.4	2,823	2.7
Primary Cause of ESRD							
Diabetes	53,525	48,311	90.3	4,774	8.9	440	0.8
Hypertension	34,087	30,857	90.5	2,950	8.7	280	0.8
Glomerulonephritis	9,038	6,991	77.4	1,495	16.5	552	6.1
Cystic Kidney	2,543	1,536	60.4	537	21.1	470	18.5
Other/Unknown	21,242	18,402	86.6	1,480	7.0	1,360	6.4
Total	120,435	106,097	88.1	11,236	9.3	3,102	2.6

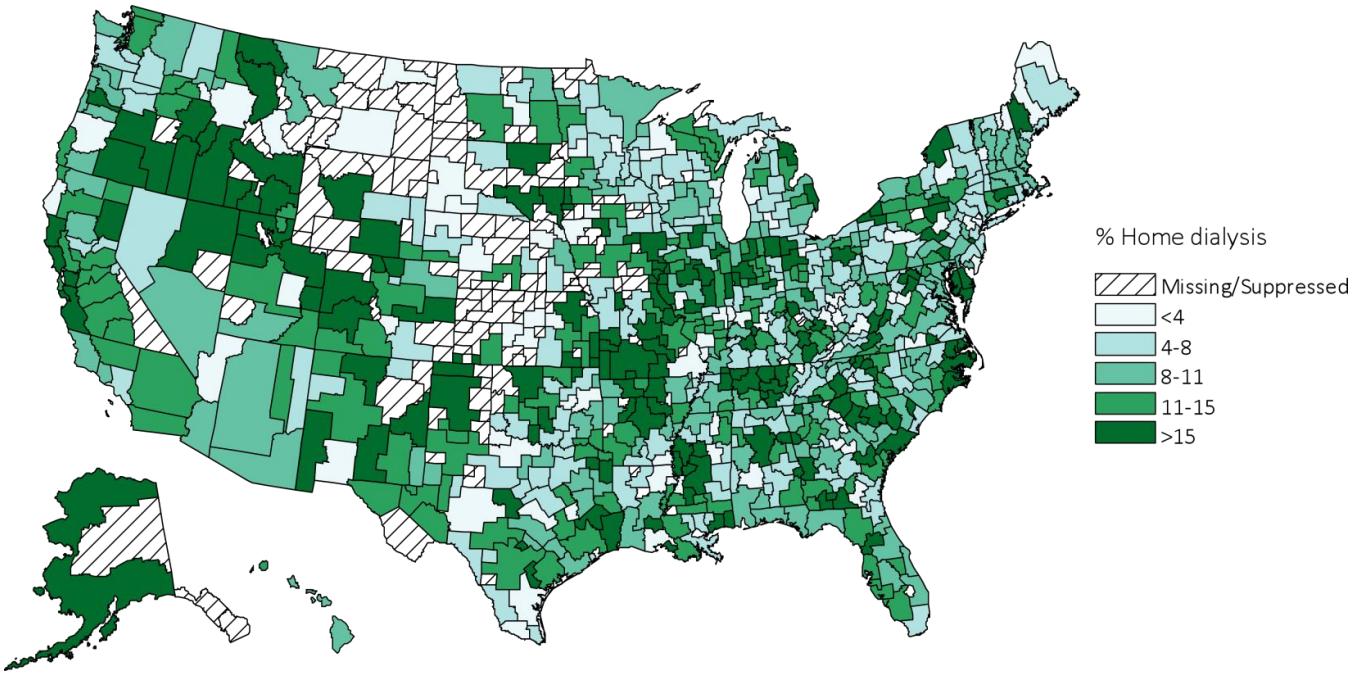
Data Source: Special analyses, USRDS ESRD Database. The numbers in this table exclude "Other PD" and "Uncertain Dialysis." Abbreviations: ESRD, end-stage renal disease; HD, hemodialysis; PD, peritoneal dialysis.

RRT MODALITY USE: BY REGION

Among incident ESRD cases, hemodialysis was the predominant modality in all networks, ranging from 85.1% in Network 12 (IA, KS, MO, NE) to 92.1% in Network 2 (NY) (Table 1.2). Use of peritoneal dialyses varied over 2-fold, from to 4.5% in Network 2 (Table 1.2) to 13.8% in Network 17 (Table 1.2). Pre-emptive kidney transplantation remained an uncommon initial RRT modality (2.5% overall), although its use ranged over 3-fold from 1.4% in Network 18 to 4.6% in Network 1.

The proportion of incident dialysis cases using home dialysis varied substantially across 677 Health Services Areas, ranging from 0% to 55% (interquartile range: 6.5% to 14.3%) (Figure 1.18). Geographic patterns are not apparent, supporting the likelihood that differences in home dialysis use are largely driven by differences among individual dialysis centers or groups of centers, rather than by large-scale regional effects.

vol 2 Figure 1.18 Map of the percentage of incident dialysis cases using home dialysis (peritoneal dialysis or home hemodialysis), by Health Service Area, 2014



