...care and labor are as much correlated to human existence as shadow is to light.

*Harriet Beecher Stowe, Household Papers & Stories*
Growth of the ESRD program, particularly of the dialysis patient population, has required providers to keep pace by increasing the number of units that deliver services to ESRD patients. Reimbursement for dialysis services is capitated on a per treatment basis, and includes costs for staff and supplies, overhead, and ancillary support services. This capitation has placed increased pressure on providers to reduce costs over time, particularly since the rates of payment have changed minimally since their implementation in 1982. The consolidation of dialysis providers into large chains, and the transition of these providers from non-profit to for-profit status, are both consistent with the need for increased capital to build dialysis units and with the inability of non-profits to compete. Detailed information on the costs associated with dialysis services can be found in the latter part of this chapter and in Chapter Twelve.

Within this chapter we present information on recent trends in the dialysis infrastructure and on how these changes relate to provider profit status, growth in the number of dialysis treatments, and differences in geographic distribution of providers across ESRD networks, states, and Health Service Areas.

Since providers affiliated with large dialysis chains are not equally distributed across the country, the characteristics of the patients they serve can vary. We illustrate the descriptive characteristics of these patients by provider type and dialysis modality, and explain why direct comparisons should be viewed with caution unless data are adjusted for the mix of patients. We also present data from the Medical Evidence form (2728), including primary diagnosis, estimated glomerular filtration rate (eGFR), body mass index (BMI), albumin level, and pre-ESRD erythropoietin use.

Elsewhere in this chapter we present data on variations in the use of peritoneal dialysis, the number of transplants, staffing patterns, indicators of clinical care (hemoglobin level, erythropoietin dose per week, percent of patients receiving IV iron, and adequacy of dialysis therapy), vascular access rates, vaccination rates, anemia treatment, and dialysis adequacy. In each area we present data by provider, allowing readers to compare aspects of clinical care among the chain-affiliated and non-affiliated units.

The USRDS has been the first to analyze these elements of patient care in terms of unit chain affiliation, introducing such data in the previous two editions of the Annual Data Report. Because most nationwide guidelines on care have been instituted only recently, our assessments...
should be taken not as judgments of the care provided, but rather as baselines for future trend analyses.

The first national guidelines for ESRD care were published by the National Kidney Foundation in the fall of 1997 as part of their Kidney Disease Outcomes Quality Initiative (K/DOQI). The NKF has since published guidelines for patients with chronic kidney disease. The anticipated improvements in care fostered by these guidelines will be assessed in subsequent editions of the ADR.

Since many dialysis units are now affiliated with major dialysis chains, the USRDS uses data from several sources to determine unit ownership and to link patients with facilities. CMS obtains ownership information through its Independent Renal Facility Cost Report, which is submitted by each dialysis provider. From this information we have identified the five largest chains in the U.S., and analyzed patient-level data in relation to unit ownership. A chain-affiliated unit is defined by the USRDS as one of a group of 20 or more freestanding dialysis units that are owned by a common party and that are located in more than one state.

Since 1993, the number of dialysis units run by chain providers has accelerated (Figure 11.1). Prior to that time, fewer than 500 units were affiliated with chains. By 2000, however, this number had grown to 2,345, with 1,746 units considered non-affiliated. The number of dialysis patients cared for within chain-affiliated units in 2000 was 171,540, with 101,793 in non-chain units.

This growth in the number of units affiliated with chains has occurred predominantly within the for-profit sector, with 3,065 units designated as for-profit by 2000, and 958 as non-profit (Figure 11.2). These units treated 212,632 and 60,701 patients, respectively, a total prevalent dialysis population of 273,333. In 2000, 57.3 percent of all dialysis units were affiliated with chains, accounting for 62.8 percent of all dialysis patients.
The growing incidence of chronic kidney disease over the last ten years has been coupled with significant increases in the number of dialysis treatments, though these changes have not occurred consistently across the country.

ESRD Networks 2, 6, 9, 14, and 18 show the highest growth in the number of hemodialysis treatments, while peritoneal treatments have increased most in Networks 5, 8, 9, 15, and 18 (Figure 11.4). It is important to note, however, that the number of peritoneal treatments has decreased or remained the same in many areas of the country, illustrating a continuing decline in the use of this therapy as a modality of choice.

Since 1996 the number of dialysis units under corporate ownership has increased significantly (Figures 11.5–6). These units are concentrated most dramatically in the eastern and southern portions of the United States. Chain-affiliated units now exist in all ESRD networks, further demonstrating this transition to corporate ownership.

