Association Between Achievement of Hemodialysis Quality-of-Care Indicators and Quality-of-Life Scores

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Background: Incremental achievement of quality indicator goals has been associated with progressive improvement in mortality and hospitalization risk in hemodialysis (HD) patients.

Study Design: Descriptive cross-sectional study.

Setting & Participants: All 33,879 HD patients treated at Fresenius Medical Care North America facilities for >90 days with scorable 36-Item Short Form Health Survey responses from January 1, 2006, to December 31, 2006.

Predictor: We hypothesized that achieving up to 5 HD goals before the survey (albumin $\geq$ 4.0 g/dL, hemoglobin of 11-12 g/dL, equilibrated Kt/V $\geq$ 1.2, phosphorus of 3.5-5.5 mg/L, and absence of HD catheter) results in better self-reported quality of life (QoL).

Outcomes & Measurements: Distributions of Physical and Mental Component Summary (PCS/MCS) scores within and across quality indicator categories determined during the prior 90 days from survey date (compared using analysis of covariance and linear regression models, with adjustment for case-mix and each of the quality indicators).

Results: Incremental achievement of up to 5 goals was associated with progressively higher PCS and MCS scores (both P for trend < 0.001). Compared with patients meeting all 5 goals (n = 4,208; reference group), case-mix–adjusted PCS score was lower by 1.8 point with only 4 goals met (n = 11,785), 3.4 points for 3 goals (n = 10,906), 4.9 points for 2 goals (n = 5,119), 5.9 points for 1 goal (n = 1,592), and 7.8 points in the 269 patients who failed to meet any goal (each P < 0.001 vs the reference group). The corresponding decreases in case-mix–adjusted MCS scores were 1.0 point for 4 goals met, 1.7 point for 3 goals, 2.3 points for 2 goals, 3.0 points for 1 goal, and 4.7 points with no goal met, with each P < 0.001 compared with the MCS score from patients who achieved all 5 goals.

Limitations: Potential residual confounding from unmeasured covariates.

Conclusion: Patients progressively meeting more quality goals report incrementally better QoL. Further studies are needed to determine whether prospective achievement of quality goals will result in improved QoL for HD patients.

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INDEX WORDS: Hemodialysis (HD); quality of life (QoL); 36-Item Short Form Health Survey (SF-36); end-stage renal disease (ESRD); clinical performance measures (CPMs); continuous quality improvement (CQI).

Nation focus on improving the quality of health care for maintenance hemodialysis (HD) patients has intensified during the past

decade.[1] Currently, the Centers for Medicare & Medicaid Services tracks several clinical performance measures encompassing nutrition, dialysis adequacy, anemia, and vascular access.[2] Achievement of quality goals embodied within these clinical performance measure domains have each been associated with improved outcomes individually, whereas patients meeting multiple quality goals have had associated further decreased mortality, fewer hospitalizations, and lower resource use.[2-4] In 2 of these 3 outcome studies, treatment goals for mineral metabolism also were considered as an additional quality improvement target.[3,4] We recently identified 5 potentially actionable variables that represent the strongest association with both mortality and hospitalization risk, which coincide with each of the 5 mentioned quality indicators.[5] Although the association between attainment of treatment

goals for ≥ 1 of these 5 indicators with subsequent morbidity and mortality risks are known, similar associations with patient-reported quality of life (QoL) has not been fully elucidated.

We sought to confirm that achieving each of the quality goals for the 5 domains individually will be associated with improved Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) domain scores and, ultimately, both Physical Component Summary (PCS) and Mental Component Summary (MCS) score in a contemporary large nationally distributed HD patient cohort. The SF-36 is a well-validated general QoL assessment tool that has been widely used in patients with end-stage renal disease (ESRD).[6-12] It consists of 36 questions capturing the multidimensional nature of Qol, measuring 8 health domains and 2 summary scores: the PCS and MCS.[6] Individually, smaller studies have indicated that domain scores, PCS, and/or MCS were associated with levels of albumin,[9,13-17] hemoglobin,[9,13-19] dialysis dose,[13-17,20,21] and even catheter use.[16] The MCS score previously was associated with calcium-phosphorus product, but not specifically with phosphorus level alone.[22] We hypothesized that progressive achievement of up to 5 of these quality indicator goals will be associated with incremental gains in overall patient-reported QoL, encompassing both mental and physical dimensions, represented by the PCS and MCS scores.

