Dialysis "No-Shows" on Saturdays: Implications of the Weekly Hemodialysis Schedules on Nonadherence and Outcomes

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Background: The prevalence of skipped hemodialysis or no-show is higher among African Americans, younger ages, smokers and illicit drug users. The effect of the weekly hemodialysis treatment schedules [Mondays, Wednesdays, Fridays (MWF); or Tuesdays, Thursdays, Saturdays (TTS)] on adherence is unknown.

Methods: Our hemodialysis patients were prospectively monitored for compliance over a 12-month duration. Regression analyses were employed for associations between variables and outcomes.

Results: A total of 114 African-American patients—mean age 55 ± 14 and 53% male—were surveyed. Compared to the MWF, the TTS patients had higher rates of no show (2.4% vs. 1.7%, p=NS); shortened hemodialysis time (30% vs. 26%, p=NS); cocaine use (18% vs. 8%, p=0.09); higher interdialytic weight gain (4.3 ± 1.8 kg vs. 3.4 ± 1.3 kg, p=0.005); prolonged length of hospital stay (9 ±12 days vs. 4 ± 5 days, p=0.02); and higher mortality (16% vs. 8%, p=NS). Compared to other days of the week, the Saturday no-show rate was significantly higher: 31% vs. 13%, 15%, 16%, 17%, 8%, Monday through Friday, respectively. Length of hospital stay correlated with no show (R^2=0.4, p<0.0001), while early termination was associated with smoking, cocaine use, female gender, TTS schedule, low serum albumin, hematocrit and adequacy of dialysis (Kt/V) (R^2=0.6, p=0.009).

Conclusions: The TTS-scheduled hemodialysis patients are less adherent, and have higher morbidity than the MWF patients and a predilection for skipping on Saturdays.

Key words: kidney ■ dialysis

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INTRODUCTION

Supervision of chronic dialysis patients goes beyond the provision of dialysis therapy. It involves monitoring of adherence to the dialytic therapy, evaluation of compliance with medications, fluid and dietary restrictions. Thus, adherence in dialysis is complex with variable definitions. The most comprehensive definition currently available is the one promoted by Leggat et al.[1] He used pooled data from the U.S. Renal Data System (USRDS) case mix adequacy study and the Dialysis Morbidity and Mortality wave-1 study to define nonadherence in terms of skipping hemodialysis sessions or no-shows, shortening hemodialysis sessions (early termination), excessive interdialytic weight gain (IDWG) and serum phosphorus levels >7.5 mg/dl (2.4 mmol/L).

Noncompliance is quite prevalent among the U.S. end-stage renal disease (ESRD) population. Depending on which aspect of the hemodialysis treatment is in question, various studies have noted that the prevalence of noncompliance could be up to 50%.[2-5] It has been suggested that this high prevalence may be partially responsible for the inferior survival of the U.S. ESRD patients when compared to the European and Japanese ESRD population.[6] The frequency of skipped dialysis is also variable. Many published reports have noted a range of 1–10%.[1,3,6-9] It may be more prevalent in African Americans, younger patients aged <40 years old and in smokers.[1,9,10] Patients who consume illicit drugs also tend to have high no-show rates.[10] It should not come as a surprise, therefore, that high no-show rates portend higher hospitalization rates[7,9] and possibly higher mortality.[1,9,11]

Most studies on compliance had focused on the demographic aspects of nonadherence,[1,4,7,9,10] while others had emphasized psychosocial and behavioral modifications that could improve adherence to fluid restriction.[2,12-14] We

are unaware of any study that has evaluated the effect of the weekly hemodialysis treatment schedules or day of the week on skipped hemodialysis sessions. Most freestanding hemodialysis facilities in the United States perform dialysis on three-days-per-week schedules of Mondays, Wednesdays and Fridays (MWF), and/or Tuesdays, Thursdays and Saturdays (TTS). This study was designed to examine the effect of these weekly schedules on no-show, early terminations and outcomes.

