clinical indicators of care

and blest are those
Whose blood and judgment are so well commingled…

William Shakespeare, Hamlet
After the American Journal of Kidney Diseases published the proceedings of the 1990 Dialysis Mortality Symposium, the care of dialysis patients began to receive increased attention. The symposium, chaired by Drs. Alan Hull and Tom Parker, pointed to dialysis adequacy, anemia treatment, vascular access, and overall dialysis patient survival as areas greatly in need of improvement in the United States.

A number of organizations have since developed clinical practice guidelines, including the National Institutes of Health, the Consensus Conference, the Renal Physicians Association, the American Association for the Advancement of Medical Instrumentation, the Centers for Medicare and Medicaid Services (CMS) in their Clinical Performance Measures (CPM) project, and the National Kidney Foundation through its Kidney Disease Outcomes Quality Initiative (K/DOQI).

In this chapter we present data on trends in anemia treatment in the dialysis population, and include new information on iron dosing. We look in particular at incident patients under ESRD treatment, providing insight into hemoglobin levels at the initiation of dialysis (as reported on the Medical Evidence form) and the efforts taken to correct anemia. To show how data from two sources may differ, we present information from both the CPM project and the Medicare claims.

We also illustrate characteristics of anemia treatment by age, gender, and race, and look at the stability of hemoglobin levels and overall success in reaching the DOQI target hemoglobin of 11–12 g/dl.

In our section on EPO resistance we present new data on the relationship of hemoglobin levels and EPO dosing to infections and catheter insertions. To illustrate issues in dialysis therapy, we look at urea reduction ratios as reported in both the CPM data and the Medicare claims, and show data on delivered therapy as it relates to unit characteristics such as profit status, unit type, and chain affiliation.

Vascular access data presented here include trends over time in the use of fistulas and catheters, along with the types of procedures performed by physicians. On the final
4.2 · Mean monthly hemoglobin at initiation of therapy & in the first six months of ESRD
incident hemodialysis patients with a first EPO claim within the first 30 days of the ESRD start date & at least one EPO claim in each of the first six months.

4.4 · Percent of patients receiving iron at initiation of therapy & in the first six months of ESRD same cohort as Figure 4.2; 2000 data complete through June 1.

There have been significant changes in anemia treatment over the past ten years. Figure 4.1 shows, for instance, that mean hemoglobin levels in prevalent hemodialysis patients increased from 9.7 g/dl in 1991 to 11.5 g/dl by the year 2000. The slowing of the increase in both hemoglobin levels and EPO dosing during 1997–1998 reflects the restriction of erythropoietin payments by CMS.

Iron use increased significantly from 1991 to 1997, at which point the distribution of the average number of vials per month remained stable until the year 2000. In that year the billing system in the U.S. changed, with patients being billed for each 50 mg or 62.5 mg dose rather than for an individual vial. At this same time DOQI guidelines recommended that iron dosing practices be changed to include more maintenance therapy. It is not clear, then, whether the changes in iron dosing seen in 2000 are a reflection primarily of the new billing practices or of an increase in maintenance therapy.

In Figures 4.2–4 we show mean monthly hemoglobin levels, mean monthly erythropoietin doses, and the cumulative number of patients receiving intravenous iron. Hemoglobin levels in incident patients, both at the beginning of treatment and in the following six months, have risen consistently since 1996. By the fourth month of treatment, a mean hemoglobin of between 11.5 and 12 g/dl is now being achieved and maintained. Weekly erythropoietin doses have increased over time, with doses peaking by the second to third month of treatment and declining as target hemoglobin levels are achieved. In addition, more than 85 percent of patients who have been on dialysis for six months are now receiving intravenous iron, up 12 percent since 1996.

The consistent increase in hemoglobin levels appears to be more directly related to increasing EPO doses than to changes in iron therapy. This recent growth in hemoglobin levels has occurred following the introduction of the K/DOQI guidelines, which recommend a target hemoglobin level of >11 g/dl.
Compared to patients who enter treatment with higher hemoglobin levels, patients with the lowest levels at the initiation of dialysis continue to have lower hemoglobins in the first six months of therapy, even under EPO treatment (Figure 4.5). While weekly EPO doses are higher in this lower hemoglobin group, the cumulative percent of patients receiving iron in the first six months of treatment is relatively consistent regardless of hemoglobin level (Figures 4.6–7).

