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Predictors of Provider-Patient Visit Frequency During Hemodialysis

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Abstract

Background/Aims—In 2004, the Centers for Medicare & Medicaid Services tied reimbursement for outpatient hemodialysis services to number of times per month providers see their dialysis patients, resulting in increased provider-patient visit frequency. Greater provider-patient visit frequency is associated with lower hospitalization risk for hemodialysis patients. Determinants of visit frequency are uncertain. We aimed to identify patient, provider, and dialysis facility characteristics associated with provider visit frequency.

Methods—This retrospective cohort study used United States Renal Data System (USRDS) data for point-prevalent patients receiving in-center hemodialysis on January 1, 2006 ($n = 144,860$). Patient characteristics were defined January 1-June 30, 2006, and provider-patient visit frequency (< 4 vs. ≥ 4 visits/month) July 1-December 31, 2006. Patient characteristics were obtained from the USRDS. Provider data were obtained from the American Medical Association Physician Master File. We determined longitudinal associations between patient, provider, and facility characteristics and provider-patient visit frequency using logistic regression.

Results—Patient characteristics independently associated with greater provider-patient visit frequency included older age, African American race, longer dialysis duration, higher comorbidity score, Medicaid eligibility, urban residence, better compliance with dialysis, and more hospital days during run-in. Provider characteristics associated with greater provider-patient visit frequency included more years in practice, graduation from a foreign medical school, shorter distance between provider office and dialysis unit, and caring for more dialysis patients; facility characteristics included free-standing, independent status.

Conclusion—After the Medicare reimbursement policy change, several patient, provider, and facility characteristics were independently associated with greater dialysis provider-patient visit frequency.

Keywords

Hemodialysis; Medicare; nephrology

Introduction

Patients with end-stage renal disease (ESRD) have high rates of morbidity and mortality.¹ In 2004, the Centers for Medicare & Medicaid Services (CMS) tied physician reimbursement for outpatient hemodialysis services to number of times per month providers see their patients.² This reimbursement policy change gave providers financial incentive to increase the number of monthly visits to their hemodialysis patients, and resulted in an increased number of visits during dialysis.³ Studies have reported that greater provider-patient visit frequency was associated with lower risk of death⁴ and hospitalization,⁵ as well as better achievement of clinical performance measures.^{3;6;7} Despite financial incentive and association with improved patient outcomes, provider response to the policy change varies substantially, and 40% of all provider visits occur at less than maximum reimbursed frequency.⁵ Specific characteristics of patients, providers, and dialysis facilities that are independently associated with provider-patient visit frequency are unknown.

Several factors have been reported to influence the frequency of contact between patients and their providers. In the primary care setting, patient factors that have been associated with increased frequency of visits include older age, more prior health care use, mental health issues, compliance, and more comorbid conditions. These factors accounted for up to 19.4% of the variability associated with follow-up frequency.^{8–11} In addition, physician characteristics accounted for up to 22.4% of variability in follow-up visit frequency; these characteristics included sex, a plan to change medical management, a tendency to order tests, and the provider's perception of patient illness.^{9–12} The only study that evaluated the association between patient and facility characteristics and frequency of provider visits during dialysis was conducted before the reimbursement policy change.⁶ This study found that patients receiving dialysis in facilities that reported the least frequent provider contact were more likely to be white and unemployed or retired, compared with patients in facilities with more frequent provider visits.⁶ Currently, associations of patient, provider, and facility characteristics with provider-patient visit frequency during hemodialysis are unknown. Thus, in a prevalent cohort of hemodialysis patients, we aimed to determine patient, provider, and facility characteristics associated with frequency of provider-patient visits during hemodialysis.

Methods

The study cohort consisted of patients who were receiving in-center hemodialysis on January 1, 2006, survived and continued to receive in-center hemodialysis for 12 months, were covered by Medicare Part A and Part B at cohort entry, were aged 20 years or older, and resided in the US.

