Frequency of Sit-Down Patient Care Rounds, Attainment of Clinical Performance Targets, Hospitalization, and Mortality in Hemodialysis Patients

Abstract. Sit-down patient rounding in hemodialysis units allows providers to focus collectively on each patient's needs and may affect patient outcomes positively. The objective was to examine whether sit-down rounding practices improve patient outcomes in a cohort of 644 adult hemodialysis patients from 75 outpatient dialysis clinics in 17 states throughout the United States who survived at least 6 mo after enrollment (average follow-up, 3.2 yr). Achievement of well-accepted 6-mo clinical performance targets of albumin (≥3.5 g/dl), hemoglobin (≥11 g/dl), calcium-phosphate product (<60 mg²/dl²), dose (Kt/V ≥1.2), and vascular access type (fistula); hospitalization rates; and all-cause mortality served as outcomes. Monthly or more frequent sit-down rounds were conducted in 36 (48%) of 75 clinics, representing 287 (45%) of 644 patients. More frequent sit-down rounds were positively associated with an increased chance of achieving the 6-mo clinical performance target for albumin compared with less frequent rounds (odds ratio [OR], 1.88; 95% confidence interval [CI], 1.12 to 3.15); patients who were treated at clinics with more frequent rounds also had nearly twice the odds of achieving more of the five performance targets (OR, 1.95; 95% CI, 1.11 to 3.42). After adjustment for potential confounders, patients who were treated at clinics with more frequent sit-down rounds were 32% less likely to be hospitalized (incidence rate ratio, 0.68; 95% CI, 0.51 to 0.91), had fewer hospital days per year (rate ratio, 0.50; 95% CI, 0.26 to 0.98), and were 29% less likely to die (relative hazard, 0.71; 95% CI, 0.53 to 0.95). Adjustment for some clinical performance targets attenuated the statistical significance of the association with hospitalization. More frequent sit-down rounds in hemodialysis units are associated with better patient outcomes, including an increased chance of meeting the albumin clinical performance target, decreased hospitalization, and decreased risk of mortality. This association may be due to the positive effect of collaborative discussion by the patient care team of short- and long-term care goals for individual patients.

It has been postulated that collaborative or interdisciplinary rounds, in which all members of a patient care team discuss each patient’s status and develop short- and long-term patient care goals, improve patient care and decrease medical errors in a variety of settings (1–3). However, most of the evidence that such rounds actually improve patient outcomes is anecdotal in nature. Although a few substantive studies of patient rounds and outcomes have been conducted, the results are somewhat inconsistent. For example, in the intensive care unit setting, the hemodialysis unit, which provides longitudinal care away from the patient, to review each patient’s status with review of the medical record and discussion. In one clinical setting, the hemodialysis unit, which provides longitudinal care for patients with chronic kidney disease, the team may include a diverse group of professionals composed of nephrologists, nurses, technicians, social workers, and dietitians. These professionals must work together closely to coordinate health care. Sit-down rounds provide an opportunity for the patient care team to assess progress, address problems, and formulate pa-
tient care plans that are specifically suited to each patient’s individual needs. Sit-down rounds typically involve more members of the patient care team than “walk-rounds,” which generally occur frequently and are brief and focused on immediate care needs. Sit-down rounds, conversely, are longer and focused on both short- and long-term needs, and they may occur sporadically or not at all, as a result of time and resource constraints.

Sit-down patient rounding in hemodialysis units may also allow concerted focus on each patient’s clinical performance, including reviews of nutrition, anemia, bone disease, dialysis adequacy, and vascular access, by the entire patient care team. More frequent conduct may allow for more opportunities to monitor treatment regimens closely, to discover any new medical problems or complications that might compromise long-term outcomes, and to refer patients to primary care providers or specialists, such as cardiologists or gastroenterologists. Therefore, we conducted a national study to examine whether the frequency of sit-down rounding in hemodialysis care is associated with improvement in both intermediate- and long-term patient outcomes.

Materials and Methods
Study Design
Our study design was a national cohort study, the ESRD Quality (EQUAL) study, of hemodialysis patients who were cared for at 75 not-for-profit, free-standing outpatient dialysis clinics in 17 states throughout the United States. The cohort was assembled from the Choices for Healthy Outcomes in Caring for End-Stage Renal Disease (CHOICE) study (7) in which 1041 incident dialysis patients (767 hemodialysis, 274 peritoneal dialysis) were enrolled in the study at 81 dialysis clinics in 19 states between October 1995 and June 1998. The CHOICE study was based on a collaborative relationship between Johns Hopkins University and Dialysis Clinics, Inc. (DCI; Nashville, TN; n = 79 clinic), New Haven CAPD (New Haven, CT; n = 1 clinic), and St. Raphael’s Hospital (New Haven, CT; n = 1 clinic). To be eligible, patients had to be older than 18 yr and speak either English or Spanish. Median time from dialysis initiation to enrollment was 45 d, with 98% enrolling within 4 mo of initial dialysis. Informed consent was obtained from each patient. The CHOICE study sample is representative of the United States Renal Data System (USRDS) population with respect to age, gender, and race. The proportion of patients who were treated with hemodialysis was less than that in the USRDS because peritoneal dialysis patients were oversampled for the CHOICE study. Diabetes and hypertension together accounted for 45.1% of the cohort, a figure similar to the USRDS.