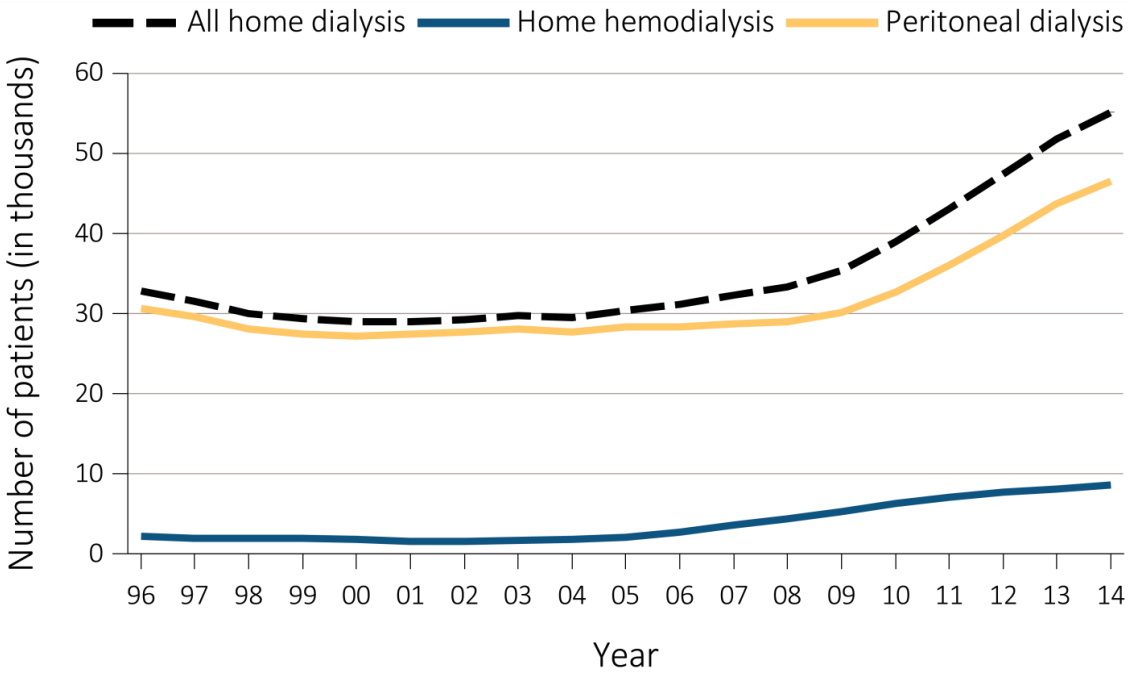
Data Source: Special analyses, USRDS ESRD Database. Values for cells with 10 or fewer patients are suppressed.

Modality of Renal Replacement Therapy: Prevalent ESRD Cases

TRENDS IN PREVALENT COUNTS: BY RRT MODALITY

The use of home dialysis (peritoneal dialysis or home hemodialysis) among prevalent ESRD cases has increased appreciably in recent years (Figure 1.19), mirroring patterns shown for incident dialysis cases (Figure 1.17). Home dialysis accounted for 11.6% of all prevalent dialysis patients in 2014, up from a low of 8.7% in 2008. Among home dialysis cases, the proportion using hemodialysis was over 2.5-fold higher in 2014 (15.6%) than in 2000 (6.2%).

vol 2 Figure 1.19 Trends in number of prevalent ESRD cases (in thousands) using home dialysis, by type of therapy, in the United States, 1996-2014



Data Source: Reference Table D.1. December 31 prevalent ESRD patients. Peritoneal dialysis consists of CAPD and CCPD only. Abbreviations: CAPD, continuous ambulatory peritoneal dialysis; CCPD, continuous cycler peritoneal dialysis; ESRD, end-stage renal disease.

RRT MODALITY USE: BY PATIENT CHARACTERISTICS

Distributions of modality use by patient characteristics generally mirror those for incident patients. Uses of peritoneal dialysis and kidney transplant were more common among patients who were younger, White, non-Hispanic, and with glomerular disease or cystic kidney disease as the primary cause of ESRD (Table 1.6).

vol 2 Table 1.6 Percentage of prevalent cases of in-center hemodialysis, home hemodialysis, peritoneal dialysis, and transplant by age, sex, race, ethnicity, and primary ESRD diagnosis, in the United States, 2014

	Total	HD		PD		Transplant	
		n	%	n	%	n	%
Age							
0-21	9,783	1,783	18.2	1,131	11.6	6,869	70.2
22-44	101,298	50,922	50.3	8,797	8.7	41,579	41.0
45-64	298,786	177,690	59.5	20,609	6.9	100,487	33.6
65-74	157,089	106,869	68.0	9,943	6.3	40,277	25.6
75+	109,043	91,294	83.7	6,054	5.6	11,695	10.7
Sex							
Male	389,372	243,883	62.6	25,658	6.6	119,831	30.8
Female	286,562	184,637	64.4	20,873	7.3	81,052	28.3
Race							
White	414,472	240,919	58.1	30,680	7.4	142,873	34.5
Black/African American	208,419	156,716	75.2	11,697	5.6	40,006	19.2
Asian	38,644	23,463	60.7	3,472	9.0	11,709	30.3
Native American	7,325	5,099	69.6	432	5.9	1,794	24.5
Other/Unknown	7,139	2,361	33.1	253	3.5	4,525	63.4
Ethnicity							
Hispanic	115,330	78,135	67.7	7,190	6.2	30,005	26.0
Non-Hispanic	560,669	350,423	62.5	39,344	7.0	170,902	30.5
Primary Cause of ESRD							
Diabetes	255,896	193,487	75.6	17,078	6.7	45,331	17.7
Hypertension	170,487	125,422	73.6	12,377	7.3	32,688	19.2
Glomerulonephritis	108,406	44,073	40.7	8,440	7.8	55,893	51.6
Cystic Kidney	31,794	9,850	31.0	2,064	6.5	19,880	62.5
Other/Unknown	109,416	55,726	50.9	6,575	6.0	47,115	43.1
Total	675,999	428,558	63.4	46,534	6.9	200,907	29.7