Data were from the United States Renal Data System (USRDS) and included all Medicare claims (Part A institutional, Part B physician/supplier), Medicare enrollment data, and ESRD Medical Evidence Report (CMS-2728) data.

We used a 6-month period, from January 1 to June 30, 2006, to define patient characteristics, including hospital days during the 6 months, number of dialysis sessions attended, and comorbid conditions. Provider-patient visit frequency was calculated as the mean number of visits per month by a dialysis provider to each patient during the 6-month period from July 1 to December 31, 2006. Visit frequency information was obtained using Medicare Part B claims; the billing code in each claim denotes the number of visits a provider made to a patient over a month of care. For our calculations, we counted the code for 1 visit (G0319) as 1 visit, the code for 2–3 visits (G0318) as 2.5 visits, and the code for 4 or more visits (G0317) as 4 visits. For patients hospitalized for any portion of a month during the 6-month period, that month's provider visit frequency was counted as missing ($n = 111,977/869,160$ patient-months, 12.88%), as the patient was not present in the dialysis unit to be seen, potentially biasing our estimation of visit frequency. In our prior analyses, when we expressed provider visit frequency as tertiles ($0 < 3$, $3 < 4$, and ≥ 4 visits per month), only the highest provider visit frequency of 4 or more visits per month was associated with lower hospitalization rates.⁵ Therefore, the visit frequency variable was expressed using clinical categories (< 4 and ≥ 4 visits per month); providers are not likely to visit their patients more frequently than 4 times per month due to lack of incentive and opportunity costs.

Information on demographics was obtained from the Medical Evidence Report.¹³ Comorbid conditions were defined based on the Medical Evidence Report and using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes from Medicare claims incurred from January 1 to June 30, 2006.^{1;13} The comorbidity index for dialysis patients was calculated based on 11 comorbid conditions.¹⁴ The number of hospitalization days during the 6-month period was obtained from Part A Medicare inpatient claims. A socioeconomic score was determined for each patient based on home zip code using 2000 census data.¹⁵ We used dual eligibility for Medicaid and Medicare as another surrogate for low socioeconomic status (SES). Rural and urban definitions were adopted from the US Census Bureau based on zip code.¹⁶ We estimated patient compliance with dialysis by counting the number of dialysis sessions attended during the 6-month period using facility claims for hemodialysis. Because patients who are hospitalized cannot attend outpatient dialysis sessions, confounding the results, only months without hospitalizations were included.

We identified physicians providing care using the Unique Provider Identification Number (UPIN) from the Part B Medicare claims for outpatient dialysis services. We obtained information on physician characteristics by merging our data with the American Medical Association (AMA) Physician Master File using UPINs. The distance a provider travels to a dialysis facility was calculated based on the provider's billing zip code and the zip code of the respective dialysis facility. We obtained facility characteristics from the facility file in the USRDS data.

Patient, provider, and facility characteristics were tabulated and stratified by provider-patient visit frequency. We used unadjusted and adjusted logistic regression to determine associations between patient, provider, and facility characteristics and provider-patient visit frequency during hemodialysis. The generalized estimating equations method was used to account for clustering of patients by providers. The models were adjusted for patient characteristics: age, sex, race, ethnicity, dialysis duration, cause of ESRD, comorbidity score (or individual comorbid conditions), socioeconomic status, eligibility for Medicaid, urban residence, compliance with dialysis, and number of days hospitalized from January 1 to June 30, 2006. The models were also adjusted for physician characteristics: sex, years in practice, foreign medical graduate status, specialty, type of practice (office based, full-time hospital, administration/teaching/research, or other/missing/unknown), metropolitan service area (MSA) size, distance from office to hemodialysis unit, and number of hemodialysis patients. Facility characteristics included hospital affiliation and chain affiliation. All analyses were performed using 9.1 SAS software.