Intermediate measures of whether patients achieved clinical performance “targets” at 6 mo after enrollment in the study, hospitalizations, and all-cause mortality served as the outcome variables for this study. The clinical performance targets included 6-mo values for albumin (≥3.5 mg/dl), hemoglobin (≥11 g/dl), calcium-phosphate (Ca-P) product (<60 mg2/dl2), dialysis dose (Kt/V ≥1.2), and vascular access (presence of functioning arteriovenous fistula). Targets of these measures were based on Kidney Disease Outcomes Quality Initiative guidelines (9), Centers for Medicare and Medicaid Services (CMS), and other studies of clinical performance measures (10–14), and clinical judgment. Hospitalization data with a limited follow-up (through November 1998) was obtained from CMS inpatient files. Mortality information was ascertained from clinic report, medical records, and CMS (death notification forms and Social Security records). Follow-up continued until death, transplantation, loss to follow-up, or survival to January 1999.

Data Collection
A questionnaire was administered to medical directors or head nurses at the 81 participating clinics in October 1998 to ascertain the value of the independent variable for this study. The questionnaire asked about each clinic’s current (in October 1998) customary practice with regard to which types of regular patient care rounds they had, with possible responses of “yes” or “no” to “walk-rounds with the nephrologist,” “walk-rounds with the nurse manager rounds,” “sit-down meetings to review charts,” and “multidisciplinary meeting with dietitian, social worker, etc.” Frequency was assessed for each type of rounds with the question, “How often?” Although we analyzed all four types of rounds, we report only on the independent variable derived from the item “sit-down meetings to review charts.” Neither nurse manager rounds nor multidisciplinary meetings produced significant results, and analyses with nephrologist rounds gave results that mirrored those seen previously with frequency of physician contact (8).

Seventy-eight (96%) of 81 clinics responded to the questionnaire item regarding sit-down rounds. Of 767 total hemodialysis patients enrolled in CHOICE, 736 were treated at clinics that provided information on sit-down rounds. Because we intended to use 6-mo process-of-care measures as intermediate outcomes and only those patients who survived to 6 mo could be assessed for these outcomes, we limited the analyses to those who survived at least 6 mo, yielding a total sample size of 644 patients, representing 75 clinics (DCI, n = 74 clinics; St. Raphael’s, n = 1 clinic). Responses to this item (see Figure 1) were collapsed into two categories—high frequency (monthly or more often) and low frequency (less than monthly or none) of rounding—and linked by clinic to relevant patient-level data, because we believed that sit-down rounds at a frequency that was less than monthly might not have the same impact as more frequent rounds. Alternative cutoff points to define the frequency of rounds, including sit-down rounds at any frequency versus no sit-down rounds, did not substantially change the results in either magnitude or statistical significance. It should be noted that patients who were excluded on the basis of survival of <6 mo had a similar proportion of patients (45.1%) exposed to higher frequency of rounds as patients who were included (44.6%; P = 0.930 by Pearson χ2 test).

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follow-up, or the last follow-up date of November 2003 (average follow-up, 3.2 yr).

In addition to the independent variables and outcome variables, we collected extensive individual-level data on demographic, laboratory, and clinical characteristics. Data regarding patient demographics (age, gender, and race) and socioeconomic status (education, employment, and marital status) were collected from a baseline self-report questionnaire. Laboratory values (albumin, creatinine, and hematocrit) and height and weight (used to calculate body mass index) were obtained from clinic records or from the CMS Medical Evidence report (CMS Form 2728). Vascular access information was obtained on a subset of individuals through review of discharge summaries, dialysis flow sheets, and dialysis clinic progress notes, performed for previous CHOICE Study research (15). Dialysis dose (Kt/V) was calculated from clinic-supplied values of blood urea nitrogen, pre- and postdialysis weight, and dialysis duration using the Daugirdas formula (16). Comorbidity was assessed at baseline using the Index of Coexistent Disease, whose composite integer score ranges from 0 to 3 (with 3 as the highest severity level) and is a measure of both the presence and the severity of comorbid conditions (17–20). Mental and physical health status was assessed at baseline using the mental component score and physical component score from the Medical Outcomes Study Short Form 36 (21).