METHODS

Study Population

An automated reminder alerts the social worker to offer the SF-36 survey to all patients initiating dialysis therapy in Fresenius Medical Care, North America (FMCNA) facilities after their 45th day, and upon completion (or refusal to participate), at 6-month intervals thereafter. Between January 1, 2006, and December 31, 2006, a total of 61,033 maintenance HD patients from 1,084 FMCNA-legacy dialysis facilities with vintage >90 days were provided the opportunity to complete the survey. Of these, 33,879 (56%) unique patients provided scorable SF-36 responses (ie, "responders"), forming the basis of this report. SF-36 summary scores range from 0-100, with higher scores representing better self-reported health, and were calculated using standard (US derived) scoring algorithms from Ware et al.[6,23] General Health and Vitality are domains contributing significantly to both the PCS and MCS scores. In addition, PCS score strongly correlated with Physical Functioning, Role–Physical, and Bodily Pain, whereas the MCS score correlates strongly with Social Functioning, Role–Emotional, and Mental Health.

Case-mix information (age, sex, race, diabetes, and vintage) was collected as of the survey date for both responders and nonresponders; the latter was composed of patients who were unable to respond (eg, because of cognitive or language difficulties), were unwilling to respond, had incomplete/unscorable responses, or postponed addressing the survey and never completed it. For responders, age was calculated on the date of the survey, whereas vintage was defined as time elapsed between each patient's date of first dialysis and the survey date. For nonresponders, we substituted the date that the survey was offered for "survey date."

Clinical Quality Indicator Variables and FMCNA Goals

Vascular access and laboratory values (averaged during 3 months before and leading up to the survey date) from a single laboratory (Spectra Laboratories, Rockleigh, NJ) were used to classify patients within each of 5 quality indicator domains; namely, hemoglobin level (<10, 10-10.99, 11-12 [FMCNA goal], 12.01-13, and >13 g/dL), albumin level measured using the bromcresol green method[24] (<3.2, 3.2-3.5, 3.51-3.99, and ≥4.0 g/dL [FMCNA goal]), dialysis dose using equilibrated Kt/V (eKt/V) calculated using urea kinetic modeling[25-27] (<1.2 vs ≥1.2 [FMCNA goal]), phosphorus level (<3.5, 3.5-5.5 [FMCNA goal], and >5.5 mg/L), and HD catheter (present [yes] vs absent [no; FMCNA goal]).

These FMCNA goals were determined based (at minimum) on established national guidelines; some were modified after deliberations within the Medical Department and consultation with our national Medical Advisory Board composed of leading FMCNA facility medical directors representing different regions of the country.

Statistical Analysis

Distributions of scores for the PCS, MCS, and each of the 8 SF-36 domains were determined for each individual quality indicator category (hemoglobin level, albumin level, eKt/V, phosphorus level, and catheter access) with and without adjustment for case-mix. Observed differences in PCS and MCS scores between categories were tested using analysis of covariance F test with each prespecified goal as the reference group. Case-mix–adjusted multiple linear regression models were then constructed to determine the association of meeting each of the goals for the indicators (in combination and including paired interaction terms) with both MCS and PCS scores.

Patients then were categorized based on meeting 0, 1, 2, 3, 4, or all 5 quality goals at the time of the QoL survey. Linear regression models were constructed to test the primary hypothesis that a greater number of goals achieved would be associated with higher SF-36 summary scores, with case-mix adjustment.

Three preliminary findings modified our subsequent analytical plan: First, there was no evidence of a decrease and some evidence of continued improvement in PCS/MCS scores at hemoglobin levels > 12 g/dL (ie, the goal hemoglobin range of 11-12 g/dL did not fully cover "best range" for QoL); therefore, the hemoglobin reference group was collapsed into hemoglobin level ≥ 11 g/dL; second, meeting the phosphorus level target was no longer significantly