Results

Overall, 144,860 point prevalent in-center hemodialysis patients who survived for 1 year and were covered by Medicare as primary insurance were included in the analysis (Figure 1). Included patients were elderly, with 47.0% aged 65 years or older; 46.7% were women, 42.9% African American, 13.2% Hispanic, and 49.5 % eligible for Medicaid (Table 1). Prevalence of comorbid conditions was high; 42.9% of patients had ESRD secondary to diabetes, 37.6% had history of coronary artery disease, 41.1% had history of congestive heart failure, and 21.5% had comorbidity scores of 8 or higher. Among included patients, 15.5% received outpatient dialysis care from female providers, 35.4% from providers who had been in practice for 22 years or more, 42.6% from foreign medical graduates, 92.8% from nephrologists, 2.5% from providers in academic (research or teaching) positions, 57.4% from providers who practiced in large metropolitan areas with 1 million or more residents, and 29.2% from providers who drove an average of more than 11.5 miles to their patients' dialysis units (Table 2). Seventy percent of patients dialyzed in chain-affiliated facilities and 11.7% in hospital-affiliated facilities. Distributions of patient, provider, and facility characteristics by provider visit frequency are presented in Tables 1 and 2.

Patient characteristics independently associated with greater provider-patient visit frequency (defined as 4 or more visits per month) included older age, African American race, longer dialysis duration, higher comorbidity score, urban residence, Medicaid eligibility, compliance (attending a greater number of dialysis sessions over 6 months), and more hospital days during run-in (Table 1).

In addition, considering individual comorbid conditions, coronary artery disease, congestive heart failure, cerebrovascular disease, peripheral vascular disease, history of dysrhythmia, and liver disease were independently associated with greater provider visit frequency, but the magnitude of the effect was small (Table 1). In addition to patient characteristics, several provider characteristics were independently associated with greater provider-patient visit frequency (Table 2). Patients whose providers had been in practice for 22 years or more had 18% higher odds of being seen 4 or more times per month, compared with patients

whose providers had been in practice for 8 years or less. Patients whose providers were foreign medical graduates were 14% more likely to be seen 4 or more times per month. In addition, there was an inverse graded association between the distance a provider travelled to the dialysis facility and the number of provider-patient visits; adjusted odds ratios (95% confidence intervals) for 4 or more visits per month were 0.77 (0.73–0.82) for patients whose providers travelled 2.5 to 11.5 miles and 0.55 (0.51–0.59) for patients whose providers travelled > 11.5 miles to dialysis facilities, compared with patients whose providers travelled < 2.5 miles. Patients whose providers cared for more patients were also seen more frequently.

Finally, patients who dialyzed in hospital-affiliated facilities and patients who dialyzed in chain-affiliated facilities were less likely to be seen 4 or more times per month than patients who dialyzed in non-hospital-affiliated facilities and non-chain-affiliated facilities, respectively.

Discussion

In this cohort of prevalent hemodialysis patients, we found that several patient, provider, and facility characteristics were independently associated with greater provider-patient visit frequency during hemodialysis.

African American race, Medicaid eligibility, and residence in urban areas were associated with greater number of provider-patient visits. Possibly, because of high density of providers and dialysis facilities in urban areas, providers visit their patients more frequently. Our results are similar to results of the CHOICE (Choices for Healthy Outcomes in Caring for ESRD) study of incident dialysis patients, which revealed a significantly higher proportion of African American patients dialyzing at facilities with a practice of more frequent provider contact.⁶

We found that patients with greater dialysis compliance were more likely to be seen more frequently by their providers. This is not surprising, since the patients who miss dialysis sessions are not available to be seen. Other studies report an independent association between greater provider visit frequency and greater patient compliance. In the CHOICE study, provider visit frequency was reported by dialysis facility nurse managers in a study survey, and was not documented on a patient level. The CHOICE study found that patients who dialyzed at facilities that reported low provider visit frequency were 2.67 times more likely to be non-compliant (miss > 3% of sessions without a reason) than patients who dialyzed at facilities with high provider visit frequency.⁶ Mentari et al³ compared prevalent hemodialysis patient characteristics before and 7 months after the Medicare reimbursement policy change. They reported that after the policy change, the number of provider-patient visits during hemodialysis increased from 1.52 to 3.14 per month, and the number of skipped dialysis treatments decreased from 0.36 to 0.31 per patient/month. While greater provider-patient visit frequency is associated with greater patient compliance with dialysis, the observational nature of the current study does not allow us to make cause-and-effect determinations.