METHODS

This is a prospective surveillance for dialysis compliance at a single-center, inner-city, 45-station dialysis facility. The patients dialyzed on a three-day weekly schedule of MWF or TTS. Our dialysis facility is >20 years old, and assignment of patients to a particular weekly hemodialysis schedule was based entirely on availability of space at intake. It did not depend on patient's characteristics or desirability. There were no transfers between weekly hemodialysis schedules during the study period. The number and frequency of missed dialysis or no-show and shortened hemodialysis sessions were carefully recorded on the dialysis flow sheets and then transcribed into the computer. Patients who shortened their treatment times were made to sign early termination forms. These documents were incorporated into the patients' medical records and uploaded into the computer. The total number of no-shows, early terminations and hospitalizations were reviewed monthly during the monthly quality-assurance meetings. Data recorded over a 12-month period—January 2005 to December 2005—is presented in this paper.

In accordance with the criteria proposed by Leggat et al.,[1] we defined noncompliance in terms of: no-show or skipped/missed dialysis without prior notification or scheduled absence, shortening of dialysis session by >10 minutes more than once per month, excessive IDWG >5.7% of dry weight and serum phosphorus >7.5 mg/dL (2.4mmol/L). Missed dialysis as a result of scheduled hospitalization and dialysis vascular access-related absence were not considered a no-show. Shortened hemodialysis sessions as a result of vascular access problems, clinical events or facility-related issues such as power failure or machine problems were not considered early terminations

Extracted data included patients' demographics; history of smoking, cocaine or polysubstance use; computer-generated weekly averages of IDWG and blood pressures; and monthly averages of the hematocrit, serum albumin, phosphorus and Kt/V. Patients who either expired or transferred to another facility within the first two months of the study were excluded from analysis. Patients were interrogated by the social worker for explanations for their missed dialysis. Self-reported explanations for the no-show were classified into seven broad categories: transportation difficulties, oversleeping, bad weather, doctors' appointments, family issues, diarrhea and no reason when no explanation was provided.

Statistical Analysis

Continuous variables are reported as a mean ± SD, while comparisons between continuous variables and weekly dialysis schedules used one-way analysis of variance (ANOVA) with Fisher's modification. Chi-squared test was used to compare nominal/categorical variables. We used multiple regression analysis for associations

Table 1. Comparison of patient demographic and clinical data according to weekly hemodialysis treatment schedules

Variables	Monday, Wednesday, Friday	Tuesday, Thursday, Saturday	P Value
N	53	61	
Age (years)	54 ± 13	55 ± 14	NS
Male (%)	33 (62)	27 (38)	0.05
Serum albumin (g/dL)	3.8 ± 0.4	3.7 ± 0.5	NS
Hematocrit (%)	35 ± 3	34 ± 5	NS
IDWG (kg)	3.4 ± 1.3	4.3 ± 1.8	0.005
Kt/V	1.4 ± 0.3	1.4 ± 0.3	NS
Serum phosphorus (mg/dL)	5.9 ± 1.6	5.6 ± 1.6	NS
BP systole (mmHg)	139 ± 24	151 ± 29	0.01
BP diastole (mmHg)	76 ± 13	81 ± 15	0.07
Length of hospital stay (days)	4 ± 5	9 ± 12	0.02
Hospitalization rate (%)	47	61	NS
No-show rate (%)	1.7	2.4	NS
Shortened treatment (%)	26	30	NS
Mortality (%)	8	16	NS
Smoking (%)	49	48	NS
Cocaine use (%)	8	18	0.09