Statistical Analyses

We first compared individual-level patient characteristics by clinic-reported frequency of sit-down rounds using Pearson χ² tests for categorical variables and two-sided t tests for continuous variables. For 6-mo clinical performance targets, we used logistic regression models to obtain odds ratios (OR) that compare the odds of achieving the target in the more frequent (monthly or more often) group with the odds of achieving the target in the less frequent (less than monthly/none) reference group. Ordinal logistic regression models were used to analyze the total number of targets achieved. Linear regression was also used with outcomes (albumin, Ca-P product, hemoglobin, and dose) that could be analyzed as continuous variables, to calculate average difference in value between the two frequency groups. These models were adjusted for the value at first dialysis of the specific clinical performance measure in question (except for dialysis dose and vascular access, which remained unadjusted), because we did not identify any other stronger confounders of the outcome. Crude hospitalization rates were calculated, and Poisson regression models were used to assess the relation between sit-down rounds and hospitalization (incidence rate ratio [IRR]). Rate ratios comparing number of hospital days per year were obtained by exponentiation of coefficients from linear regression of log(hospital days/yr) on the independent variable. Survival time was assessed starting at time of patient enrollment, and we assessed individual cumulative mortality by frequency of sit-down rounds by calculating overall crude mortality rates at the average follow-up (3.2 yr) in the cohort excluding those who died before 6 mo and by using Kaplan-Meier methods. At 80% power, we were able to detect a difference of 11% in mortality between the less and more frequent rounds groups. We used Cox proportional hazards models to assess the strength and independence of an association between frequency of sit-down rounds and death. We calculated both unadjusted and adjusted relative hazards (RH) for mortality by frequency of sit-down rounds using time from first dialysis to death or censoring (at transplantation, loss to follow-up, or closeout) as the survival time variable. The proportional hazards assumption was not violated (global test of Schoenfeld residuals, $\chi^2 = 0.31$ and $P = 0.58$). Variables were considered for adjustment in the Cox models on the basis of either their demonstration to be confounders (i.e., significantly associated with both the frequency of rounds and the outcome measure) or previous evidence of their association with survival. Race, Index of Coexistent Disease, age at enrollment, albumin level at first dialysis, baseline creatinine level, and high-sensitivity C-reactive protein (CRP) level (quartiles) were chosen as adjusters for both hospitalizations and mortality on the basis of these criteria. Some variables that have been associated with survival, such as diabetes and hematocrit, were excluded in the interest of parsimony, because their associations with survival disappeared with adjustment for the above-mentioned, stronger confounders.

Analyses of other outcomes that could be associated with sit-down rounds frequency were performed as well. For patients with a permanent access (fistula or graft) by 6 mo, time to access failure (i.e., another access had to be placed) was assessed with Cox models. Cox models were also used to look at time to placement on the transplant waiting list. Finally, logistic models were run to determine whether patients considered themselves independent at 1 yr after enrollment. Patients who responded “a little of the time” or “none of the time” to the CHOICE Health Experience Questionnaire (22) item, “How often do you feel dependent on your family and friends?” were considered independent.

Patients at the same clinic cannot reasonably be considered independent observations (23). We accounted for this consideration (Stata option cluster) by using an unconditional method that involves obtaining robust variance-covariance matrix estimates in all Cox proportional hazards, Poisson regression, and logistic regression models (24,25). For the binary outcomes (26), we also tested random-effects logistic regressions, grouped by clinic cluster. For Cox regressions, frailty models (similar to random-effects models) were also tested (27). Because the results were so similar to those from models with no accounting for clustering and to those with robust variance estimates and because we were interested in the average effect across clinics, allowing for any within-clinic correlation, we present the robust variance models.

Because covariates for the Cox models were missing for some participants (e.g., albumin, $n = 4$; creatinine, $n = 16$; CRP, $n = 31$), we addressed the possibility that missing independent variables could influence our results by performing separate analyses in which missing data were replaced using multiple imputation methods (28). This approach yielded similar results in magnitude of estimates and statistical significance to analyses that were based on only nonmissing data. Thus, we present results excluding records with missing values. All analyses were performed using Stata v. 8 and SAS v. 8.01.

Results

Patients and Their Characteristics

A total of 644 incident in-center hemodialysis patients (84% of the 767 incident hemodialysis patients in the CHOICE study) who were treated at 75 clinics (93% of the 81 not-for-profit clinics in the CHOICE study) for whom we had information on frequency of sit-down rounds and who survived 6 mo were included in our analyses. Patients at the six clinics that were not included in this study were more likely to be unmarried and to have lower hemoglobin levels at first dialysis than their counterparts at included facilities. Of the 75 included clinics, 35 (47%) had no sit-down rounds and 31 (41%) conducted sit-down rounds monthly (Figure 1). The remaining facilities had sit-down rounds more (6%) or less (5%) often than monthly.

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For patients who were included in the analysis, 357 were treated at 39 (52.0%) clinics with sit-down rounds less than monthly or not at all; the remaining 287 patients were treated at 36 (48.0%) clinics with sit-down rounds monthly or more often. Most patient characteristics did not differ significantly by frequency of sit-down rounds (Table 1). However, significantly higher proportions of patients who were treated at clinics with a practice of more frequent rounds were white, married, or high school graduates. Also, there is evidence that larger clinics are more likely to have less frequent or no rounds versus more frequent rounds: Patients who were seen at clinics with less frequent rounds were more likely to be seen at clinics that also had a greater number of hemodialysis patients, greater patient:technician ratios, and more hemodialysis shifts per week (Table 1). Frequency of walk-rounds by the nephrologist did not differ by the frequency of sit-down rounds.