In our study, a higher comorbidity score was associated with a significant increase in the odds of being seen more frequently by providers. In the study by Plantinga et al,⁶ comorbidity score was not associated with provider visit frequency. Severity of illness is associated with the frequency of provider visits in most medical settings where patients or providers schedule the visits based on an indication.^{8–11} While the Medicare reimbursement policy provides an incentive to see dialysis patients more frequently, whether other factors affect provider-patient visit frequency is unknown. Possibly, providers travel to dialysis facilities to see their sickest patients more often.

Conversely, greater frequency of provider visits has been associated with higher albumin and hemoglobin. In the study by Plantinga et al, patients receiving care at facilities with the least frequent provider-patient contact had lower Kt/V and hematocrit values than those receiving care at facilities with more frequent contact.^{6,7} Mentari et al³ evaluated quality of care and prevalent patient outcomes before and after the Medicare reimbursement policy change. They reported that after the policy change, dialysis dose and percent of patients with albumin and hemoglobin values at goal increased, while phosphorus, calcium, and percent of patients with hemodialysis catheters decreased.³ Unfortunately, due to our data limitations, we could not evaluate the association between provider visit frequency and hemoglobin, albumin, or parameters of bone metabolism measured prospectively.

Provider characteristics associated with the greater number of provider-patient visits included more years in practice and more dialysis patients per provider. Provider characteristics associated with the lower number of provider-patient visits included longer travel distances to dialysis facilities and practices centered around administration, teaching, or research. This is the first study to evaluate provider characteristics associated with provider-patient visit frequency during dialysis. Our results suggest that the effort involved in travelling to a dialysis facility and the number of patients that can be seen there are major determinants of provider visit frequency. Long driving distances between dialysis units might result in lost opportunities for providers. Since greater provider-patient visit frequency is associated with reduced risk of hospitalization for dialysis patients,⁵ identified characteristics can be used to target interventions aimed at increasing provider-patient interaction. For example, to decrease the burden of driving to outlying units several times a month, non-comprehensive visits could be performed using telemonitoring devices.

We found that patients of providers who care for a greater number of dialysis patients were seen more frequently, while patients of providers whose practices centered around administration, teaching, or research were seen less frequently. Provider practices reflect their beliefs regarding the benefits of more frequent visits. Desai et al surveyed random samples of nurses, AMA nephrologists, key opinion leaders, and Renal Physician Association members about their beliefs regarding the benefits of more frequent provider-patient visits during dialysis.¹⁷ Physicians who saw more than 50 dialysis patients per month were more likely than less busy physicians to endorse more frequent visits, and physicians in academic practices were less likely than non-academic physicians to endorse frequent visits.¹⁷ In addition, our results may reflect a situation in which providers whose incomes largely depend on reimbursement for dialysis patient care are more likely to organize their practices to maximize reimbursement, while providers who are salaried or who dedicate

large proportions of their practices to research, administration, or teaching are less likely to respond to reimbursement incentives.

Patients who dialyzed in hospital-affiliated and in chain-affiliated facilities were seen by their providers less frequently than patients who dialyzed in non-chain affiliated facilities. Plantinga et al also reported facility characteristics associated with frequency of provider visits during hemodialysis; patients treated in larger facilities with the greatest number of patients and hemodialysis shifts per week, and the greatest patient-to-staff ratios, were more likely to be seen with intermediate frequency (weekly or more than once per month).⁶ Possibly, physician practices centered around administration, teaching, or research follow patients who receive outpatient dialysis in hospital-affiliated facilities. These providers are less likely to see their patients 4 times per month. One can also speculate that facilities located in remote areas where providers see their patients less frequently are more likely to be chain affiliated. Other potential confounders might include ownership of non-chain affiliated facilities by providers who care for patients in these facilities. As facility owners and medical directors, these providers are more motivated to visit patients who dialyze in their facilities.