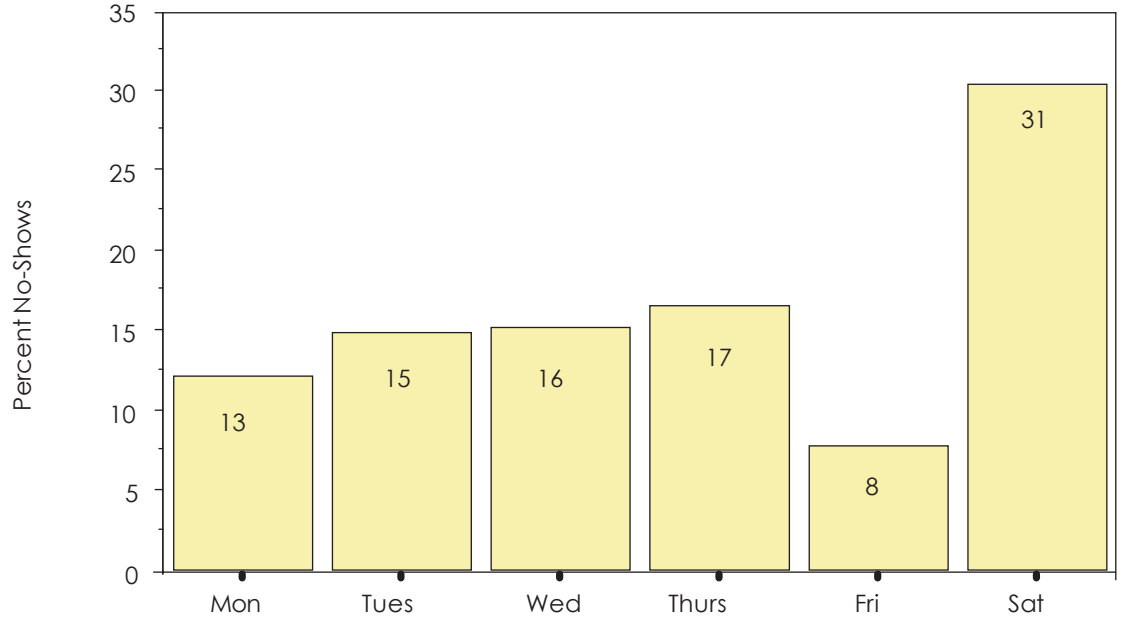
Values expressed as mean ± SD or percent unless noted otherwise. To convert serum albumin in g/dL to g/L, multiply by 10; Serum phosphorus from mg/dL to mmol/L, multiply by 0.3229. N: Number of patients; BP: Blood Pressure, IDWG: Interdialytic weight gain

between the rates of no-show and nine continuous variables. These variables include age, Kt/V, length of hospital stay, IDWG, systolic and diastolic blood pressures, hematocrit, serum albumin and phosphorus. Associations between shortening of treatment time or mortality and other additional nominal variables such as gender, smoking, cocaine use and weekly treatment schedules utilized multiple logistic regression models. The logistic whole model fit had a likelihood ratio of 92%. No-show rate was determined based on the total number of missed dialysis. Since there were patients with zero no-shows, it was necessary to perform data transformation on the rate so as to meet the assumptions of the regression analysis. A step-wise regression procedure was performed for variable selection in the final regression model. The StatView (SAS Institute, Cary, NC) and Stata 9.2 Software (Stata Corp, College Station, TX) were used for all analyses. The study was approved by the institutional review board of the Morehouse School of Medicine and was conducted in accordance with the Helsinki Declaration of 1975 (and as revised in 1983).

RESULTS

A total of 114 African-American patients were monitored during the 12-month surveillance period. Their mean age was 55 ± 14 years, and 60 of 114 patients (53%) were male. There were 587 skipped treatments out of 14,421 scheduled treatments; thus, a no-show rate of 4.1%/year. Thirty-two of 114 patients (36%) shortened their treatment time by ≥10 minutes more than once per month, while 69 of 114 patients (61%) skipped hemodialysis at least once during the study period. Although not statistically significant, the TTS scheduled patients had higher rates of shortened hemodialysis sessions, no-show, hospitalization, smoking, cocaine use and mortality. The IDWG, length of hospital stay and systolic blood pressure were significantly higher in the TTS group (Table 1). Although only 15 of 114 patients (17%) used cocaine, 11 of the 15 cocaine users (73%) dialyzed on the TTS schedule. The total number of skipped dialysis sessions was significantly higher among cocaine users than nonusers (15 vs. 4, p=0.0008). Similarly, 13 of 15 (87%) of the cocaine users shortened their time (p<0.0001), while 26 of 32 (81%) of those who shortened time smoked (p<0.0001). Overall, 55 of 114 patients (63%) smoked. There was no significant difference in the number of skipped treatments between smokers and nonsmokers. With the exception of Wednesdays, the frequency of no-show was significantly higher on Saturdays than the other days of the week (Figure 1). Patients who shortened their treatment were four times more likely to skip treatment (p<0.0001). Categorization of our patients by age group showed that patients aged <50 years comprised 30%, age group 50–69 years, 55%, while those aged ≥70 years made up only 15% of our patient population. Although the <50-age group was not the dominant group, no-show was disproportionately more prevalent in this age category, 67% vs. 27% in age group 59–69 years and 6% in age group ≥70 years (p=0.0003, respectively). The predominance of no-show

Figure 1. Bar chart showing the frequency of skipped dialysis according to days of the week: Sat. vs. Mon., p=0.04; Sat vs. Tues, p=0.003; Sat. vs. Wed, p=0.09; Sat vs. Thurs., p=0.005; Sat vs. Fri., p=0.006



Mon: Mondays, Tues.: Tuesdays, Wed.: Wednesdays, Thurs.: Thursdays, Fri.: Fridays; Sat: Saturdays

in younger patients and in the TTS treatment schedule is shown in Figure 2.