There are interesting differences in anemia treatment between hemodialysis and peritoneal dialysis patients. Weekly EPO doses for patients on peritoneal dialysis are less than half of those for hemodialysis patients, and lack the same layered relationship to initial hemoglobin levels (Figure 4.6). In addition, fewer than one-fifth of peritoneal dialysis patients receive IV iron by the sixth month of treatment, compared to 80 percent of hemodialysis patients (Figure 4.7). The less consistent hemoglobin levels for peritoneal dialysis patients on EPO may be related to EPO or iron dosing patterns, or may be complicated by infections or conditions that create inflammatory blockades.

The USRDS and the Clinical Performance Measures group at CMS have collaborated on a combined patient dataset. We present here analyses of hemoglobin levels and EPO dosing for a matched set of patients (8,196) with both Medicare claims and CPM data; patient counts are shown in Table 4.a. In EPO-treated hemodialysis patients, regardless of iron treatment, there is excellent agreement in hemoglobin levels between the Medicare claims and the CPM data (Figure 4.8). For peritoneal dialysis patients on EPO, in contrast, CPM data report an almost 0.5 g/dl higher hemoglobin level than that seen in the claims data. Reasons for these differences are unclear. CPM and claims data may represent different aspects of care, a possibility that merits further investigation.

These discrepancies are also evident in data on mean weekly EPO dose (Figure 4.9). While data from the two sources is consistent for hemodialysis patients, regardless of iron therapy, the CPM data reports higher EPO doses in patients on peritoneal dialysis.

Figures 4.5–7 Incident dialysis patients, 1995–2000 combined; hemoglobin group is determined by the patient’s hematocrit on the CMS Medical Evidence form (2728). Included for each year are all incident dialysis patients from that year with a first EPO claim within the first 30 days of the ESRD start date, at least one EPO claim in each of the first six months, & a hematocrit value listed on the Medical Evidence form. Table 4.a point prevalent ESRD patients on December 31, 2000, for whom there are data in both the CPM & USRDS databases. "USRDS database"
4.9 · Trends in mean hemoglobin, by modality, iron use, & data source

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shows patient distribution based on USRDS information on age, gender, race, primary cause of ESRD, & modality ("all" category includes unknown dialysis); "CPM" shows patient distribution based on CPM information on age, gender, race, primary cause of ESRD (as indicated by principal diagnoses) & modality (the CPM database does not contain an "unknown dialysis" category). Figures 4.8–9 USRDS data are from period prevalent hemodialysis & peritoneal dialysis patients with EPO claims during October of the previous year through April of the prevalent year; CPM data are obtained from the CMS Clinical Performance Measures project report, which is based on a national sample of adult dialysis patients regardless of insurance payer status.

Figure 4.7 Because of the low number of peritoneal dialysis patients with hemoglobin levels above 12 g/dl, the cumulative percent of patients receiving iron is calculated for two-month periods.

4.8 · Trends in mean hemoglobin, by modality, iron use, & data source

4.9 · Trends in mean EPO dose per week, by modality, iron use, & data source
In both hemodialysis and peritoneal dialysis patients treated with EPO, hemoglobin levels have risen significantly over the last ten years (Figure 4.10). Regardless of modality, children, women, and black patients consistently have the lowest levels. While many of these differences among age, gender, and racial groups have lessened over time in the hemodialysis population, this has not been the case for patients on peritoneal dialysis, in whom there is a far wider variation in hemoglobin levels, particularly by age and race.

Mean weekly EPO dosing has followed similar patterns over the last ten years (Figure 4.11). Once again there is clear stratification by age, with the exception of lower doses in the pediatric population (an expected finding, since EPO doses are per kilogram and are therefore lower in children). Black patients, followed by whites, receive the highest doses of EPO. Similar patterns are seen across the modalities, though doses for peritoneal dialysis patients are about half of those given to patients on hemodialysis.

In Figures 4.12–13 we present trends in the distribution of patients by hemoglobin group. Patients with hemoglobin levels less than 10 g/dl, who constituted 54 percent of the dialysis population in 1991, accounted for only 10.4 percent in 2001. Fifty-nine percent of patients in 1991 had rolling three-month averages (including the current month and the two previous months) of less than 10, a proportion that dropped to less than 6.5 percent by 2001. In terms of higher hemoglobin ranges, in 1991 only 14.0 percent of patients had a level between 11 and 12 g/dl—the target recommended by K/DOQI in 1997. By June 2001, however, 41 percent of patients met that target on a rolling three-month basis, and 33 percent had rolling three-month averages above 12 g/dl.