Our study has several strengths. To our knowledge, this is the first study to evaluate associations of patient, provider, and dialysis facility characteristics with provider-patient visit frequency during hemodialysis after introduction of the Medicare reimbursement policy that incentivized more frequent visits. Our study population is highly representative of hemodialysis patients in the US. Due to our large sample size, this study was well powered to show an effect of small differences in characteristics on visit frequency.

However, this study has several limitations. It may not be generalizable to patients without Medicare as primary insurance provider. We could determine only providers of the comprehensive visits who outlined the plan of care for the month of interest, and we could not determine whether other providers performed non-comprehensive visits. We did not have information about the content of provider-patient visits. In addition, distances were calculated based on zip codes and not actual addresses. Despite the limitations, this study provides important insight into factors that contribute to provider response to financial incentives.

We identified patient, provider, and dialysis facility characteristics associated with greater provider-patient visit frequency during hemodialysis. Because greater provider visit frequency is associated with lower hospitalization rates in dialysis patients,⁵ this study identifies patient, physician, and facility characteristics that can be used as potential targets for interventions aimed at increasing provider visit frequency and improving patient outcomes. Adapting telemedicine devices to perform non-comprehensive visits can simultaneously decrease the burden of long-distance driving for nephrologists and provide their patients in rural and underserved areas with better care.

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References

1. U.S. Renal Data System. . USRDS 2010 Annual Data Report: Atlas of Chronic Kidney Disease & End-Stage Renal Disease in the United States. 2010. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2010.
2. Medicare program; revisions to payment policies under the physician fee schedule for calendar year 2004. Final rule with comment period. Fed Regist. 2003; 68:63195–63395. [PubMed: 14610760]
3. Mentari EK, DeOreo PB, O'Connor AS, Love TE, Ricanati ES, Sehgal AR. Changes in Medicare reimbursement and patient-nephrologist visits, quality of care, and health-related quality of life. Am J Kidney Dis. 2005; 46:621–627. [PubMed: 16183416]
4. McClellan WM, Soucie JM, Flanders WD. Mortality in end-stage renal disease is associated with facility-to-facility differences in adequacy of hemodialysis. J Am Soc Nephrol. 1998; 9:1940–1947. [PubMed: 9773796]
5. Slinin Y, Guo H, Li S, et al. Association of Provider-Patient Visit Frequency and Patient Outcomes on Hemodialysis. J Am Soc Nephrol. 2012; 23:1560–1567. [PubMed: 22797182]
6. Plantinga LC, Fink NE, Sadler JH, et al. Frequency of patient-physician contact and patient outcomes in hemodialysis care. J Am Soc Nephrol. 2004; 15:210–218. [PubMed: 14694175]
7. Plantinga LC, Jaar BG, Fink NE, et al. Frequency of patient-physician contact in chronic kidney disease care and achievement of clinical performance targets. Int J Qual Health Care. 2005; 17:115–121. [PubMed: 15723821]
8. Roos NP, Carriere KC, Friesen D. Factors influencing the frequency of visits by hypertensive patients to primary care physicians in Winnipeg. CMAJ. 1998; 159:777–783. [PubMed: 9805023]
9. Schwartz LM, Woloshin S, Wasson JH, Renfrew RA, Welch HG. Setting the revisit interval in primary care. J Gen Intern Med. 1999; 14:230–235. [PubMed: 10203635]
10. DeSalvo KB, Block JP, Muntner P, Merrill W. Predictors of variation in office visit interval assignment. Int J Qual Health Care. 2003; 15:399–405. [PubMed: 14527983]
11. Welch HG, Chapko MK, James KE, Schwartz LM, Woloshin S. The role of patients and providers in the timing of follow-up visits. Telephone Care Study Group. J Gen Intern Med. 1999; 14:223–229. [PubMed: 10203634]
12. DeSalvo KB, Bowdish BE, Alper AS, Grossman DM, Merrill WW. Physician practice variation in assignment of return interval. Arch Intern Med. 2000; 160:205–208. [PubMed: 10647759]
13. U.S. Renal Data System. Researcher's Guide to the USRDS Database: 2009 ADR Edition. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2009. Available at: http://www.usrds.org/2009/fb/index_rg.html [Accessed May 23, 2013]
14. Liu J, Huang Z, Gilbertson DT, Foley RN, Collins AJ. An improved comorbidity index for outcome analyses among dialysis patients. Kidney Int. 2010; 77:141–151. [PubMed: 19907414]
15. Ward MM. Socioeconomic status and the incidence of ESRD. Am J Kidney Dis. 2008; 51:563–572. [PubMed: 18371532]
16. U.S. Census Bureau. [Accessed May 23, 2013] US Census Bureau Data Set. 2000. Available at: <http://www.census.gov/main/www/cen2000.html>
17. Desai AA, Bolus R, Nissenson A, et al. Identifying best practices in dialysis care: results of cognitive interviews and a national survey of dialysis providers. Clin J Am Soc Nephrol. 2008; 3:1066–1076. [PubMed: 18417745]