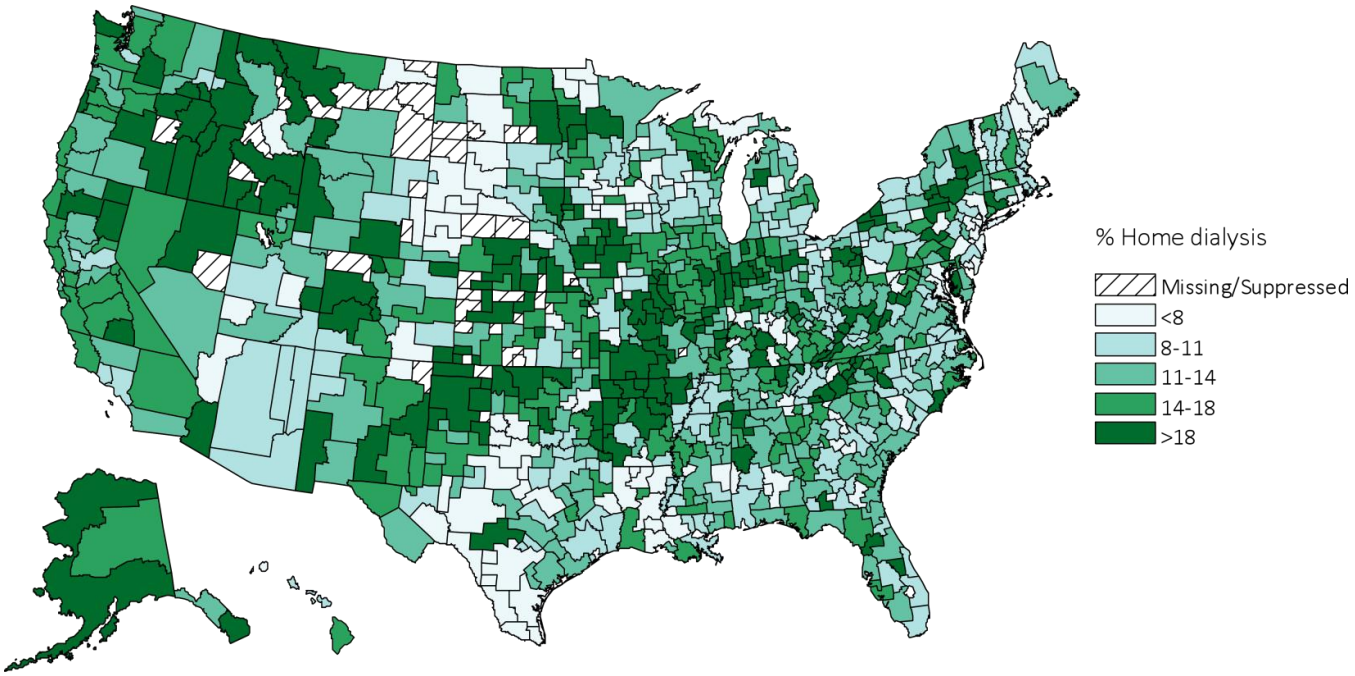
Data Source: Special analyses, USRDS ESRD Database. The numbers in this table exclude "Other PD" and "Uncertain Dialysis."
Abbreviation: ESRD, end-stage renal disease; HD, hemodialysis; PD, peritoneal dialysis.

RRT MODALITY USE: BY REGION

As observed for incident dialysis cases, RRT modality use among prevalent ESRD cases varied substantially by region. Use ranged between networks from 54% to 69% for hemodialysis, from 4% to 9% for peritoneal dialysis, and from 23% to 39% for transplantation (Table 1.4). The percent on hemodialysis was generally higher and the percent with a transplant was generally lower in networks with higher prevalence of ESRD.

Across 763 Health Service Areas in 2014, the percent of prevalent dialysis cases using home dialysis ranged from 0% to 83% (interquartile range: 9.5% to 17.2%) (Figure 1.20). Health Service Areas with home dialysis use ranging from low to high were found in most regions of the country.

vol 2 Figure 1.20 Map of the percentage of prevalent dialysis cases using home dialysis, by Health Service Area, 2014



Data Source: Special analyses, USRDS ESRD Database. Values for cells with 10 or fewer patients are suppressed.

Patient and Treatment Characteristics at ESRD Onset

PRE-ESRD CARE

In 2014, 24% of patients starting ESRD therapy in 2014 were reported on the CMS 2728 form as not having received nephrology care prior to ESRD onset (Table 1.7). This reflects little change from 25% in 2013. An additional 13% had unknown duration of pre-ESRD nephrology care. Because treatment characteristics (e.g., erythropoiesis-stimulating agent [ESA] use and dietary care) for this group were similar to those for no pre-ESRD nephrology care, one may assume that up to 38% of new ESRD cases received little or no pre-ESRD nephrology care (Table 1.7.a).