**Association of Frequency of Sit-Down Rounds with Clinical Performance Measures**

Overall, 84% of patients achieved the albumin target (≥3.5 g/dl) at 6 mo, 60% achieved the hemoglobin target (≥11 g/dl), 77% achieved the Ca-P product (<60 mg²/dl²) target, 83% achieved the dose target (Kt/V ≥ 1.2), and 27% achieved the vascular access target (functioning fistula). Patients who were treated at clinics with sit-down rounds monthly or more often had significantly greater odds of achieving the albumin target at 6 mo and also had a significantly greater level of albumin at 6 mo (Table 2). These patients also had greater odds of achieving the hemoglobin, Ca-P product, and dose targets, but these associations were not statistically significant. Note that when the stricter Disease Outcomes Quality Initiative (9) guidelines for albumin (≥4.0 g/dl) and Ca-P product (<55 mg²/dl²) were imposed, only 30 and 65% of patients, respectively, achieved the 6-mo targets. Despite this, the results are fairly similar to those obtained with our original targets but with slightly lower magnitude: albumin (OR, 1.41; 95% CI, 0.97 to 2.06) and Ca-P product (OR, 1.02; 95% CI, 0.67 to 1.53). Adjustment for gender did not affect the association between sit-down rounds and achieving the vascular access target (OR, 1.10; 95% CI, 0.79 to 1.54), although men were significantly more like than women to achieve the target (OR, 2.47; 95% CI, 1.33 to 4.57). There was no evidence of an interaction between gender and sit-down rounds frequency. Although those with diabetes and those with late referral to a nephrologist were less likely to achieve the access target, the association of sit-down rounds with the vascular access target was not affected by adjustment for these variables. Also, with a target of fistula or graft (i.e., any permanent access), the results are similar: OR, 0.96; 95% CI, 0.57 to 1.64. Adjustment for factors that reflect clinic size (patient:technician ratio, patient:nurse ratio, number of hemodialysis patients, and number of hemodialysis shifts/wk) did not affect the results appreciably for any of the individual targets.

More frequent rounds were significantly associated with greater number of targets achieved (Table 2) for those who had information on all five targets at 6 mo. The median number of targets achieved was also less for the less frequent group versus the more frequent group (three versus four targets). Those who did not have information on all five targets were less likely to have a fistula at baseline and had lower body mass index than those who did have all of these values. The addition of frequency of nephrologist walk-rounds, a potential confounder, did not change any of the results. Adjustment for factors that reflect clinic size (patient:nurse ratio, number of hemodialysis patients, and number of hemodialysis shifts/wk) did not affect the results, except for patient:technician ratio, which resulted in similar results but with marginal statistical significance (OR, 1.79; 95% CI, 0.97 to 3.29).

**Association of Frequency of Sit-Down Rounds with Hospitalization**

Those who were treated at clinics with more frequent sit-down rounds had lower crude hospitalization incidence rates and were 32% less likely to be hospitalized during the follow-up period than those who were treated at clinics with less frequent or no rounds (Table 3). After adjustment for the 6-mo laboratory clinical performance measures (albumin, hemoglobin, Ca-P product, dialysis dose, and vascular access), there was no association between sit-down rounds and hospitalization. Adjustment for frequency of nephrologist walk-rounds, late referral to a nephrologist, and diabetic status did not change the association between sit-down rounds and hospitalization; neither did adjustment for factors that reflect clinic size (patient:technician ratio, patient: nurse ratio, number of hemodialysis patients, and number of hemodialysis shifts/wk).

The number of days hospitalized per year was also associated with sit-down rounds frequency, with patients who were exposed to sit-down rounds more frequently having approximately half the number of hospital days per year than patients with less frequent or no rounds had (Table 3); further adjustment for clinical performance measures again gave nonsignificant results. When analysis was restricted only to those patients who had a nonzero total number of hospital days (n = 324), the association was more statistically significant (rate ratio, 0.68; 95% CI, 0.54 to 0.87), and the significance was robust to the addition of clinical performance measures to the model.

Because the outcomes of hospitalization and days hospitalized were not rare in this dialysis population and Poisson regression therefore might not provide the best estimates of association of frequency of sit-down rounds with hospitalization, we also ran linear regression models on hospitalizations per year and days hospitalized per year. In adjusted models, more frequent sit-down rounds were associated with a decrease of 0.5 hospitalizations per year (β = −0.50; 95% CI, −0.91 to −0.09) and a decrease of approximately 4 d hospitalized per year (β = −4.27; 95% CI, −6.90 to −1.63). Further adjustment for clinical performance measures did not attenuate the statistical significance of these results, except for the addition of vascular access to the hospitalization model.
Table 1. Baseline characteristics of patients by clinic practice of the frequency of sit-down patient rounds

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency of Sit-Down Rounds</th>
<th>Overall</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than Monthly/None</td>
<td>Monthly or More Often</td>
<td></td>
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<tr>
<td></td>
<td>357 (55.4)</td>
<td>287 (44.6)</td>
<td>644 (100)</td>
</tr>
</tbody>
</table>

**Patient characteristics**

- **no. of patients (%)**
  - 357 (55.4) 287 (44.6) 644 (100)

**demographic**

- **age at enrollment (N = 644)\(^b\)**
  - 58.9 ± 14.2 60.2 ± 14.5 59.5 ± 14.3 0.247

- **gender (N = 644)\(^c\)**
  - female: 45.4 46.3 45.8 0.807
  - male: 54.6 53.7 54.2