Figure 1.
Study cohort.

Table 1

Patient characteristics and provider-patient visit frequency

	Mean Number of Provider Visits per Month			Logistic Model for 4 Visits per Month AOR* (95% CI)
	All	< 4	4	
	n (%)	n (%)	n (%)	
All (patient level)	144,860	71,430	73,430	
Age, yr				
20–44	20,091 (13.9)	10,750 (15.1)	9,341 (12.7)	1
45–64	56,699 (39.1)	27,813 (38.9)	28,886 (39.3)	1.13 (1.10–1.17)
65	68,070 (47.0)	32,867 (46.0)	35,203 (47.9)	1.19 (1.15–1.23)
Female	67,635 (46.7)	33,497 (46.9)	34,138 (46.5)	0.98 (0.96–1.00)
Race				
White	74,175 (51.2)	37,785 (52.9)	36,390 (49.6)	1
African American	62,172 (42.9)	29,064 (40.7)	33,108 (45.1)	1.07 (1.04–1.10)
Other	8513 (5.9)	4581 (6.4)	3,932 (5.4)	0.99 (0.95–1.04)
Hispanic	19,092 (13.2)	9366 (13.1)	9,726 (13.3)	1.03 (0.99–1.07)
Dialysis duration, yr				
< 1	14,693 (10.1)	7657 (10.7)	7,036 (9.6)	0.98 (0.95–1.01)
1–< 5	82,116 (56.7)	40,861 (57.2)	41,255 (56.2)	1
5	48,051 (33.2)	22,912 (32.1)	25,139 (34.2)	1.06 (1.04–1.09)
Primary cause of ESRD				
Diabetes	62,121 (42.9)	30,014 (42.0)	32,107 (43.7)	1
Hypertension	43,347 (29.9)	21,317 (29.8)	22,030 (30.0)	0.94 (0.92–0.96)
Glomerulonephritis	16,525 (11.4)	8353 (11.7)	8,172 (11.1)	0.93 (0.90–0.96)
Other/missing/unknown	22,867 (15.8)	11,746 (16.4)	11,121 (15.2)	0.91 (0.89–0.94)
Comorbidity score*				
4	80,343 (55.5)	41,101 (57.5)	39,242 (53.4)	1
> 4–< 8	33,366 (23.0)	15,939 (22.3)	17,427 (23.7)	1.06 (1.04–1.09)
8	31,151 (21.5)	14,390 (20.2)	16,761 (22.8)	1.10 (1.07–1.14)
Comorbid conditions				
CAD	54,518 (37.6)	25,925 (36.3)	28,593 (38.9)	1.02 (1.00–1.04) [†]
CHF	59,466 (41.1)	28,294 (39.6)	31,172 (42.5)	1.02 (1.00–1.04) [†]
CVA/TIA	20,422 (14.1)	9694 (13.6)	10,728 (14.6)	1.03 (1.00–1.06) [†]
Other CVD	27,885 (19.3)	13,383 (18.7)	14,502 (19.8)	1.02 (1.00–1.05) [†]
PVD	42,395 (29.3)	19,849 (27.8)	22,546 (30.7)	1.04 (1.02–1.07) [†]
Diabetes	85,591 (59.1)	41,317 (57.8)	44,274 (60.3)	1.05 (1.02–1.07) [†]
COPD	21,283 (14.7)	10,233 (14.3)	11,050 (15.1)	1.02 (0.99–1.05) [†]
Dysrhythmia	28,845 (19.9)	13,630 (19.1)	15,215 (20.7)	1.04 (1.01–1.06) [†]
GI disorders	7477 (5.2)	3517 (4.9)	3,960 (5.4)	1.02 (0.98–1.07) [†]