Multiple regression analysis for association between no-show and nine independent variables that included age, Kt/V, IDWG, systolic and diastolic blood pressure, hematocrit, serum albumin, phosphorus and length of hospital stay revealed a significant association (R^2=0.6, p=0.008. The three main variables that independently contributed to this association are hospital stay, serum albumin and diastolic blood pressure. The strong independent association between no-show and length of hospital stay is shown in Figure 3.

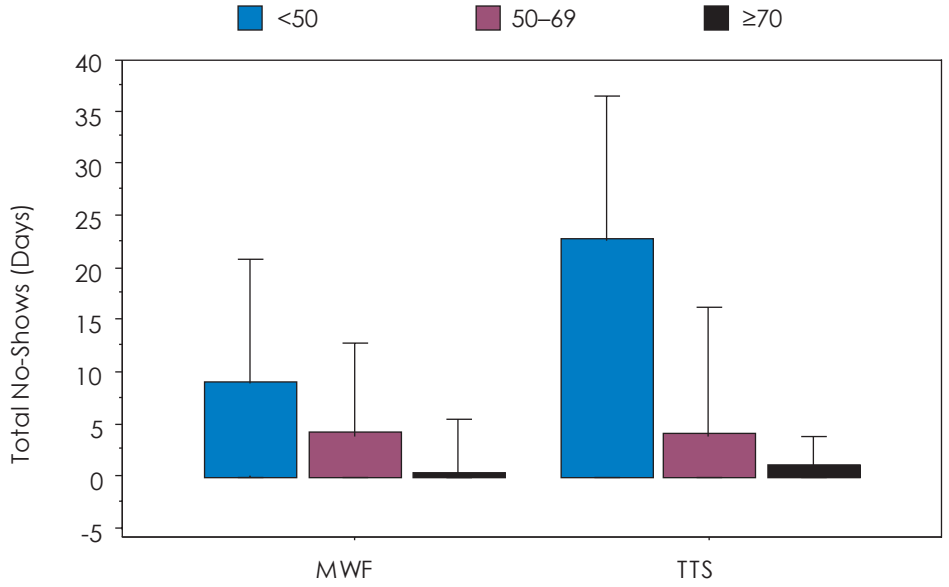
Association between shortening of dialysis treatment time and 14 variables was examined in a multivariate logistic regression model. The variables examined are: age, gender, TTS schedule, hematocrit, serum phosphorus and albumin, IDWG, Kt/V, systolic and diastolic blood pressure, smoking, cocaine use, hospitalization and mortality. Table 2 shows that early termination of dialysis is significantly associated with the female gender, smoking, cocaine use, TTS schedule, low serum albumin and hematocrit, skipped dialysis and poor dialysis adequacy (R^2=0.6, p=0.009). Other variables had either no association or weak and nonsignificant associations. A similar analysis for association with mortality showed that age was the only variable that was significantly associated with mortality (data not shown). Mortality was 29% in those aged ≥70 years, compared to 9% in the age group <50 years and 10% in age group 50–69 years (p=0.06, respectively).

Most of the patients who skipped hemodialysis could not adequately account for their absence (Figure 4); generally, such patients were more likely to be cocaine users. A large proportion of our patients either had transportation difficulties or felt poorly. Examination of the relationship between these explanations and age category revealed that nine of 17 patients (53%) who could not explain their absence were aged <50 years. Examination of these explanations in relation to the weekly treatment schedule showed that three of four patients (75%) who reported oversleeping, five of eight patients (63%) who claimed family issues, six of nine patients (67%) who reported feeling poorly and eight of 17 patients (47%) of those who had no explanations for their absence dialyzed on the TTS schedule.