- **race (N = 644)\(^c\)**
  - white: 58.8 62.0 60.3 <0.001
  - black: 38.4 28.6 34.0
  - other: 2.8 9.4 5.7

**education (N = 632)\(^c\)**

- not a high school graduate: 35.7 27.3 32.0 0.024
- high school graduate: 64.3 72.7 68.0

**marital status (N = 642)\(^c\)**

- not currently married: 50.8 42.7 47.2 0.039
- currently married: 49.2 57.3 52.8

**employment status (N = 643)\(^c\)**

- not employed: 91.6 90.6 91.1 0.664
- employed: 8.4 9.4 8.9

**clinical**

- **baseline ICED (N = 644)\(^c\)**
  - ≤1: 30.3 30.0 30.1 0.408
  - 2: 37.2 41.8 39.3
  - 3: 32.5 28.2 30.6

- **baseline MCS (N = 553)\(^b\)**
  - 47.1 ± 11.5 45.8 ± 11.9 46.5 ± 11.7 0.196

- **baseline PCS (N = 553)\(^b\)**
  - 31.9 ± 9.5 32.9 ± 10.7 32.4 ± 10.0 0.227

- **body mass index (N = 603)\(^b\)**
  - 27.1 ± 6.9 28.0 ± 7.1 27.5 ± 7.0 0.130

- **Kt/V (N = 627)\(^b\)**
  - 1.24 ± 0.33 1.28 ± 0.34 1.26 ± 0.33 0.079

**late referral to nephrologist (N = 538)\(^b\)**

- ≥4 mo from evaluation to start of dialysis: 68.7 65.8 67.3 0.470
- <4 mo from evaluation to start of dialysis: 31.3 34.2 32.7

**vascular access (N = 437)\(^c\)**

- temporary: 63.9 67.0 67.0 0.501
- permanent (fistula/graft): 36.1 33.0 33.0

**laboratory**

- **albumin at first dialysis (g/dl; N = 640)\(^b\)**
  - 3.50 ± 0.47 3.49 ± 0.48 3.50 ± 0.47 0.762

- **mean creatinine (mg/dl; N = 628)\(^b\)**
  - 7.21 ± 2.41 7.37 ± 2.48 7.28 ± 2.44 0.441

- **mean hemoglobin (g/dl; N = 635)\(^b\)**
  - 9.85 ± 1.47 9.80 ± 1.53 9.83 ± 1.50 0.693

- **mean Ca-P product (mg\(^2\)/dl\(^2\); N = 638)\(^b\)**
  - 44.0 ± 13.7 44.8 ± 14.5 44.4 ± 14.1 0.496

- **mean CRP (\(\mu\)g/ml; N = 613)\(^b\)**
  - 8.9 ± 12.2 8.8 ± 14.2 8.8 ± 13.1 0.957

**Clinic characteristics**

- **no. of hemodialysis patients (N = 614)\(^c\)**
  - ≤100: 151 (42.3) 142 (55.2) 293 (47.7) 0.002
  - >100: 206 (57.7) 115 (44.8) 321 (52.3)

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\(^a\) All covariates shown were measured at enrollment except the laboratory values albumin, hemoglobin, and Ca-P product, dose, and vascular access (which were measured at the start of dialysis) and CRP (which was measured an average of 3.5 mo after enrollment and an average of 5 mo after start of dialysis). Significant \( P \) values are in boldface type. ICED, Index of Coexistent Disease; MCS, mental component score; PCS, physical component score; Ca-P, calcium-phosphate; CRP, C-reactive protein.

\(^b\) Shown are means ± SD. \( P \) values obtained from two-sided \( t \) test.

\(^c\) Shown are percentages of patients in each category. \( P \) values obtained from Pearson \( \chi^2 \) test.
Table 1. (Continued)

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<td></td>
<td>Less than Monthly/None</td>
<td>Monthly or More Often</td>
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<tr>
<td>patient:nurse ratio (N = 637)(^c)</td>
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<tr>
<td>≤3</td>
<td>170 (48.6)</td>
<td>150 (51.9)</td>
<td>320 (50.1)</td>
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<tr>
<td>&gt;3</td>
<td>180 (51.4)</td>
<td>138 (48.1)</td>
<td>318 (49.9)</td>
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<td>patient:technician ratio (N = 535)(^c)</td>
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<tr>
<td>≤3</td>
<td>154 (48.9)</td>
<td>128 (58.2)</td>
<td>282 (52.5)</td>
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<tr>
<td>&gt;3</td>
<td>161 (51.1)</td>
<td>92 (41.8)</td>
<td>255 (47.5)</td>
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<tr>
<td>no. of hemodialysis shifts (N = 644)(^c)</td>
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<tr>
<td>&lt;4</td>
<td>97 (27.2)</td>
<td>109 (38.0)</td>
<td>206 (31.8)</td>
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<tr>
<td>≥4</td>
<td>260 (72.8)</td>
<td>178 (62.0)</td>
<td>441 (68.2)</td>
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<td>frequency of nephrologist walk-rounds (N = 602)</td>
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<td></td>
</tr>
<tr>
<td>&lt;weekly</td>
<td>73 (21.7)</td>
<td>62 (23.4)</td>
<td>136 (22.5)</td>
</tr>
<tr>
<td>≥weekly</td>
<td>264 (78.3)</td>
<td>204 (76.6)</td>
<td>469 (77.5)</td>
</tr>
</tbody>
</table>

\(^a\) All covariates shown were measured at enrollment except the laboratory values albumin, hemoglobin, and Ca-P product, dose, and vascular access (which were measured at the start of dialysis) and CRP (which was measured an average of 3.5 mo after enrollment and an average of 5 mo after dialysis). Significant P values are in boldface type. ICED, Index of Coexistent Disease; MCS, mental component score; PCS, physical component score; Ca-P, calcium-phosphate; CRP, C-reactive protein.