The overall mean hemoglobin level of dialysis patients appeared to stabilize at 11.5 g/dl by June 2001, with the mean weekly EPO dose approaching 16,800 units (Figure 4.14).

Across the country, mean hemoglobin levels in hemodialysis patients tend to be highest in areas west of the Mississippi, while weighted mean EPO doses show a contrasting pattern, with higher doses in the eastern half of the country (Figures 4.15–16). Higher hemoglobin levels in the Rocky Mountain region are consistent with the area’s higher elevations, as are the lower EPO doses.

Figure 4.10 period prevalent dialysis patients with at least one EPO claim during their prevalent year & a hematocrit on that claim of between 10 & 50 percent. Figure 4.11 period prevalent dialysis patients with at least one EPO claim during their prev
Trends in patient distribution, by mean hemoglobin

**4.12 - by mean monthly hemoglobin**

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Mean weekly EPO dose (thousands of units)

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Hemoglobin (g/dl)

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Hemoglobin (g/dl, period prevalent hemodialysis patients with EPO claims & a hematocrit of between 10 & 50 percent, 2000, by HSA, unadjusted.

**Figure 4.12** period prevalent dialysis patients with EPO claims. **Figure 4.13** period prevalent dialysis patients with EPO claims; three-month average includes current month & two previous months. **Figure 4.14** period prevalent dialysis patients with EPO claims; for monthly EPO dose, patients also have ≤20 administrations per month. Variability in EPO data is caused by monthly shifts in the ratio of treatment days to billing days. **Figure 4.15** units of EPO, period prevalent hemodialysis patients with EPO claims & ≤20 administrations per month, 2000, by HSA, unadjusted.

4.13 - by rolling three-month mean hemoglobin

4.14 - Trends in mean monthly hemoglobin & mean EPO dose per week

4.15 - Mean hemoglobin: hemodialysis

4.16 - Mean EPO dose: hemodialysis
Data presented in this spread illustrate the relationship between EPO dosing and potential EPO resistance due to infectious complications. In Figures 4.17–18 we present the geographic distribution of patients by hemoglobin and weekly EPO dose as they relate to the number of hospital stays for all-cause infections. These maps demonstrate that EPO dosing rises with the number of infectious hospitalizations, while hemoglobin levels steadily decrease.

Figures 4.19–20 support these data, showing that hemoglobin levels consistently decline across age and race groups as the numbers of all-cause infections, catheter infections, and catheter insertions rise. Weekly EPO doses, represented by the symbols, tend to increase reciprocally with lower hemoglobins. (Volatility in the EPO dose of patients with five or more infections or catheter insertions may be caused by the low numbers of patients in these groups.) The most consistent pattern is depicted in Figure 4.21, which shows that with greater numbers of attempted catheter insertions, patient hemoglobins are lower and EPO dosing rises. These data strongly suggest that any analyses of hemoglobin levels should consider infectious complications, particularly those resulting from the use of dialysis catheters.

Figures 4.17–18 period prevalent hemodialysis patients with at least one EPO claim during 2000; the number of infections represents the number of inpatient hospital stays, per patient year, with infection as the principal diagnosis (ICD-9-CM codes are listed in Appendix A). Figures 4.19 period prevalent hemodialysis patients age 20 & older as of January 1, 2000. The number of infections represents the number of inpatient hospital stays, per patient year at risk, with infection as the principal diagnosis. Figure 4.20 period prevalent hemodialysis patients age 20 & older as of January 1, 2000; the number of infections represents the number of inpatient hospital stays, per patient year at risk, with catheter infection as the principal diagnosis (ICD-9-CM diagnosis code: 996.62). Figure 4.21 period prevalent hemodialysis patients age 20 & older as of January 1, 2000; excludes those with catheters for chemotherapy (CPT codes: 96408, 96410, & 96412) or parenteral nutrition (CPT codes: B4164–B5200, B9004, B9006, & B9999).

