RESULTS FROM THE 2002 END-STAGE RENAL DISEASE (ESRD) CLINICAL PERFORMANCE MEASURES (CPM) SUPPLEMENTAL QUESTIONNAIRE: IMPACT OF SPECIALIZATION OF PRIMARY NEPHROLOGIST ON CARE OF PEDIATRIC HEMODIALYSIS PATIENTS

Supplemental Report #1 **February 2003**
2002 ESRD Clinical Performance Measures Project

Department of Health and Human Services
The Centers for Medicare & Medicaid Services

INTRODUCTION

The purpose of the ESRD Clinical Performance Measures (CPM) Project is to assist providers of End-Stage Renal Disease (ESRD) services in the assessment of care provided to ESRD patients and to stimulate improvement in that care. Beginning with the 2000 data collection effort, and again in 2001, clinical information was collected on all pediatric in-center hemodialysis (HD) patients in the U.S. aged 12 years up to, but not including, 18 years old. For the first time, in 2002, clinical information was also collected on all pediatric in-center HD patients in the U.S. who were less than 12 years of age.

At this time, CPMs have not been developed for the pediatric age group. This report provides information on responses to supplemental questions from the 2002 ESRD CPM data collection form and describes associations of selected intermediate outcomes with dialysis care provided by pediatric compared to adult nephrologists.

METHODS

All in-center HD patients aged < 18 years identified by the 18 ESRD Networks as alive and receiving HD on December 31, 2001 were included in the study.

Data Collection

During May 2002, a three-page data collection form was sent to each facility that had one or more HD patients aged < 18 years dialyzing at that facility. In addition, an additional page with supplemental questions was sent with the three-page data collection form for dialysis facility staff to complete. Staff at the facility abstracted clinical information from the medical record for each patient who was < 18 years old and receiving in-center HD during the months of October, November, and December, 2001. Patient characteristic information collected included gender, age, race, Hispanic ethnicity, years on dialysis, and primary cause of ESRD.

Clinical information used to assess the quality of care provided to these patients included the following: patient height and pre- and post-dialysis weight, pre- and post-dialysis blood urea nitrogen (BUN) values, dialysis session length to calculate Kt/V values, dialyzer KUf values, reported urea reduction ratios (URRs) and reported Kt/V values, type of vascular access, blood pump flow rates 60 minutes from the start of the hemodialysis session, hemoglobin (Hgb) values, prescribed Epoetin alfa dose and route of administration, iron use and route of administration, transferrin saturation (TSAT) values, serum ferritin concentrations, serum albumin values and the laboratory method used to determine them (bromcresol green [BCG] or bromcresol purple [BCP]).

The supplemental clinical information included first monthly total serum calcium values, first monthly serum phosphate values, first monthly intact PTH and units (pg/mL, pmol/L, other), prescription of a phosphate binder, prescription of Vitamin D and route of administration, whether growth hormone had ever been prescribed, and whether the primary supervision of the dialysis care of the patient was provided by a pediatric or adult nephrologist, as reported by the dialysis facility.

Completed forms were returned to the appropriate Network office where data were reviewed and entered into a computerized database (Visual FoxPro). The data were aggregated by The Renal Network, Inc. and forwarded to the Centers for Medicare & Medicaid Services (CMS) for analysis.

Data Analysis

For this report, all available information was used to calculate means, medians, and threshold values. Single pool Kt/V values were calculated according to the Daugirdas II formula.[1] Due to the small numbers of persons in racial categories other than black and white, analyses by race were limited to these two racial groups. Causes of ESRD were categorized as congenital/urologic vs. other identified causes combined (FSGS, glomerulonephritis, SLE, hypertension or cystic disease). Associations of clinical data with patient characteristics were tested by Chi square, hierarchical ANOVA, and two-tailed Student's t-test. A p-value < 0.05 was considered to be significant.

The data analyses were conducted utilizing SAS v. 8.02[2] and SPSS for Windows, v. 10.0.[3]

RESULTS

668/710 (94%) of patients met the inclusion criteria for the sample for analysis. The percent of pediatric HD patients in this sample for analysis within Network regions ranged from 2%-11%, with the highest concentrations of pediatric patients

found in Networks 7 and 18 (Figure 1). 72% (n=478) of these patients were provided dialysis care primarily by a pediatric nephrologist; 26% (n=175) by an adult nephrologist. Patient characteristics associated with care primarily provided by a pediatric or adult nephrologist are shown in Table 1. There were no significant differences by gender or race. Hispanics were more likely to receive care from a pediatric nephrologist compared to an adult nephrologist (30% vs. 18%, $p < 0.01$) as were patients with a congenital/urologic cause of ESRD compared to other causes combined (45% vs. 30%, $p < 0.01$). Pediatric nephrologists supervised the care of younger patients (13.1 [± 4.1] years vs. 15.9 [± 2.4] years, $p < 0.001$) and patients who had been receiving dialysis therapy for a longer period of time (3.4 [± 3.5] years vs. 2.6 [± 3.5] years, $p < 0.05$).