\(^b\) Shown are means ± SD. P values obtained from two-sided t test.

\(^c\) Shown are percentages of patients in each category. P values obtained from Pearson \(\chi^2\) test.

Association of Frequency of Sit-Down Rounds with Mortality

The crude mortality rate at the average follow-up of 3.2 yr was slightly lower in the more frequent (monthly or more often) group than in the less frequent group (Table 3); however, the cumulative mortality incidence in the two groups was not significantly different by log-rank test of the Kaplan-Meier estimates (\(P = 0.31\)). However, this relationship may be confounded because whites have higher mortality than blacks, and whites were more likely to be treated at clinics with more frequent sit-down rounds (Table 1). Race-adjusted survival curves (Figure 2) suggested that those who are seen monthly or more often have a survival advantage. Cox models confirmed this association: After adjustment for race and other variables, the RH of death for the more frequent group relative to the reference group (less than monthly or none) was significantly lower than 1 (Table 3), indicating that patients who were treated at clinics with more frequent sit-down rounds were less likely to die than their counterparts who were treated at facilities with less frequent or no rounds.

Adjustment for the 6-mo laboratory clinical performance measures of interest (albumin, hemoglobin, and Ca-P product) did not change the magnitude of the results but did attenuate the statistical significance. However, further adjustment for vascular access at 6 mo (fistula versus other types) amplified the protective effect (Table 3), whereas dialysis dose had no effect (these results are shown separately because 6-mo data on dose and access were available only on subsets of patients). Late referral to a nephrologist and diabetic status were tested as confounders and were not found to affect the relationship between frequency of sit-down rounds and mortality. Adjustment for factors that reflect clinic size (patient:technician ratio, patient:nurse ratio, number of hemodialysis patients, and number of hemodialysis shifts/wk) did not affect the results appreciably; neither did adjustment for the frequency of nephrologist walk-rounds.

Sensitivity Analysis of Alternative Categorization of Sit-Down Rounds

The results with an alternative categorization of sit-down rounds (any frequency of rounds versus no rounds) were similar to those presented in Tables 2 and 3 and indicate that our parameter estimates are robust. For clinical performance targets, albumin again was the only target for which results were individually significant (OR, 1.94; 95% CI, 1.16 to 3.23), although all had positive associations. The number of targets achieved was also statistically significant (OR, 1.82; 95% CI, 1.05 to 3.15). For hospitalization and mortality, the results again were similar: adjusted IRR, 0.65; 95% CI, 0.51 to 0.83; and adjusted RH, 0.71; 95% CI, 0.52 to 0.97, respectively. Further adjustment for clinical performance measures gave results that are similar to the results in Table 3.

Association of Frequency of Sit-Down Rounds with Other Outcomes

For the small subgroup (\(n = 276\)) of patients for whom we had access information and who had permanent access (fistula or graft) by 6 mo, access failure was not associated with sit-down rounds (RH, 1.26; 95% CI, 0.59 to 2.72). For patients with information on independent living at 1 yr (\(n = 421\)), there was no association of independence with sit-down rounds frequency (OR, 1.12; 95% CI, 0.75 to 1.65). Finally, there was no association of sit-down rounds frequency with time to placement on the kidney transplant waiting list (\(n = 618\);
During sit-down rounds, members of the dialysis team typically have face-to-face discussions about the care of individual patients, close to but removed from the immediate environment in which care is rendered. These discussions allow review of progress, coordination among team members, and development of care plans through examination of medical records and dialysis team experiences. This study suggests that chronic kidney disease patients who were treated at hemodialysis clinics with a routine practice of sit-down rounds monthly or more often were more likely to achieve clinical performance targets than those who were treated at clinics with less frequent or no rounds. These patients were also 32% less likely to be hospitalized and 29% less likely to die. In addition, these results provide evidence for the belief that time spent meeting to discuss each patient’s progress is as important as direct patient care, in that this rounding practice is associated with better outcomes. These results may also be relevant to recent changes in requirements for face-to-face interactions in reimbursement programs. If time spent in sit-down rounds away from patients is associated with improved patient outcomes and resource utilization, then this may warrant additional reimbursement to providers for such activities.