Figures 4.17–21 hemoglobin is mean yearly hemoglobin; EPO is yearly mean of weighted mean weekly dose.
Figures 4.19–20: Number of inpatient hospital stays, per patient year at risk, with infection as the principal diagnosis

All · All patients, regardless of status
1+ · Patients with at least one stay during year
A · Patients with no stays
B · Patients with 1–<2 stays
C · Patients with 2–<3 stays
D · Patients with 3–<5 stays
E · Patients with five or more stays

Figure 4.21: Number of catheter (temporary & permanent) insertions per patient year

All · All patients, regardless of status
1+ · Patients with at least one insertion during year
a · Patients with no insertions
b · Patients with 1 insertion
c · Patients with >1–2 insertions
d · Patients with >2–3 insertions
e · Patients with three or more insertions
In Figures 4.22–25 we present information on delivered dialysis therapy as represented by the urea reduction ratio (URR). Figure 4.22 uses data from the CMS ESRD Clinical Performance Measures (CPM) project, which has monitored dialysis therapy since 1993. Remaining URR data has been obtained from Medicare, which requires URR ranges to be indicated on provider claims, allowing us to evaluate a large sample of patients across the U.S.

While there are slight differences in the URRs reported by the two sources, overall trends are similar. The proportion of hemodialysis patients with URRs greater than 70 percent has increased steadily over the last seven years (Figure 4.22), and levels have consistently been higher in women than in men (Figure 4.23). In most of the country more than 80 percent of patients now meet the K/DOQI target URR of ≥65 percent, and since 1998 more than one-fifth of the HSAs have seen at least a seven percent increase in the number of patients meeting this target (Figure 4.24).

Delivered dialysis therapy may be highly influenced by certain provider types, as well as by policies and procedures used by individual providers and large chains. Overall, 88 percent of hemodialysis patients in 2000 had a URR level ≥65 percent—89 percent in for-profit units, and 85 percent in non-profit units (Figure 4.25). In terms of unit ownership, DaVita and the Renal Care Group appear to have the greatest percentage of patients treated with higher doses of dialysis therapy. Levels of therapy are comparable in non-affiliated units, hospital-based units, and units owned by chains other than the five largest.

There appears to be little difference overall between for-profit and non-profit units in the amount of weekly Kt/V delivered to peritoneal dialysis patients (Figure 4.26). Freestanding units provide slightly lower amounts of therapy, but since 1995 levels have increased across all unit types.

Profit status seems to have a strong relationship to mean weekly creatinine clearances for peritoneal dialysis patients (Figure 4.27), with patients in for-profit units having higher levels. Patients in freestanding units have, since 1997, had higher clearances than those in units that are hospital-based. (Since there are too few patients on peritoneal dialysis to allow us to adequately define unit ownership for these patients during a single year, this analysis was omitted.)

All URR figures patients are 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 be-
Figure 4.22 claims data: from period prevalent hemodialysis patients with claims containing URR information during October through December of the prevalent year; CPM data: from the CMS Clinical Performance Measures project report, which is based on a national sample of adult dialysis patients regardless of insurance payer status. For CPM data, the year refers to the year collected (e.g. 1999 data come from what is called the “2000 CPM data set”). Figures 4.23–25 period prevalent hemodialysis patients. Figure 4.24 by HSA, unadjusted. Figure 4.25 claims data, 2000. Information on unit ownership obtained from CMS’s Independent Renal Dialysis Facilities Cost Report (www.cms.hhs.gov/data/download). Figures 4.26–27 data obtained from the CMS Clinical Performance Measures project report, which is based on a national sample of adult dialysis patients regardless of insurance payer status (data have been merged into the USRDS database to link with information on unit affiliation & profit status); the year refers to the year collected (e.g. 1999 data comes from what is called the “2000 CPM dataset”).

Unit affiliation
- All · All units
- Chain 1 · Fresenius
- Chain 2 · Gambro
- Chain 3 · DaVita
- Chain 4 · Renal Care Group
- Chain 5 · Dialysis Clinics, Inc.
- O · All other chain-affiliated units
- I · Non-chain units
- HB · Hospital-based units
- U · Unknown affiliation
In Figure 4.28 information from the CPM random sample of patients and the CDC Facility Survey provides a view of access use within the hemodialysis population. Both data sources show that 27–28 percent of patients in 2000 had a simple arteriovenous fistula, 23–24 percent were using a dialysis catheter, and 46–48 percent had synthetic grafts.