Several differences are notable in the distributions of pre-ESRD nephrology care by patient characteristics. Young patients (0-21 years) were most likely (43%), and adults aged 22-64 years were least likely (28%), to have had longer duration (12 months or more) of pre-ESRD nephrology care. Blacks were slightly less likely to have had pre-ESRD care than were other racial groups, and Hispanics were less likely to have had pre-ESRD care than were non-Hispanics.

ESRD patients with a primary etiologic diagnosis of cystic kidney disease or, to a lesser extent, glomerulonephritis were more likely to have had pre-ESRD nephrology care than were patients with a diagnosis of diabetes or hypertension. Having no nephrology care was most common for patients with hypertension as the primary cause of ESRD. One could surmise that some patients initially presenting at or near dialysis facilities might be assigned this diagnosis in the absence of evidence of other possible etiologies.

Patients receiving longer pre-ESRD nephrology care were relatively more likely to use an ESA before ESRD, receive dietary care before ESRD, and start dialysis with an arteriovenous fistula (AV) fistula, rather than a central venous catheter (Table 1.7.b). Patients receiving longer pre-ESRD nephrology care were less likely to start dialysis at either very low eGFR levels (<5 ml/min/1.73m^2) or very high (≥15 ml/min/1.73m^2) eGFR levels.

vol 2 Table 1.7 Distribution (%) of the reported duration of pre-ESRD nephrology care, by (a) demographic and (b) clinical characteristics, among incident ESRD cases in the U.S. population, 2014

(a) Demographic characteristics (% within row)

		Duration of pre-ESRD nephrology care				
	No. of cases	>12 mo.	6-12 mo.	0-6 mo.	None	Unknown
Total	116290	30.6	18.6	13.2	24.2	13.4
Age						
0-21	1523	43.1	13.8	15.1	22.1	5.9
22-44	13513	27.4	17.8	13.1	29.1	12.5
45-64	44653	28.1	18.8	13.6	26	13.3
65-74	29745	32.8	18.9	12.9	21.8	13.5
75+	26856	33.1	18.5	12.7	21.3	14.2
Sex						
Female	49041	30.8	18.6	13.4	23.6	13.5
Male	67249	30.5	18.5	13	24.6	13.3
Race						
Native American	1158	27.6	18.6	18.4	26.2	9.1
Asian	6029	30.5	19.5	15	21.7	13.2
Black/African American	31252	26.2	18.4	12.7	26.8	15.6
White	77843	32.4	18.5	13.1	23.3	12.6
Other/Unknown	*	*	*	12.5	12.5	50
Ethnicity						
Non-Hispanic	99715	31.8	18.6	13	23.4	13.1
Hispanic	16575	23.3	18.5	14	29	15.1
Primary Diagnosis						
Diabetes	53642	31.4	20.6	13.7	21	13.3
Hypertension	34226	27.4	17.9	13.1	25.6	15.9
Glomerulonephritis	9151	38.8	17.8	12.6	22.7	8
Cystic kidney	2573	58.3	16.3	8.6	9.6	7.2
Other/Unknown	16698	25.8	13.9	12.8	34.5	12.4

Table 1.7 continued on next page.

vol 2 Table 1.7 Distribution (%) of the reported duration of pre-ESRD nephrology care, by (a) demographic and (b) clinical characteristics, among incident ESRD cases in the U.S. population, 2014 *(continued)*

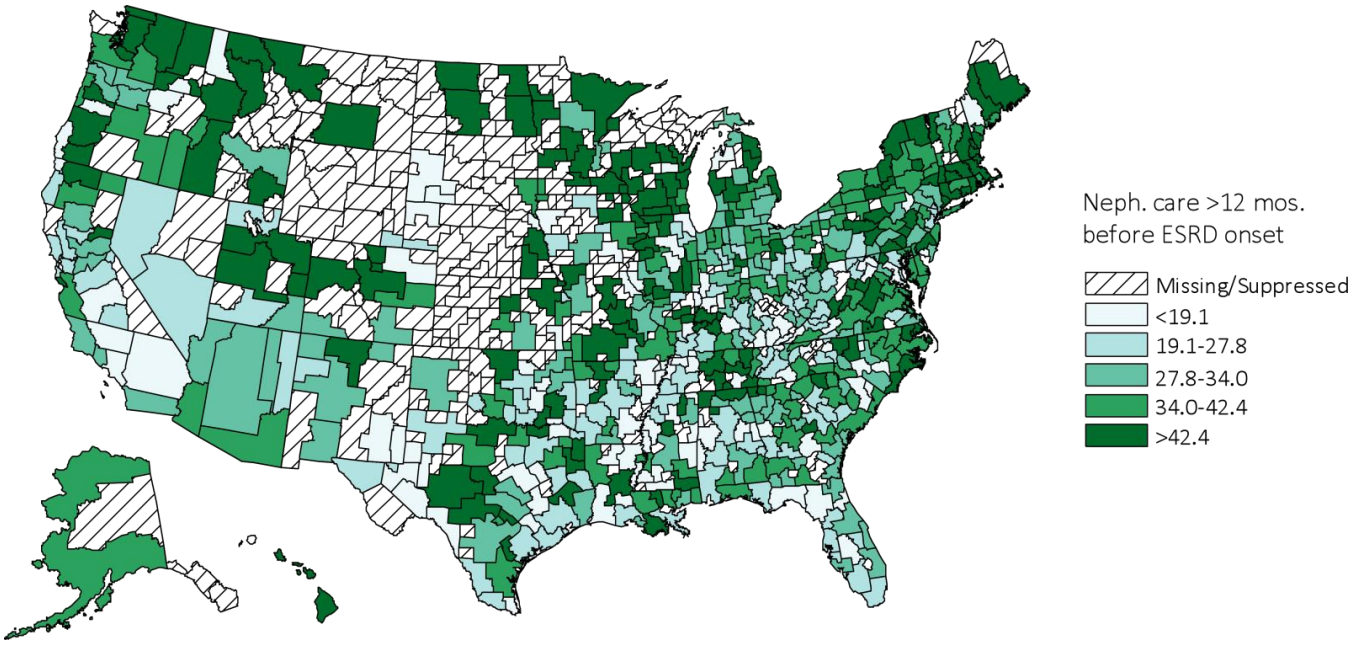
(b) Clinical characteristics (% within row)