Sit-down rounds do require dedicated time when team members can meet. In busy dialysis units that are short-staffed or under financial constraints, this may be difficult. Such rounds must be scheduled outside regular shifts (unless additional personnel are available to treat patients) or when there is a low volume of patients, which for some clinics may be impossible. In fact, a large number of the facilities that we studied (35 clinics [47%]) did not have sit-down rounds, and the larger units in our cohort (more patients per provider and/or more shifts) were less likely to have regular sit-down rounds. Another study showed that resistance of team members to spending time away from the patient was frequently encountered in a hospital setting (3). Such reluctance may also exist in the hemodialysis unit. Finally, it should be noted that sit-down rounds are not meant to supplant direct assessment of the patient’s status. Indeed, 99% of the patients in our cohort were treated at clinics that also had regular rounds (78% weekly or more often) by nephrologists, who assessed the patient during a hospital setting (3). Such reluctance may also exist in the hemodialysis unit.

**Discussion**

During sit-down rounds, members of the dialysis team typically have face-to-face discussions about the care of individual patients, close to but removed from the immediate environment in which care is rendered. These discussions allow review of progress, coordination among team members, and development of care plans through examination of medical records and dialysis team experiences. This study suggests that chronic kidney disease patients who were treated at hemodialysis clinics with a routine practice of sit-down rounds monthly or more often were more likely to achieve clinical performance targets than those who were treated at clinics with less frequent or no rounds. These patients were also 32% less likely to be hospitalized and 29% less likely to die. In addition, these results provide evidence for the belief that time spent meeting to discuss each patient’s progress is as important as direct patient care, in that this rounding practice is associated with better outcomes. These results may also be relevant to recent changes in requirements for face-to-face interactions in reimbursement programs. If time spent in sit-down rounds away from patients is associated with improved patient outcomes and resource utilization, then this may warrant additional reimbursement to providers for such activities.

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There is a tremendous desire to identify interventions to improve clinical performance and adherence to clinical practice guidelines. One might surmise that more coordinated care through sit-down rounds might be associated with improved clinical performance, an intermediate step in the path toward better clinical outcomes. We did find that more frequent sit-down rounds were associated with having better aggregate measures of clinical performance at 6 mo. Albumin (a measure of nutrition and health status) was the only individual target for which the association was statistically significant, but associations with hemoglobin and Ca-P product were in the same

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**Table 2. Association of clinic practice of the frequency of sit-down rounds with odds of achieving clinical performance targets at 6 months**

<table>
<thead>
<tr>
<th>Clinical Performance Target</th>
<th>N</th>
<th>Less than Monthly or None, Achieving Target</th>
<th>Monthly or More Often, Achieving Target</th>
<th>(p^b)</th>
<th>Adjusted OR (95% CI), Monthly or More Often versus Less than Monthly or None</th>
<th>Average Difference in 6-Month Level (95% CI), Monthly or More Often versus Less than Monthly or None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin: (\geq 3.5 \text{ g/dl})</td>
<td>626</td>
<td>281 (81%)</td>
<td>246 (88%)</td>
<td>0.038</td>
<td><strong>1.88 (1.12–3.15)</strong></td>
<td><strong>0.06 (0.01–0.11)</strong></td>
</tr>
<tr>
<td>Hemoglobin: (\geq 11 \text{ g/dl})</td>
<td>620</td>
<td>203 (59%)</td>
<td>172 (63%)</td>
<td>0.349</td>
<td>1.18 (0.78–1.78)</td>
<td>0.10 (0.20–0.40)</td>
</tr>
<tr>
<td>Ca-P product: (&lt;60 \text{ mg}^2/\text{dL})</td>
<td>627</td>
<td>262 (76%)</td>
<td>223 (79%)</td>
<td>0.351</td>
<td>1.26 (0.76–2.07)</td>
<td>−1.45 (−4.88–1.98)</td>
</tr>
<tr>
<td>Kt/V, (\geq 1.2)</td>
<td>527</td>
<td>243 (81%)</td>
<td>194 (85%)</td>
<td>0.190</td>
<td>1.34 (0.66–2.72)</td>
<td>0.00 (−0.06–0.06)</td>
</tr>
<tr>
<td>Vascular access: graft/graft</td>
<td>413</td>
<td>64 (26%)</td>
<td>48 (28%)</td>
<td>0.669</td>
<td>1.10 (0.83–1.46)</td>
<td>—</td>
</tr>
</tbody>
</table>

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\(a\) Shown are the adjusted OR (95% CI) for achieving the clinical performance target indicated at 6 mo. Models were adjusted for baseline values of the clinical performance measure indicated (except dose and vascular access). OR, odds ratio; CI, confidence interval. 
\(b\) \(p\) values are from \(X^2\) tests (individual targets) and Wilcoxon rank-sum (number of targets achieved) tests. 
\(c\) Ordinal logistic regression was used to obtain the odds of having a higher number of targets achieved versus lower number of targets achieved.
direction. One reason that sit-down rounds were not associated with most of the clinical performance measures may be limited power to detect a difference. It may also be that such issues are usually covered by walk-rounds or that case-mix factors, in addition to clinic practice factors (e.g., standard anemia management protocols), contribute to these outcomes, as was suggested for the association between anemia management and hemoglobin levels (29). Last, the association of sit-down rounds with serum albumin, although intriguing, might be due to unmeasured patient factors related to comorbidity, not a direct effect of rounds, consistent with the known difficulty of improving serum albumin with clinical interventions (30).