While the number of units has grown in all areas of the country, it is readily apparent that increases in the peritoneal dialysis population are far outpaced by those in the number of patients on hemodialysis (Figure 11.7).

It appears that—with the exception of Networks 17 and 18—the number of dialysis units is keeping pace with increases in the patient population. In some instances, such as Networks 2, 4, 9, 11, and 12, growth in the number of units has been far greater than that in the patient population (Figure 11.8).

The number of units available per 100,000 population differs widely across the country (Figure 11.10). This ratio can vary as much as seven times between the highest and lowest quintiles.

Figures 11.4, 11.7–9, & 11.11–12 data obtained from CMS’s annual End-Stage Renal Disease Facility Survey.

Figure 11.4 hemodialysis includes outpatient hemodialysis & hemodialysis training treatments; peritoneal dialysis includes outpatient IPD treatments & IPD, CAPD, & CCPD training treatments. Figures 11.5–6 data obtained from CMS’s annual End-Stage Renal Disease Facility Survey & Independent Renal Facility Cost Reports. Figure 11.7 percent change from 1996 to 2000, by state, unadjusted. Figure 11.10 2000, by HSA, unadjusted; data obtained from CMS’s annual End-Stage Renal Disease Facility Survey & estimates of the U.S. 2000 census (based on 1990 census figures).
Percent growth in numbers of units & patients

11.7  -  by state

Units

Hemodialysis patients

Peritoneal dialysis patients

11.8  -  by ESRD network

11.9  -  Distribution of patients, by unit type

11.10  -  Units per 100,000 population

11.11  -  Trends in distribution of for-profit & non-profit units, by ESRD network

11.12  -  Trends in distribution of freestanding & hospital-based units, by ESRD network

For a map of the ESRD networks, see Figure 1.40.
The composition of the ESRD program has changed considerably over the past ten years. More dialysis units are currently classified as for-profit, and corporate ownership has increased dramatically. In this section we compare patient demographic and clinical characteristics among the different types of units.

The number of units classified as freestanding and the number owned by corporations, as well as the number of patients who dialyze in these units, have increased significantly (Figure 11.13).

Prevalent dialysis patients in hospital-based units and units owned by Dialysis Clinics Incorporated (DCI) tend to be youngest (Figure 11.14). Patients in non-affiliated units, or units owned by chains other than the largest ones, are slightly older. The mean age of the incident population, 61.5 years, is somewhat higher than the 59.1 seen in prevalent patients (Figure 11.15).

Variations by unit type in terms of gender, race, and diabetic status are slight. While racial distributions among the various types of units are similar, patients of Hispanic ethnicity are not well represented. Hemodialysis, not surprisingly, is the preferred modality regardless of ownership.

Mean hemoglobin levels at the initiation of dialysis show little difference across unit type. EPO use prior to the start of ESRD treatment, however, varies from less than 29 percent in several of the larger chains to almost 34 percent in facilities owned by DCI.

These data suggest that differences in patient populations do exist among provider types, and that such differences may warrant further study.

Figure 11.13 dialysis patients; data obtained from CMS’s annual End-Stage Renal Disease Facility Survey & Independent Renal Facility Cost Reports.

Figures 11.14–15 prevalent dialysis patients, 2000; data obtained from CMS’s annual End-Stage Renal Disease Facility Survey, CMS’s Independent Renal Facility Cost Reports, & the USRDS database.

The lower limit of albumins measured by brom cresol purple is 3.2 gm/dl, & by brom cresol green is 3.5 gm/dl. The Medical Evidence form indicates the lower limit (± the test used) along with the patient’s albumin level; data here reflects all patients whose levels fall below the reported limit.
Producers vary greatly in their use of peritoneal dialysis. Compared to chain-affiliated units, those that are independently owned or hospital-based have a greater proportion of patients on peritoneal dialysis (Figure 11.16). Patterns of time on this modality, however, show little change. The percent of patients transplanted also varies, with units not affiliated with a corporation tending to have slightly more patients who receive a transplant (Figure 11.17).

Patient per station ratios vary by provider type, and range between 3.5 and 4.6 (Figure 11.19). Hospital-based units have the highest number of patients per station. These units also have the lowest patient-to-staff ratios, while the highest ratios are found in chain-affiliated facilities (Figure 11.20).

Overall mean hemoglobin levels and erythropoietin doses per week vary among providers, while the use of iron and the percent of patients with urea reduction ratios of 65 percent and greater show little difference by provider type (Figure 11.22).

Arteriovenous grafts and fistulas account for the majority of vascular accesses (Figure 11.24). Units with no corporate affiliation or that are hospital-based tend to use slightly more AV fistulas than are used elsewhere.