	Mean Number of Provider Visits per Month			Logistic Model for 4 Visits per Month AOR* (95% CI)
	All	< 4	4	
	n (%)	n (%)	n (%)	
Liver disease	10,299 (7.1)	4279 (6.0)	6,020 (8.2)	1.06 (1.00–1.13) [†]
Cancer	10,687 (7.4)	5231 (7.3)	5,456 (7.4)	0.97 (0.93–1.00) [†]
SES [‡]	71,753 (49.5)	35,626 (49.9)	36,127 (49.2)	0.98 (0.95–1.00)
Eligible for Medicaid	66,539 (45.9)	32,542 (45.6)	33,997 (46.3)	1.03 (1.01–1.05)
Urban	107,935 (74.5)	51,332 (71.9)	56,603 (77.1)	1.22 (1.16–1.29)
Compliance during run-in [§]				
< 78 sessions	77,965 (53.8)	40,573 (56.8)	37,392 (50.9)	1
78 sessions	66,895 (46.2)	30,857 (43.2)	36,038 (49.1)	1.27 (1.24–1.30)
Hospital days during run-in ^{//}				
0	86,047 (59.4)	42,864 (60.0)	43,183 (58.8)	1
> 0–< 8	28,400 (19.6)	14,191 (19.9)	14,209 (19.4)	1.00 (0.98–1.03)
8	30,413 (21.0)	14,375 (20.1)	16,038 (21.8)	1.06 (1.03–1.09)

AOR, adjusted odds ratio; CAD, coronary artery disease; CHF, congestive heart failure; CI, confidence interval; COPD, chronic obstructive pulmonary disease; CVA/TIA, cerebrovascular accident/transient ischemic attack; CVD, cardiovascular disease; ESRD, end-stage renal disease; GI, gastrointestinal; PVD, peripheral vascular disease; SES, socioeconomic status.

* The model adjusted for patient characteristics: age, sex, race, ethnicity, dialysis duration, cause of ESRD, comorbidity score, socioeconomic status, eligibility for Medicaid, urban residence, compliance with dialysis, and number of days hospitalized from January 1 to June 30, 2006; physician characteristics: sex, years in practice, foreign medical graduate status, specialty, type of practice, metropolitan service area size, distance from office to hemodialysis unit, and number of hemodialysis patients; and facility characteristics: hospital affiliation and chain affiliation.

[†] The model adjusted for all patient characteristics included in the table, including separate comorbid conditions, except comorbidity score, and for provider and facility characteristics included in Table 2.

[‡] Principal component less than median.

[§] Number of dialysis sessions attended over 6 months.

^{//} Run-in period January 1–June 30, 2006.