Compared to freestanding units, hospital-based units have more patients with fistulas and dialysis catheters and fewer with synthetic grafts (Figure 4.29). For-profit units have a greater prevalence of patients using synthetic grafts than do non-profit units.

Trends in the use of permanent and temporary catheters, and in creation rates for simple fistulas, are presented in Figure 4.30. Since 1996 the use of temporary catheters has fallen 30 percent. Placement rates for permanent catheters, in contrast, have doubled, and the rate of simple fistula creation has increased 50 percent. This is consistent with the K/DOQI guidelines.

Figures 4.31–33 present information on insertion rates and vascular access complications as determined from Part B physician service claims. Placement rates for grafts have declined since 1996, while the use of angioplasty procedures increased until 1999, and the rate of stent placement has grown steadily. The rate of vascular access revisions has increased slightly since 1996, but a parallel increase in the rate of declotting procedures ended with a sharp decrease in 2000. While this may reflect actual practice, analyses of 2001 data will be needed to ascertain that there is adequate reporting of these procedures.

Figure 4.32 shows that the rate of vascular access services provided by nephrologists has been declining, while more procedures are now performed by radiologists.

Maps of catheter and fistula use show no direct relationship (Figure 4.33). Temporary catheter insertions rates vary by four-fold, permanent catheters by three-fold, and fistula placement two-fold from the lowest to the highest quintiles.

**Figure 4.28** Hemodialysis patients; CPM data obtained from the CMS Clinical Performance Measures project report, which is based on a national sample of adult dialysis patients regardless of insurance payer status; CDC data obtained from the annual CDC National Surveillance of Dialysis-Associated Diseases (the CDC did not conduct a survey in 1998). Figure 4.29 hemodialysis patients, 2000, data obtained from the annual CDC National Surveillance of Dialysis-Associated Diseases. Figures 4.30–32 period prevalent hemodialysis patients. Figure 4.33 per 1,000 patient years at risk, period prevalent hemodialysis patients, 2000, by HSA, unadjusted.
4.31 · Trends in vascular access event rates, by event type

4.32 · Vascular access event rates, by MD specialty

4.33 · Geographic variations in catheter insertion & fistula creation rates
On this spread we examine anemia treatment in patients whose ESRD is caused by one of the less frequently occurring diseases.

Patients with IgA nephropathy, Berger’s disease, or IgM nephropathy have hemoglobin levels comparable to those in all other patients, and they use slightly less EPO and iron (Figures 4.34–35). Similar patterns are also seen in patients with Goodpasture’s syndrome (Figures 4.36–37). Patients with SLE nephritis, in contrast, tend to have lower hemoglobin levels and to use more EPO (Figures 4.38–39).

Hemoglobin levels, erythropoietin dosing, and iron dosing in patients with other secondary glomerulonephritis and vasculitis are comparable to those in the rest of the dialysis population (Figures 4.40–41).

While EPO and iron levels are similar in patients with and without scleroderma, a higher percentage of patients with the disease have hemoglobins between 10 and 11 g/dl (Figures 4.42–43). Anemia treatment in patients with Alport’s and other hereditary/familial diseases is similar to that in other patients (Figures 4.44–45).

The largest differences in hemoglobin levels and EPO doses occur in patients with multiple myeloma, light chain nephropathy, and AIDS nephropathy (Figures 4.46–49). Since multiple myeloma has a primary bone marrow effect and is periodically treated with chemotherapy, it is not surprising that patients consistently have lower hemoglobin levels and significantly higher doses of EPO. Iron dosing in these patients is less frequent than in the general population, a pattern also noted in patients with AIDS nephropathy. The systemic nature of these diseases, and the underlying difficulties of bone marrow suppression caused by therapeutic agents, may contribute significantly to the persistent anemia and relative erythropoietin resistance seen in these patients.

Diseases are those indicated on the Medical Evidence form as the primary cause of ESRD.

Figures 4.34–49 period prevalent hemodialysis & peritoneal dialysis patients, 1999–2000 combined. EPO dose is mean weighted weekly dose. Patients classified for each year based on mean EPO dose & mean hemoglobin for that year; numbers represent aggregates across both years. Data on mean EPO dose per week include patients with at least one EPO claim during their prevalent year & ≤520 administrations per month; data on mean hemoglobin per month include patients with at least one EPO claim during their prevalent year & a hematocrit on that claim of between 10 & 50 percent.