		Duration of pre-ESRD Nephrology Care				
Total	**No. of cases**	**>12 mo.**	**6-12 mo.**	**0-6 mo.**	**None**	**Unknown**
Dietary care						
No	106987	28.7	17.9	12.5	26.2	14.5
Yes	9303	52.6	25.5	20.7	0.8	0.4
ESA use						
No	99400	26.7	17.5	12.5	27.8	15.5
Yes	16890	53.7	25.1	17.2	3	1
eGFR at RRT start						
<5	16366	25.3	16.4	11.3	33.8	13.1
5-<10	54384	32.4	19.3	13.1	22.8	12.5
10-<15	31461	32.4	19.2	14.1	20.8	13.4
>=15	13967	26.1	16.7	13.7	25.9	17.4
Vascular Access						
AV fistula	17253	55.1	24	9.5	3.8	7.5
AV graft	2965	43.1	24.3	13.6	9.7	9.2
CVC with maturing fistula/graft	19087	30.7	21.9	14.6	20.9	11.8
CVC only	63052	19	14.8	13.8	35	17.4
Other/Unknown	13933	49.8	23.1	12.7	7.9	5.7

*Data Source: Special analyses, USRDS ESRD Database. Population only includes incident cases with CMS form 2728. *Count ≤10. eGFR calculated using the CKD-EPI equation (CKD-EPI eGFR (ml/min/1.73 m^2) for those aged ≥18 years and the Schwartz equation for those aged <18 years. Abbreviations: AV, arteriovenous; CKD-EPI, chronic kidney disease epidemiology calculation; CVC, central venous catheter; eGFR, estimated glomerular filtration rate; ESA, erythropoiesis-stimulating agents; ESRD, end-stage renal disease; RRT, renal replacement therapy.*

The proportion of incident ESRD cases in 2014 with >12 months of pre-ESRD nephrology care was 31% in the United States; it varied substantially across 677 Health Services Areas, ranging from a low of 0% to a high of 83% (interquartile range: 24% to 43%) (Figure 1.21). Health Service Areas with the greatest proportions of patients with >12 months of pre-ESRD care were clustered in the Northeast, Upper Midwest, and Northwest, where over 40% of patients were under a nephrologists care for >12 months prior to ESRD.

vol 2 Figure 1.21 Percent of incident cases who had received >12 months of pre-ESRD nephrology care, by Health Service Area, 2014

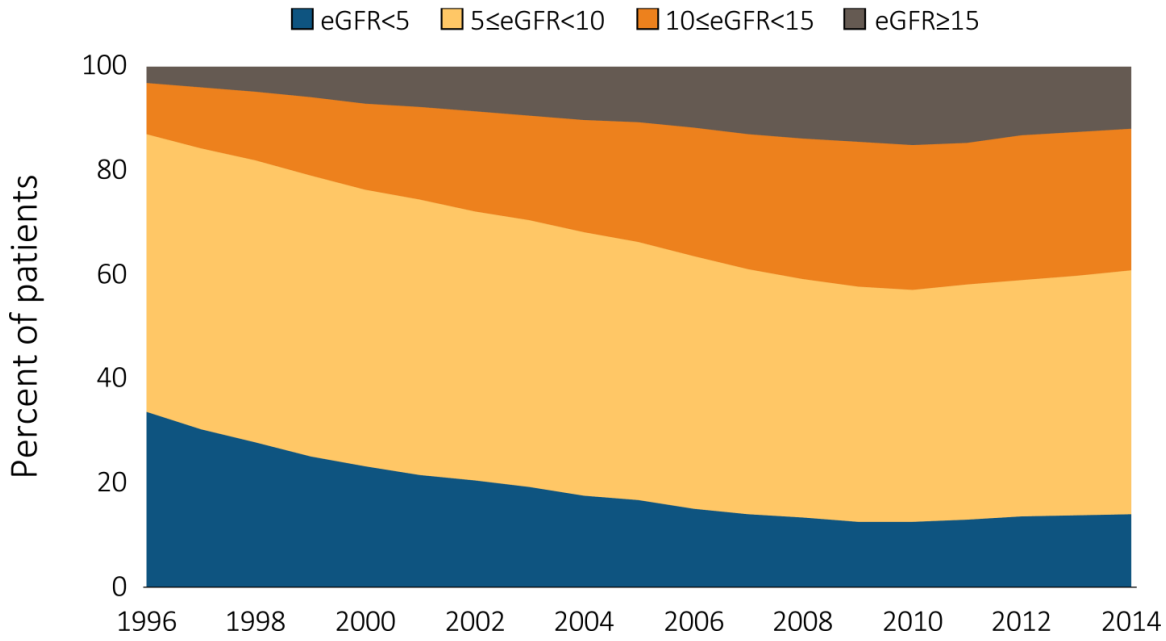


Data Source: Special analyses, USRDS ESRD Database. Population only includes incident cases with CMS form 2728. Values for cells with 10 or fewer patients are suppressed. Abbreviations: ESRD, end-stage renal disease; Neph., nephrology.