While rates of influenza and pneumococcal pneumonia vaccinations are generally similar across providers, it appears that patients in hospital-based units and units owned by Renal Care Group are most likely to receive this preventive care (Figure 11.26). In terms of staff members, more than 80 percent are vaccinated against hepatitis B (Figure 11.27).

**Figures 11.16–17** data obtained from CMS's annual End-Stage Renal Disease Facility Survey, CMS's Independent Renal Dialysis Facility Cost Reports, & the USRDS database. **Figures 11.18–19** data obtained from CMS's annual End-Stage Renal Disease Facility Survey & Independent Renal Dialysis Facility Cost Reports. **Figures 11.20–21 & 11.23–27** data obtained from CMS's annual End-Stage Renal Disease Facility Survey, CMS's Independent Renal Dialysis Facility Cost Reports, & the CDC's National Surveillance of Dialysis-Associated Diseases in the United States. **Figure 11.22** data obtained from CMS's End-Stage Renal Disease Facility Survey, CMS's Independent Renal Dialysis Facility Cost Reports, & the USRDS database.

**Figure 11.16** incident ESRD patients, 1996–1998 combined. **Figure 11.17** by patient's dialysis unit prior to transplant, 2000, intent-to-treat model. **Figure 11.18** 2000, by state, unadjusted. **Figure 11.19** 2000. **Figure 11.20** dialysis patients, 2000. **Figure 11.21** dialysis patients, 2000, by state, unadjusted.
11.22 - Anemia treatment & dialysis adequacy, by unit affiliation

Mean hemoglobin

- Hemoglobin (g/dl)
  - 10.5
  - 10.0
  - 9.5
  - 9.0
  - 8.5
  - 8.0
  - 7.5
  - 7.0

Weekly EPO dose

- EPO dose (thousands of units)
  - 19
  - 18
  - 17
  - 16
  - 15
  - 14
  - 13

Patients receiving iron

- Percent of patients
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100

Urea reduction ratio ≥65%

- Percent of patients with URR ≥65%
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100

11.23 - Membrane use, by unit affiliation

Membrane classifications
- Cellulose: cuprophane, saponified cellulose ester, regenerated cellulose
- Modified cellulose: cellulose acetate, diacetate, triacetate, hemophane
- Synthetic: Polysulfone, PMMA, PAN

11.24 - Vascular access use

- Non-cuffed catheters
- Cuffed catheters
- AV fistulas
- AV grafts
- Unknown

75-100%
50-74%
25-49%
<25%

11.25 - Geographic variations in the percent of patients with internal accesses

Chain-affiliated units
- 80.7+ (83.3)
- 75.3 to <80.7
- 71.9 to <75.3
- 70.1 to <71.9
- below 70.1 (39.7)

Non-chain units
- 80.7+ (84.6)
- 75.3 to <80.7
- 71.9 to <75.3
- 70.1 to <71.9
- below 70.1 (65.9)

11.26 - Patient vaccinations, by unit affiliation

Influenza
- Unknown
- 75-100%
- 50-74%
- 25-49%
- <25%

Pneumococcal pneumonia
- Unknown
- 75-100%
- 50-74%
- 25-49%
- <25%

11.27 - Staff vaccinations, by unit affiliation

Hepatitis B

Figure 11.22 period prevalent hemodialysis patients, 2000; iron: patients with Medicare iron claims between January 1 & September 30. Figure 11.23 1999. Figures 11.24–25 hemodialysis patients, 2000. Figure 11.26 dialysis patients, 2000.
Approximately eighty percent of all dialysis units in the United States reuse their hemodialyzers. Little information, however, is available on reuse as it relates to anemia treatment and dialysis adequacy. We look here at hemoglobin levels, EPO and iron dosing, and urea reduction ratios, and compare how these differ between dialysis units that perform reuse and those that do not. We also present geographic information showing the location of reuse and non-reuse units, as well as information on trends in germicide use and the types of hemodialyzer membranes most commonly preferred.

Hemoglobin levels are similar between patients who dialyze in reuse and non-reuse units (Figure 11.28), and there is little difference in EPO dosing, iron dosing, or urea reduction ratio distributions between the two populations (Figures 11.29–31).

The CDC’s National Surveillance of Dialysis-Associated Diseases shows that the use of high-flux and high-efficiency dialyzers in the United States has increased since 1995 (Figure 11.32), with synthetic-based dialyzers being used most frequently (Figure 11.34).