Table 2

Provider and facility characteristics and provider-patient visit frequency

	Mean Number of Provider Visits per Month			Logistic Model for 4 Visits per Month*
	All	< 4	4	AOR* (95% CI)
	n (%)	n (%)	n (%)	
Provider				
Sex				
Missing	2421 (1.7)	1553 (2.2)	868 (1.2)	
Men	120,027 (82.9)	58,676 (82.1)	61,351 (83.6)	1
Women	22,412 (15.5)	11,201 (15.7)	11,211 (15.3)	0.97 (0.87–1.08)
Years since training				
Missing	5915 (4.1)	3242 (4.5)	2673 (3.6)	
0–8	39,374 (27.2)	20,115 (28.2)	19,259 (26.2)	1
9–21	48,283 (33.3)	24,437 (34.2)	23,846 (32.5)	0.98 (0.89–1.09)
22	51,288 (35.4)	23,636 (33.1)	27,652 (37.7)	1.18 (1.07–1.31)
Foreign medical graduate	61,763 (42.6)	29,090 (40.7)	32,673 (44.5)	1.14 (1.05–1.24)
Nephrologist	134,414 (92.8)	65,385 (91.5)	69,029 (94.0)	1.18 (0.98–1.42)
Type of practice				
Office based	127,196 (87.8)	62,151 (87.0)	65,045 (88.6)	1
Full-time hospital	6735 (4.7)	3390 (4.8)	3345 (4.6)	0.83 (0.69–1.00)
Administration/teaching/research	3675 (2.5)	2025 (2.8)	1650 (2.3)	0.74 (0.58–0.94)
Other/missing/unknown	7254 (5.0)	3864 (5.4)	3390 (4.6)	1.05 (0.83–1.33)
MSA population size				
Missing	2421 (1.7)	1553 (2.2)	868 (1.2)	
1,000,000	83,107 (57.4)	39,716 (55.6)	43,391 (59.1)	1
250,000–999,999	28,584 (19.7)	14,912 (20.9)	13,672 (18.6)	0.90 (0.80–1.00)
100,000–249,999	15,194 (10.5)	7814 (10.9)	7380 (10.1)	0.90 (0.78–1.05)
< 100,000	15,554 (10.7)	7435 (10.4)	8119 (11.1)	1.14 (0.98–1.34)
Distance to dialysis unit (miles, mean ± SD)	37.0 ± 203.9			
Missing	15,657 (10.8)	7854 (11.0)	7803 (10.6)	
0–2.5	44,518 (30.7)	18,098 (25.3)	26,420 (36.0)	1
> 2.5– 11.5	42,404 (29.3)	20,919 (29.3)	21,485 (29.3)	0.77 (0.73–0.82)
> 11.5	42,281 (29.2)	24,559 (34.4)	17,722 (24.1)	0.55 (0.51–0.59)
Patients per physician				
Missing	7539 (5.2)	3120 (4.4)	4419 (6.0)	
1–50	30,888 (21.3)	16,476 (23.1)	14,412 (19.6)	1
> 50–100	57,320 (39.6)	29,146 (40.8)	28,174 (38.4)	1.20 (1.09–1.32)
> 100	49,113 (33.9)	22,688 (31.8)	26,425 (36.0)	1.55 (1.39–1.72)
Facility				
Hospital affiliated	16,892 (11.7)	8553 (12.0)	8339 (11.4)	0.88 (0.79–0.97)

	Mean Number of Provider Visits per Month			Logistic Model for 4 Visits per Month [*]
	All	< 4	4	
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Chain affiliated	101,593 (70.1)	50,979 (71.4)	50,614 (68.9)	AOR [*] (95% CI)
				0.90 (0.84–0.96)

AOR, adjusted odds ratio; CI confidence interval; MSA, metropolitan statistical area; SD, standard deviation.

^{*} The model adjusted for patient characteristics: age, sex, race, ethnicity, dialysis duration, cause of ESRD, comorbidity score, socioeconomic status, eligibility for Medicaid, urban residence, compliance with dialysis, and number of days hospitalized from January 1 to June 30, 2006; physician characteristics: sex, years in practice, foreign medical graduate status, specialty, type of practice, metropolitan service area size, distance from office to hemodialysis unit, and number of hemodialysis patients; and facility characteristics: hospital affiliation and chain affiliation.