eGFR at ESRD onset

Figure 1.22 shows that the percentage of incident ESRD cases who were started on renal replacement therapy at higher eGFR levels increased steadily from 1996 until 2010, but has been stable or decreased slightly from 2010 to 2014. For example, the percent of incident ESRD cases starting with eGFR at ≥10 ml/min/1.73 m² rose from 13% in 1996 to 43% in 2010, but decreased to 39% in 2014. The percent of incident ESRD cases who started therapy at eGFR <5 ml/min/1.73 m² decreased from 34% in 1996 to 13% in 2010, and was 14% in 2014.

vol 2 Figure 1.22 Trends in the distribution (%) of eGFR (ml/min/1.73 m^2) among incident ESRD patients, 1996-2014



Data Source: Special analyses, USRDS ESRD Database. Population only includes incident cases with CMS form 2728. eGFR calculated using the CKD-EPI equation (CKD-EPI eGFR (ml/min/1.73 m^2) for those aged ≥18 and the Schwartz equation for those aged <18. Abbreviations: CKD-EPI; chronic kidney disease epidemiology calculation; eGFR, estimated glomerular filtration rate; ESRD, end-stage renal disease.

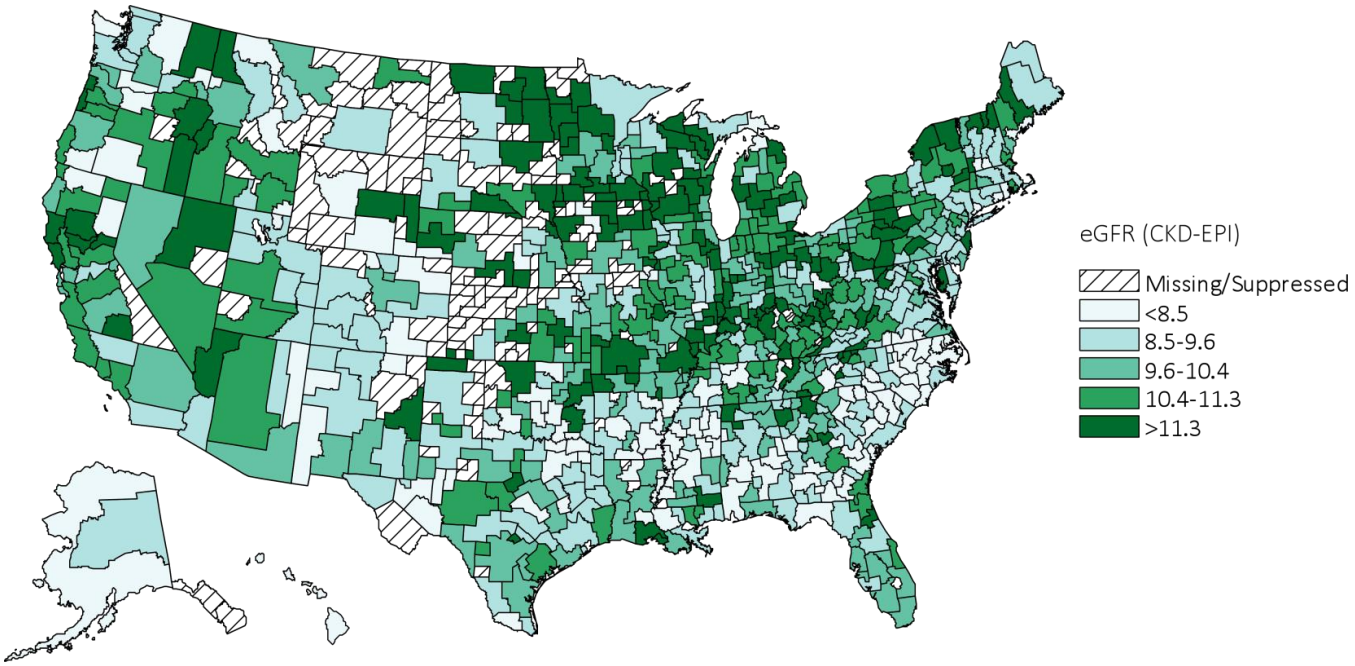
Mean eGFR at ESRD start was higher among young patients (0-21 years), males, Whites, non-Hispanics, or those with diabetes as the primary cause of ESRD (Table 1.8). Mean eGFR at ESRD start in 2013 varied substantially by Health Service Area (Figure 1.23). For example, Health Service Areas with higher average eGFRs at initiation of ESRD clustered in the North and Midwest regions, and Health Service Areas with lower average eGFRs at ESRD start clustered in the South.

vol 2 Table 1.8 Distributions of laboratory values (mean) and treatment characteristics (%), by age, sex, race, ethnicity, and primary cause of ESRD, among incident ESRD cases, 2014