Peracetic acid is the preferred reuse germicide in the majority of ESRD networks, and is currently used in 60 percent of all U.S. units (Figures 11.33 and 11.35). The number of units that perform reuse has been stable since 1996, and currently stands at just under 80 percent (Figure 11.36). There are clear geographic patterns that show preferences in germicide use as well as the use of bleach to clean dialyzers (Figure 11.37). Differences in these patterns should be taken into consideration when comparing patient clinical outcomes in reuse and non-reuse dialysis units.

Figure 11.28 period prevalent hemodialysis patients, 2000, with at least one EPO claim & a hematocrit between 10 & 50 percent. Figure 11.29 period prevalent hemodialysis patients, 2000, with at least one EPO claim, ≤20 EPO administrations per month, & a hematocrit between 10 & 50 percent. Figure 11.30 period prevalent hemodialysis patients, January–September, 2000. Data include all patients with at least one EPO & one iron claim during January–September, 2000, & exclude patients with Medicare as secondary payer any time during the same period. Figure 11.31 period prevalent hemodialysis patients, 2000. Patients assigned to URR categories based on their median URR category from all claims during the year (in the case of an even number of claims with a median value falling between two categories, 0.5 of a person is added to each category). Figure 11.32 data obtained from the CDC’s National Surveillance of Dialysis-Associated Diseases in the United States. Figure 11.33 2000; data obtained from CMS's annual End-Stage Renal Disease Facility Survey & the CDC's National Surveillance of Dialysis-Associated Diseases in the United States.
11.32 · Location of units, by therapy type

1995

1999

11.33 · Germicide use, by type & ESRD network

11.34 · Trends in dialyzer membrane use

11.35 · Trends in germicide use

11.36 · Trends in reuse practices

11.37 · Geographic variations in reuse practices

States. Figures 11.34–11.36 data obtained from the CDC’s National Surveillance of Dialysis-Associated Diseases in the United States; the CDC did not conduct a survey in 1998. Numbers may sum to greater than 100 percent. Figure 11.37 2000; data obtained from the CDC’s National Surveillance of Dialysis-Related Diseases in the United States.

For a map of the ESRD networks see Figure 1.40.
For membrane classifications see table above Figure 11.23.
Patient populations & analytical methods

- Data on provider characteristics are compiled from CMS’s annual End-Stage Renal Disease Facility Survey (Form 2744 (11-88)), CMS’s Independent Renal Dialysis Facilities Cost Reports (Form 265-94), the CDC National Surveillance of Dialysis-Associated Diseases, and the USRDS database.
- Only data from facilities that have returned a CMS summary and/or a CDC survey are reported here.
- Because the CDC did not conduct a survey in 1998, no CDC data is reported for that year.

Conclusions

- Following the consolidation of dialysis providers over the past decade, 57 percent of dialysis facilities—treating 63 percent of the patient population—are now owned by corporations.
- The number of facilities that are hospital-based or not affiliated with chains has remained relatively stable since 1988, though the patient populations in these units have decreased.
- In 2000, chain-affiliated units were present in each of the 18 ESRD networks.
- Since 1988 there has been only a ten percent increase in the number of non-profit units (since 1995, the number has decreased 11 percent), while the number of for-profit facilities has more than tripled. This growth has occurred almost exclusively in units that are not hospital-based.
- The number of hemodialysis treatments has grown across all ESRD networks. The number of peritoneal dialysis treatments, in contrast, while increasing dramatically in several networks, has declined overall.
- The distribution of patients by characteristics such as age, gender, and race differs by provider type. This is particularly true for incident patients in terms of Hispanic ethnicity, erythropoietin use prior to dialysis therapy, body mass index, estimated glomerular filtration rate, and albumin level.
- Providers vary in their use of peritoneal dialysis and in the percent of patients who receive renal transplants.
- Patient-to-staff ratios are 3.4:1 in hospital-based dialysis units, and as high as 5:1 in units that are chain-affiliated.
- Hemoglobin levels, weekly erythropoietin doses, and dialysis membrane use all vary considerably by provider type. Dialysis therapy and iron dosing practices, however, do not.
- The use of internal accesses varies considerably across the country and between chain-affiliated and non-affiliated units.
- Patients and staff are more likely to receive preventive healthcare—such as influenza, pneumococcal pneumonia, and hepatitis B vaccinations—in some types of units than in others.
- Use of high-flux and high-efficiency dialyzers has grown since 1995, and the use of synthetic dialyzers has increased dramatically since 1990.
- The choice of reuse germicides varies considerably by ESRD network.
- The percent of units reusing dialyzers has remained relatively stable since 1997.
- The percent of units using bleach as a cleaning agent varies widely across the country, from fewer than five percent of units in some states to more than 60 percent in others.