DISCUSSION

Skipping of hemodialysis (no-show) and shortening of hemodialysis sessions (early termination) continue to pose immense challenges to dialysis units and renal healthcare providers. The prevalence of these two nonadherence problems in the United States continues to surpass that in Europe and Japan.[6,9] It remains unclear why no-show and early termination are predominant in the United States. A recent publication from the Dialysis Outcomes and Practice Patterns Study (DOPPS), which evaluated adherence in seven countries, noted that large dialysis facilities with >60 patients were associated with a 77% likelihood of skipping, while those facilities with >75 patients were associated with 55% likelihood of

Figure 2. A box plot showing the association between age categories and the frequency of skipped dialysis (no-show). The frequency according to weekly dialysis schedule is compared. No-show was more prevalent in younger patients and in the TTS group.

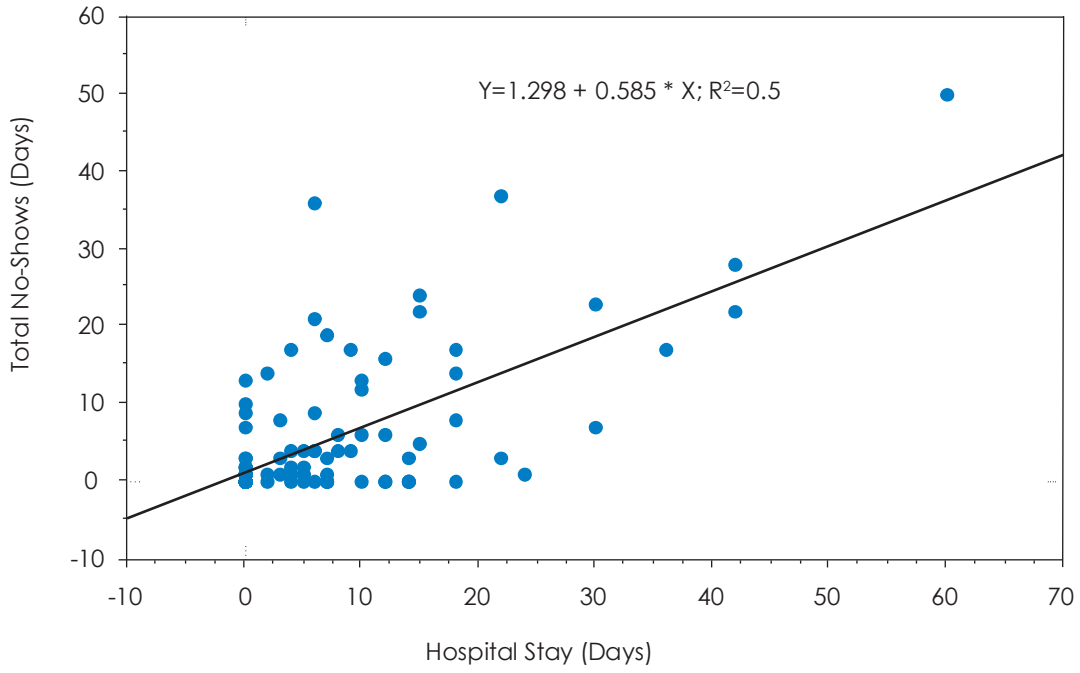


MWF: Monday, Wednesday, Friday; TTS: Tuesday, Thursday, Saturday

shortening of dialysis sessions.[9] However, much larger facilities with >125 patients only had 15% likelihood of no-show and 7% likelihood of shortening time. Thus, the notion that facility size plays a role in dialysis adherence is of questionable significance. Our facility had an average of 105 patients during the study period, with a 61% and 36% prevalence of skipping and shortening of hemodialysis sessions, respectively.