Selected parameters of dialysis care associated with the primary supervision of a pediatric or adult nephrologist are depicted in Table 2 and highlighted below.

Figure 1: Distribution of pediatric (< 18 years old) hemodialysis patients in the U.S.

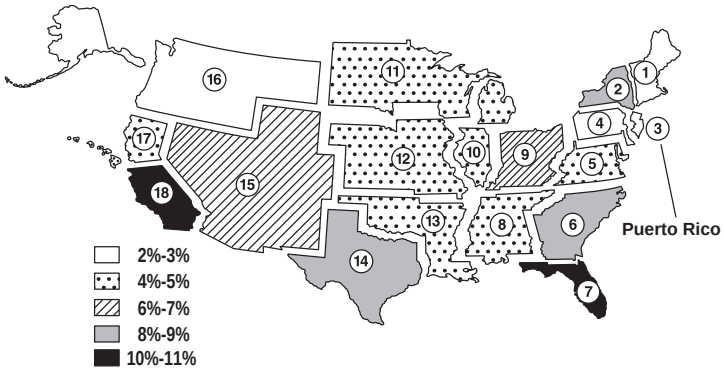

Table 1: Selected Pediatric Hemodialysis Patient Characteristics by Nephrologist Type

Patient Characteristic	Pediatric Nephrologist (n=478)	Adult Nephrologist (n=175)
% Male	57	56
Race		
% White	49	46
% Black	39	41
Ethnicity		
% Hispanic**	30	18
Age (years)		
Mean (± SD)***	13.1 (± 4.1)	15.9 (± 2.4)
Median	14.3	16.6
Primary cause of ESRD**		
Congenital/urologic	45	30
All other causes combined	55	70
Duration of dialysis (years)		
Mean (± SD)*	3.4 (± 3.5)	2.6 (± 3.5)
Median	2.0	1.1
Post-dialysis BMI^		
Mean (± SD)***	19.9 (± 5.7)	25.0 (± 17.9)
Median	18.5	21.3

^ BMI – body mass index (kg/m^2)

Significant differences between groups noted by: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Clearance

Patients receiving dialysis care primarily from a pediatric nephrologist compared to an adult nephrologist had higher mean single-pool Kt/V values (1.57 [± 0.33] vs. 1.51 [± 0.30], $p < 0.05$); a similar pattern was seen for mean URR (72.5% [± 7.9%] vs. 70.8%[± 8.3%], $p < 0.05$). There were no significant differences in the percent of patients achieving either a mean Kt/V ≥ 1.2 or a mean URR ≥ 65% by nephrologist category.

Vascular Access

Fewer patients receiving dialysis care primarily from a pediatric nephrologist compared to an adult nephrologist had an AV fistula as their vascular access (23% vs. 34%, $p < 0.01$). There were no significant differences in AV graft or catheter usage by nephrologist category.

Anemia Management

There were no significant differences in most anemia management parameters by nephrologist category.

Serum Albumin

Patients receiving dialysis care primarily from a pediatric nephrologist compared to an adult nephrologist had a lower mean serum albumin (BCG method only) (3.80 [± 0.47] gm/dL vs. 3.91 [± 0.51] gm/dL, $p < 0.05$), and fewer patients achieved a mean serum albumin ≥ 4.0/3.7 gm/dL (BCG/BCP) (38% vs. 51%, $p < 0.01$).

Supplemental Questions

Patients receiving dialysis care primarily from a pediatric nephrologist compared to an adult nephrologist had a higher total serum calcium (9.39 [± 0.87] mg/dL vs. 8.96 [± 0.95] mg/dL, $p < 0.001$), lower mean serum phosphate (6.19 [± 1.82] mg/dL vs. 6.54 [± 1.73] mg/dL, $p < 0.05$) and intact PTH (474 [± 490] pg/mL vs. 631 [± 658] pg/mL, $p < 0.01$).

Prescription of a phosphate binder was similar for both pediatric and adult nephrologists (approximately 87% of patients). More patients were prescribed Vitamin D by a pediatric nephrologist compared to an adult nephrologist (78% vs. 65%, $p < 0.001$). Prescribed route of Vitamin D administration did not differ significantly between groups, with approximately 90% of patients in both groups prescribed Vitamin D by the intravenous route.