		Nutrition		Anemia		Lipids		Diabetes
	eGFR (mL/min / 1.73 m^2)	Serum albumin (g/dL)	Dietary care (%)	Hemoglobin (g/dL)	ESA use (%)	Total cholesterol (mg/dL)	LDL (mg/dL)	HbA1c (%)
Age								
0-21	13.41	3.4	37.5	9.7	27.7	177	106.9	5.27
22-44	9.49	3.3	7.5	9.4	10.3	172	102.2	7.03
45-64	9.97	3.2	7.7	9.4	12.0	159	90.9	6.87
65-74	10.31	3.2	7.9	9.5	14.9	149	83.0	6.68
75+	10.44	3.2	6.8	9.6	16.2	143	77.5	6.43
Sex								
Male	10.48	3.2	8.0	9.6	12.5	148	84.0	6.71
Female	9.71	3.2	7.6	9.4	15.5	165	92.9	6.78
Race								
White	10.43	3.2	8.2	9.6	13.9	152	85.3	6.73
Black/African American	9.72	3.2	6.4	9.2	12.4	160	92.7	6.71
Native American	9.36	2.9	6.6	9.3	13.7	146	77.1	7.18
Asian	8.94	3.3	10.8	9.4	18.6	164	91.5	6.74
Ethnicity								
Hispanic	9.61	3.2	7.4	9.4	12.0	156	89.1	6.80
Non-Hispanic	10.24	3.2	7.9	9.5	14.1	155	87.2	6.73
Primary Cause of ESRD								
Diabetes	10.35	3.1	7.5	9.4	15.3	154	86.6	7.09
Hypertension	9.67	3.3	6.1	9.6	12.2	154	87.1	6.17
Glomerulonephritis	9.19	3.3	11.2	9.6	18.0	171	99.3	5.93
Cystic Kidney	9.35	3.8	15.0	10.3	16.1	161	88.1	5.68
Total	10.15	3.2	7.9	9.5	13.7	155	87.5	6.74

Data Source: Special analyses, USRDS ESRD Database. Abbreviations: eGFR, estimated glomerular filtration rate; ESA, erythropoiesis-stimulating agents; ESRD, end-stage renal disease; HbA1c, glycosylated hemoglobin; LDL, low-density lipoprotein.

vol 2 Figure 1.23 Map of mean eGFR at initiation of renal replacement therapy, by Health Service Area, 2014

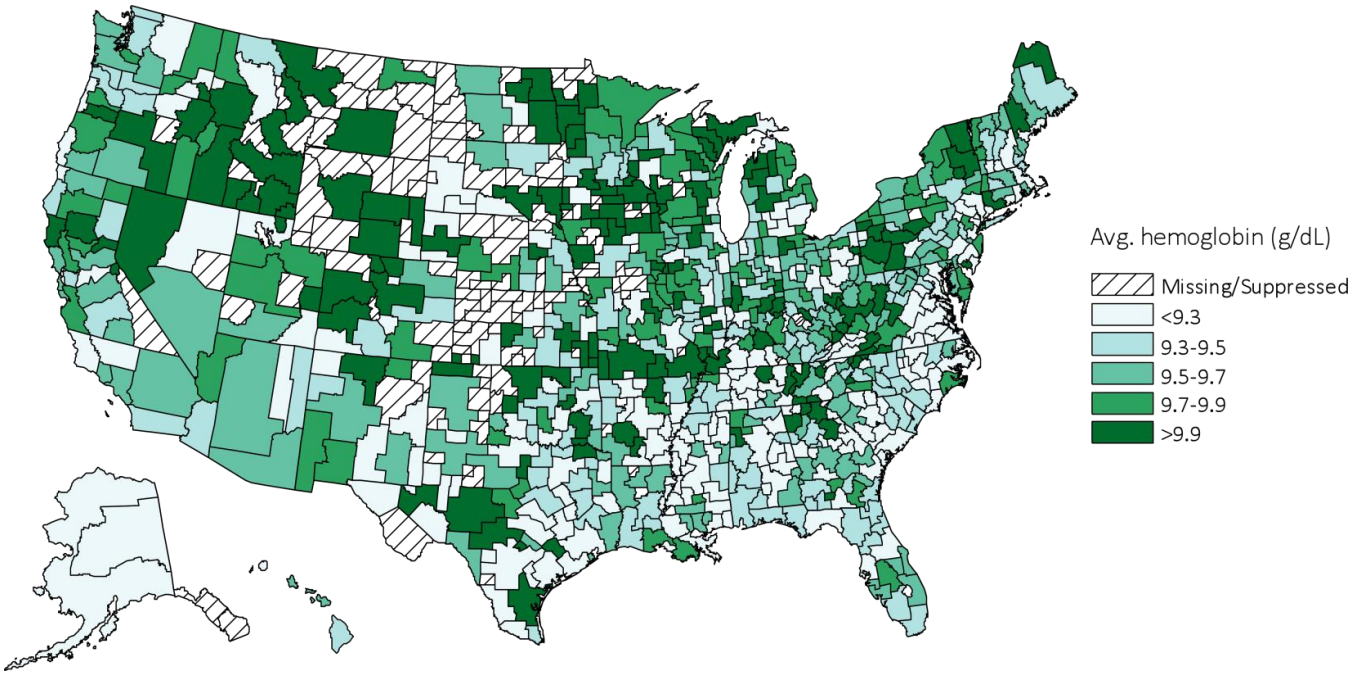


Data Source: Special analyses, USRDS ESRD Database. Population only includes incident cases with CMS form 2728. eGFR calculated using the CKD-EPI equation (CKD-EPI eGFR (ml/min/1.73 m^2) for those aged ≥18 and the Schwartz equation for those aged <18. Values for cells with 10 or fewer patients are suppressed. Abbreviations: eGFR, estimated glomerular filtration rate; CKD-EPI, chronic kidney disease epidemiology calculation.