This report confirms some of the previously documented observations on the prevalence of and demographic factors associated with dialysis noncompliance. We observed a 4.1% no-show rate, compared to 7.9% in the U.S. arm of the DOPPS[9] and 8.5% in the pooled data from the USRDS case-mix adequacy study.[1] The incidence of early termination of hemodialysis was quite high in our patients—36%—compared to 19.6% in the DOPPS and 20% in the USRDS data. It is not surprising that patients who indulged in early termination of dialysis were also more likely to skip hemodialysis, smoke, use cocaine and have lower urea kinetics. The high level observed in our study may be related to the demography of our patient population, i.e., young inner-city African Americans. In agreement with other studies, we confirmed the association between noncompliance and younger age, African-American ethnicity, smoking[1,9,10] and use of illicit drugs.[10] But, unique to our study is the association between the weekly treatment schedules and the predilection for no-show on Saturdays. Our study showed that patients who dialyzed on the TTS schedule had higher rates of no-show, early termination, excessive IDWG, higher blood pressure, increased hospitalization rate, length of hospital stay and mortality. From these observations, one could postulate that the overwhelming predominance of the previously mentioned factors, such as younger age and illicit drug use may account for the disproportionate prevalence of noncompliance in the TTS-scheduled patients. Seventy-three percent of the cocaine users in our study dialyzed on the TTS schedule, while 87% of the cocaine users shortened their time. A large percentage of our no-shows occurred on Saturdays. We are unable to provide a logical explanation for the preference for Saturday no-show except to imply that these patients consider Saturday "a dialysis-free day" and feel emboldened to take the day off since no adverse outcome occurs initially, while residual renal function remains substantial. It has been suggested that noncompliant dialysis patients are more likely to be bothered by the effects of kidney disease on their daily lives and perceived lack of control over their future health.[2] Therefore, skipping on Saturdays may represent a subtle expression of some control over their health status and their life. It is also possible that frequent use of illicit substances has impaired their judgment and reasoning. About 67% of our no-shows occurred in patients aged <50 years old, even though this subgroup only comprised 30% of our patient population. On several occasions, these patients were overheard criticizing the older and more-adherent patients.

Figure 3. Bivariate regression plot for association between lengths of hospital stay and total no-shows for dialysis (R^2=0.4, p<0.0001)



An assessment of functional health status of hemodialysis patients by De Oreo reported that patients who skip hemodialysis feel they are physically healthy and thus can "get away" with the behavior.[15] Indeed, about half of those who had no explanations for their absence from dialysis were aged <50 years old and dialyzed on the TTS schedule.

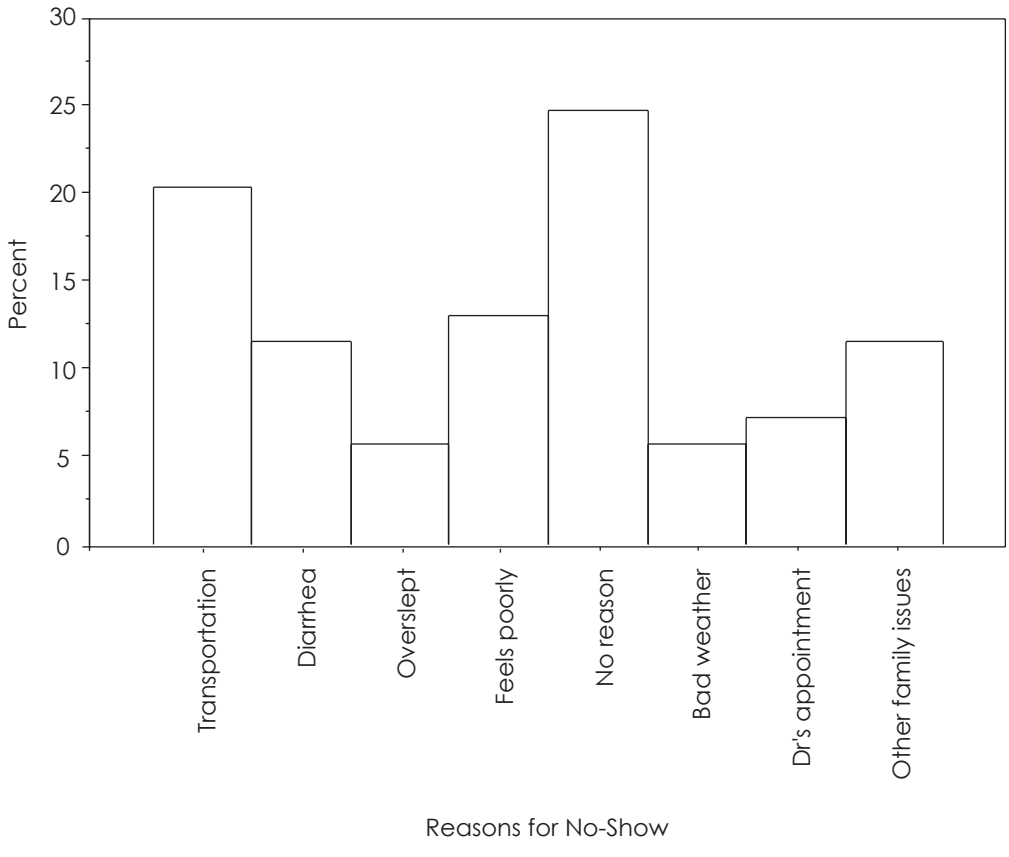
The association between noncompliance and mortality remains controversial. While some studies have noted decreased survival with no-show or early termination,[1,9,10] others could not show an association.[16,17] In the studies that demonstrated an association with mortality, the relative risks for mortality were 14%,[11] 25%,[1] 30%[9] and up to 69% in a recent study.[10] We could not show an associated mortality risk with either no-show or early termination of hemodialysis. Ifudu et al.[16] found no association between skipping one hemodialysis session per month and mortality. In a nine-year surveillance study by O'Brien,[17] patients who died early were more compliant than those who survived to the end of the study. It is noteworthy that in Japanese patients, excessive IDWG was associated with better nutrition and lower mortal-