Our results also suggest that the mechanism by which sit-down rounds could be associated with reduced hospitalization may be through achievement of clinical performance targets, because accounting for clinical performance targets in our regression model eliminated the statistical significance of the association of rounds with hospitalization. However, we found that adjustment for these performance measures did not explain the protective association of rounding with mortality. The intermediate mechanism through which sit-down rounding is associated with mortality may include factors other than the clinical performance measures that we examined, such as review of lipid profiles, ordering of tests (e.g., colonoscopy, stress test), and referral to specialists. Also, differences in clinical performance between sit-down rounds frequency groups were small relative to the differences in hospitalization and mortality, which may suggest that not meeting clinical performance measures indicates more serious underlying problems. This is worthy of future study.

It is intriguing that the frequency of sit-down patient rounds was associated with hospitalizations as well as mortality. Hospitalizations are frequent among ESRD patients, and they composed 38.5% of total Medicare expenditures for dialysis patients in 2001 (31). If sit-down rounds are able to prevent hospitalizations, then our results suggest that substantial cost

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Table 3. Association of clinic practice of the frequency of sit-down rounds with hospitalization rates and mortality (mean follow-up 3.2 years)^

<table>
<thead>
<tr>
<th>Measure</th>
<th>N</th>
<th>Frequency of Sit-Down Rounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Less than Monthly or None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>crude hospitalization rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(per 1000 pt-yr)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unadjusted IRR (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted^b IRR (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted^c IRR (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ dose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ vascular access at 6 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ both</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mean no. of days hospitalized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(per yr)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unadjusted rate ratio^d (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted^b rate ratio^d (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted^c rate ratio^d (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ dose</td>
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<tr>
<td></td>
<td></td>
<td>+ vascular access at 6 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ both</td>
</tr>
<tr>
<td></td>
<td></td>
<td>crude no. of deaths at mean follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>crude % mortality at mean follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unadjusted RH (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted^b RH (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted^c RH (95% CI)</td>
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<tr>
<td></td>
<td></td>
<td>+ dose</td>
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<td></td>
<td>+ vascular access at 6 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ both</td>
</tr>
</tbody>
</table>

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^ IRR, incidence rate ratio; RH, relative hazard. Significant values are in boldface type.

^ Adjusted for age at enrollment, race, ICED score, albumin at first dialysis, baseline creatinine, and CRP (quartiles).

^ Adjusted for^b and also for albumin, hemoglobin, and Ca-P product performance measures at first dialysis and 6 mo.

^ Calculated by exponentiation of coefficients obtained from a standard linear regression of log (days hospitalized/yr) against sit-down rounds and adjusters indicated.
savings might be realized, in addition to a reduction in morbidity that results in hospitalization. Perhaps facilities and physicians should be incentivized with higher payments to perform sit-down rounds because hospital care is not bundled into current physician and facility capitation rates.

Possible limitations of this study deserve mention. First, we assessed frequency of sit-down rounds through a survey of facilities. A more precise estimate of frequency, time devoted, personnel involved, patients discussed, and actions implemented (i.e., frequency and optimal content), made by direct observation, might have been useful. As in any prospective study, changes in rounding practice over time may have occurred at these clinics, before or after the cross-sectional assessment, and our results may have been affected by relatively late assessment of exposure (in some cases, after outcome assessment) for patients who enrolled early in the study. Also, because data concerning sit-down rounds were collected from the clinics, our measure of clinic practice of sit-down rounds was assigned to each patient who was treated by the facility and does not capture any within-clinic variation that may exist (e.g., if only the patients with the most severe problems are discussed at each meeting). Another possible limitation is that the rounding patterns at the facilities that we studied may not be entirely reflective of the pattern nationally, which may be less or more intensive; also, the results may not be generalizable to for-profit clinics, which may differ substantially in rounding patterns from the not-for-profit clinics studied here. It is also possible that sit-down rounds are a marker of better clinic processes overall. Clinical performance targets were also assessed at 6 mo only, and although the within-individual variation over time in clinical performance measures was small relative to the variation between groups at 6 mo, this limitation cannot be discounted. Also, although we have information on whether patients met clinical performance targets, we do not have information on which standard protocols clinics had in place for management of these targets. We do not have data on whether patients have primary care providers, who may provide additional levels of care for which we cannot account. Also, selection bias is always an important consideration in an observational study such as this one, and causal inferences should be made with caution. However, it is not clear to what extent patients choose a facility on the basis of rounding patterns, because such information is not readily available in consumer resources, such as the Dialysis Facility Compare tool on the Medicare web site (32). Despite collection of and adjustment with extensive data on determinants of patient outcomes, residual confounding as a result of lack of data on variables for which we could not account may still exist.

In conclusion, this study demonstrates a relationship between higher frequency of sit-down rounds, during which patients’ care is reviewed by a multidisciplinary team, and better patient outcomes. Strategies to encourage regular conduct of patient sit-down rounds in health care facilities—especially in larger, busier facilities—are needed. Future work, possibly including a randomized clinical trial, is needed to confirm these results and explore how the time devoted to patient rounds can be most effectively used to improve patient health and outcomes.

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References