ANEMIA AT ESRD ONSET

The overall mean hemoglobin level at ESRD onset in 2014 was 9.5 g/dL. Incident ESRD cases with cystic kidney disease as the primary cause had higher mean hemoglobin levels at ESRD onset than did other ESRD cases (Table 1.9). Figure 1.24 shows the distribution of mean hemoglobin levels by Health Service Area across the United States. There appear to be large Health Service Areas with higher average hemoglobin levels in the western half of the United States, especially in the Rocky Mountain areas, with smaller areas with higher hemoglobin at start of ESRD across the rest of the country.

vol 2 Figure 1.24 Map of average hemoglobin level at initiation of renal replacement therapy, by Health Service Area, 2014



Data Source: Special analyses, USRDS ESRD Database. Population only includes incident cases with CMS form 2728. Values for cells with 10 or fewer patients are suppressed. Abbreviation: ESRD, end-stage renal disease.

VARIATION IN TREATMENT CHARACTERISTICS BY ESRD NETWORK

Geographic variation in pre-ESRD care is also evident by ESRD Network. Most pronounced was over 2-fold variation in the percentage of incident ESRD cases with pre-ESRD nephrology care >12 months, ranging from 47% in Network 1 to 20% in Network 18. Mean eGFR at ESRD start ranged from 8.9 ml/min/1.73m² in Network 6 to 10.7 ml/min/1.73m² in Network 11. Mean hemoglobin at dialysis start ranged from 9.4 to 9.8 g/dL across the 18 Networks (Table 1.9). At the ESRD Network level, regional variation in eGFR at initiation does not seem to be associated with regional variation in length of time with pre-ESRD nephrology care (Table 1.9).

vol 2 Table 1.9 Distribution of duration of pre-ESRD nephrology care, hemoglobin level, and eGFR, by ESRD Network, among incident ESRD cases, 2014

Network	States* in network	Duration of pre-ESRD nephrology care (% in row)					Mean eGFR (ml/min/1.73 m^2)	Mean Hgb (g/dL)
		>12 months	6-12 months	0-6 months	None	Unknown		
18	S. CA	19.6	16.3	16.8	24.4	23.0	10.3	9.6
14	TX	25.0	18.4	14.6	29.0	12.9	9.4	9.5
10	IL	25.8	16.7	13.4	22.2	21.9	10.2	9.5
5	MD, DC, VA, WV	26.4	20.8	13.9	25.4	13.5	9.6	9.4
7	FL	26.5	17.7	12.9	27.0	15.9	10.0	9.4
3	NJ, PR	27.4	19.6	9.9	35.3	7.7	9.6	9.5
13	AR, LA, OK	28.3	18.5	11.7	26.4	15.1	9.5	9.5
9	IN, KY, OH	30.3	20.6	11.7	20.6	16.8	10.6	9.5
8	AL, MS, TN	30.5	18.9	12.6	26.1	11.9	9.1	9.3
17	N. CA, HI, GUAM, AS	30.7	20.7	14.8	21.3	12.5	10.1	9.5
15	AZ, CO, NV, NM, UT, WY	32.2	18.1	16.2	22.5	11.0	10.4	9.7
2	NY	32.7	17.3	11.8	23.6	14.6	9.3	9.3
6	NC, SC, GA	33.8	19.0	12.6	23.1	11.4	8.9	9.4
12	IA, KS, MO, NE	35.4	17.9	12.2	24.8	9.8	10.5	9.8
4	DE, PA	36.0	19.2	13.7	21.0	10.1	10.1	9.6
11	MI, MN, ND, SD, WI	39.4	16.8	11.7	22.4	9.7	10.7	9.5
16	AK, ID, MT, OR, WA	43.5	19.3	14.6	18.6	4.1	10.1	9.7
1	CT, MA, ME, NH, RI, VT	47.1	19.6	10.2	15.3	7.8	9.2	9.6
	All networks	30.6	18.6	13.2	24.2	13.4	9.8	9.5

*Data Source: Special analyses, USRDS ESRD Database. Population only includes incident cases with CMS form 2728. eGFR calculated using the CKD-EPI equation (CKD-EPI eGFR (ml/min/1.73 m^2) for those aged ≥18 years and the Schwartz equation for those aged <18 years. Listed from lowest to highest by >12 months duration of pre-ESRD nephrology care. *Includes 50 states, Washington, D.C. (DC), Puerto Rico (PR), Guam (GU), and American Samoa (AS). Northern and Southern California (CA) split into Networks 17 and 18. Abbreviations: ESRD, end-stage renal disease; eGFR, estimated glomerular filtration rate; CKD-EPI, chronic kidney disease epidemiology calculation; Hgb, hemoglobin.*