Table 2. Multivariate logistic regression analysis for association between early termination of dialysis and select variables

	χ^2	P Value
Cocaine use	4.1	0.04
Hematocrit	5.5	0.02
Tuesday, Thursday, Saturday schedule	5.9	0.02
Serum albumin	9.1	0.003
Female gender	10.8	0.001
No-show	12.0	0.0005
Smoking	12.9	0.0003
Kt/V	17.0	<0.0001

χ^2: Chi square arranged in an ascending order of significance

Figure 4. A histogram showing the frequency of the self-provided explanations by the patients for their absence from dialysis. "No explanation" had the highest frequency.



ity.[18] Similarly, in the DOPPS, the Japanese patients had the highest rate of excessive IDWG—34.5% vs. 11% and 16.8% in the European and U.S. arms, respectively. Therefore, not all nonadherence behaviors are associated with increased mortality risk. A recurrent flaw with most of the published studies, including ours, is the small sample size, which limits determination of mortality risks.[19] We observed that mortality was associated with advanced age and hyperphosphatemia. These associations have been well documented in the literature.[20,21]

Even though demographic, psychosocial and clinical correlates of no-show and early termination of hemodialysis have been delineated by multiple studies, solutions to this behavior remain elusive. Several published studies on interventions designed to ameliorate this problem have primarily focused on adherence to fluid restriction.[12-14] Recently, two studies based on cognitive behavioral interventions reported some success in improving adherence to fluid restriction.[12,13] In a review of nine intervention studies designed to reduce excessive IDWG, self-monitoring was also found to be effective.[14] The effect of "contingency contracting" on adherence was examined by one study.[22] The authors of that study noted that adherence to phosphate binding responded more favorably to contracting than fluid restriction. Strong religious beliefs and spiritualism did not have an impact on adherence in another study.[23] We are unaware of any reported interventions designed to ameliorate no-show. An increase in the presence of highly trained staff members and in staff hours were associated with a decrease in the likelihood of skipping in the DOPPS.[9] An extensive review of methods to improve adherence by Morgan[24] indicated that increased contact time between the nephrology nurse and patients helps to empower the nurse to develop individualized interventions aimed at reducing nonadherence. The use of temporary nursing staff (agency nurses) is quite prevalent in many inner-city dialysis units. Our facility is guilty of this practice, which may have contributed to the high rate of noncompliance in our patients. The high prevalence of illicit drug use in our patient population (especially the TTS group) cannot be ignored.

In conclusion, no-show for hemodialysis remains a major problem among African-American patients who dialyze in inner-city dialysis facilities. The impact of noncompliance on hospitalization is unquestionable; thus, the immense contribution to the escalating costs of ESRD care in the United States. In addition to the previously reported demographic factors that are associated with noncompliance, we have shown for the first time that the weekly dialysis treatment schedule also affects compliance. Patients who receive hemodialysis on the TTS schedule have high no-show rates and a predilection for skipping on Saturdays. Our study is limited by our sample size and the fact that it is a single-facility study. The demography of our patient population is unique to the inner-city dialysis facilities. Such patients are notoriously noncompliant and are known to present late for renal replacement therapy.[25] Thus, hemodialysis noncompliance may simply represent a manifestation of their pre-ERSD behavior. Further studies in a larger and diverse patient population are needed to confirm or refute our findings. We are currently re-evaluating our findings on a larger franchise patient pool.

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