Figures 4.40–41 other secondary GN/vasculitis includes polyarteritis, Wegener’s granulomatosis, Henoch-Schönlein syndrome, & vasculitis & its derivatives.
**Maps: National means & patient populations**

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**Patient populations & analytical methods**

- CPM refers to the CMS Clinical Performance Measures Project, in which patient data are collected during three periods each year. See Appendix A for details.
- In each figure the mean EPO dose per week is a weighted mean based on monthly administrations per patient. See Appendix A for details.
- In Figures 4.1, 4.11, 4.16 and 4.34–49 the mean EPO dose per week is calculated on a yearly basis, using the number of weeks a patient is prevalent during the year. For Figures 4.4, 4.6, and 4.12–14, it is calculated on a monthly basis, using the number of weeks in each month. For Figures 4.18–21, it is based on monthly data, and the yearly averages use only weeks from months in which the patient received EPO. For Figures 4.8–9, to more closely mirror the CPM data collection methodology, the average dose per week is calculated on a monthly basis using only months that correspond to periods in which CPM data was collected.
- In Figure 4.1, the iron data exclude MSP patients through a method that utilizes the USRDS database. In Figures 4.2, 4.7, 4.8, 4.9 and 4.34–49, the iron data instead indirectly exclude MSP patients because these figures only include patients with EPO claims.
- Table 4.a only includes patients identified in both the CPM and USRDS databases. Modality, age, gender, race, and primary cause of ESRD are assigned separately using information from each database, with the exception of the “CPM” portion of the table, in which “Medicare” and “Non-Medicare” are designated using the USRDS database. The “Medicare Claims” portion of the table does not include patients identified in the USRDS database as having a dialysis modality of “unknown.”
- In Figures 4.17–20 the number of infections refers to the number of inpatient hospital stays during the year with infection as the principal diagnosis (4.20 uses only catheter infections), and only includes patients with at least 0.3 patient-years. In Figures 4.21 and 4.30–33, the number of infections or events refers to the number per patient year based on CPT codes from Part B physician-supplier claims.
- CDC data are obtained from the CDC National Surveillance of Dialysis-Associated Diseases.

**Conclusions**

- Over the last ten years hemoglobin levels have increased nearly two g/dl. Erythropoietin doses have doubled, while the use of iron has increased but stabilized during the last four years.
- In the first four months of treatment the hemoglobin levels of incident dialysis patients rise consistently, and then stabilize through month six. Incident patient hemoglobin levels improved steadily from 1996 to 2000.
- Almost 90 percent of hemodialysis patients treated with EPO receive intravenous iron in the first six months of therapy.
- There appears to be a relationship between hemoglobin levels at initiation and the response of patients to EPO, as patients with low initial hemoglobins remain at these lower levels even under EPO treatment.
- Iron dosing for EPO-treated patients on peritoneal dialysis is one-fourth that of patients on hemodialysis.
- Non-EPO treated patients have hemoglobins that are between 1.0 and 1.5 g/dl higher than those of patients treated with EPO. For hemodialysis patients on EPO, hemoglobin levels reported on claims are similar to those reported in the CPM random sample of patients. For peritoneal dialysis patients, in contrast, hemoglobin levels reported in the CPM data are higher than those found in the Medicare claims.
- Variations in hemoglobin levels are apparent within age, gender, and race groups, with differences more pronounced in peritoneal dialysis patients than in their counterparts on hemodialysis. Black patients consistently have lower hemoglobin levels than patients of other races, and require more EPO.
- The relationship between hemoglobin levels and the number of infectious complications is consistent with inflammatory blockade of erythrocyte production, which in turn may be related to dialysis catheter use.
- While delivered dialysis therapy has continued to increase in the United States, there is significant variation in therapy by provider type, particularly within the dialysis chains.
- The percentage of patients with various types of vascular accesses varies little with respect to unit profit status or to whether a unit is hospital-based or freestanding.
- As recommended in the K/DOQI guidelines, the rate of simple fistula creation has increased, and there has been a transition from temporary to permanent catheters. Nationwide, however, the use of temporary and permanent catheters still far exceeds the use of simple fistulas, with catheter use being three to four times higher.
- Patients with rare diseases, such as lupus erythematosus, multiple myeloma, and AIDS, have lower hemoglobin levels than patients with other primary renal diseases. These patients may require increased attention to improve their hemoglobin levels.