Table 2: Selected Intermediate Outcomes by Nephrologist Type

Clinical Measure[a]	Pediatric Nephrologist (n=478)	Adult Nephrologist (n=175)
Clearance		
Kt/V		
Mean (± SD)*	1.57 (± 0.33)	1.51 (± 0.30)
Median	1.55	1.50
Mean Kt/V ≥ 1.2	386 (87)	147 (86)
URR (%)		
Mean (± SD)*	72.5 (± 7.9)	70.8 (± 8.3)
Median	72.6	72.0
Mean URR ≥ 65%	410 (86)	145 (83)
Dialysis session length (minutes)		
Mean (± SD)	203.1 (± 29.8)	204.8 (± 31.5)
Median	200.0	209.5
Blood pump flow rate (mL/minute)		
Mean (± SD)***	253.3 (± 87.6)	340.4 (± 77.6)
Median	250.0	350.0
Dialyzed with a hi-flux dialyzer (KUf ≥ 20 mL/mmHg/hr)***	113 (29)	99 (67)
Vascular Access		
Type of access		
AV fistula**	110 (23)	59 (34)
AV graft	92 (19)	29 (17)
Catheter	273 (57)	85 (49)
Catheter in use ≥ 90 days	233 (49)	67 (38)
Anemia Management		
Hemoglobin (gm/dL)		
Mean (± SD)	11.2 (± 1.6)	11.3 (± 1.6)
Median	11.4	11.5
Mean Hgb < 9	49 (10)	18 (10)
Mean Hgb < 10	106 (22)	38 (22)
Mean Hgb 11-12.0[b]	139 (30)	47 (28)
Mean Hgb ≥ 11	289 (60)	113 (65)
Patients prescribed Epoetin alfa	465 (97)	168 (96)
Within this group:		
Prescribed IV	440 (94)	151 (90)
Prescribed SC	31 (7)	17 (10)
Weekly Epoetin alfa dose (units/kg/week)		
IV		
Mean (± SD)	373.9 (± 377.6)	337.0 (± 253.9)
Median	283.4	272.4
SC		
Mean (± SD)**	202.7 (± 181.5)	479.9 (± 512.9)
Median	153.0	293.3
Transferrin saturation (%)		
Mean (± SD)	28.6 (± 14.2)	29.3 (± 14.4)
Median	26.3	27.7
Mean Transferrin saturation ≥ 20%	308 (73)	121 (73)
Serum ferritin concentration (ng/mL)		
Mean (± SD)	425.4 (± 440.5)	403.1 (± 354.7)
Median	280.5	293.5
Mean serum ferritin concentration ≥ 100 ng/mL	328 (77)	133 (82)
Patients with relative iron deficiency[c]	39 (9)	15 (9)
Patients prescribed iron	382 (80)	128 (73)
Within this group:		
Prescribed IV***	320 (84)	123 (96)
Prescribed PO***	106 (28)	8 (6)
Serum Albumin (gm/dL)		
BCG[d]		
Mean (± SD)*	3.80 (± 0.47)	3.91 (± 0.51)
Median	3.83	4.00
BCP[e]		
Mean (± SD)	3.49 (± 0.48)	3.69 (± 0.57)
Median	3.52	3.78
Mean serum albumin ≥ 4.0/3.7 gm/dL (BCG/BCP)**	183 (38)	89 (51)
Mean serum albumin ≥ 3.5/3.2 gm/dL (BCG/BCP)	385 (81)	151 (87)
Supplemental Questions		
Total serum calcium (mg/dL)		
Mean (± SD)***	9.39 (± 0.87)	8.96 (± 0.95)
Median	9.40	9.07
Serum phosphate (mg/dL)		
Mean (± SD)*	6.19 (± 1.82)	6.54 (± 1.73)
Median	6.07	6.40
Intact PTH (pg/mL)		
Mean (± SD)**	473.8 (± 490.0)	631.1 (± 657.7)
Median	295.5	394.5
Patients prescribed a phosphate binder	418 (87)	154 (88)
Patients prescribed Vitamin D***	375 (78)	113 (65)
Within this group:		
Prescribed IV	330 (88)	105 (93)
Prescribed PO	55 (15)	13 (12)
Growth hormone ever prescribed***	117 (24)	13 (7)

Significant differences between groups noted by: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

[a] Continuous variable displayed as the mean (± SD) and median values; categorical variables displayed as number and percent of available values

[b] Among patients prescribed Epoetin alfa

[c] Relative iron deficiency defined for this report as a mean transferrin saturation < 20% and a mean Serum ferritin concentration < 100 ng/mL

[d] BCG – bromcresol green laboratory method

[e] BCP – bromcresol purple laboratory method

Growth hormone had been prescribed for 24% of patients receiving dialysis care primarily from a pediatric nephrologist compared to 7% of patients cared for by an adult nephrologist.

Multivariable Analyses

After controlling for demographic and clinical variables in multivariable logistic regression analyses, nephrology specialty did not remain a significant predictor for pediatric patients attaining a mean Kt/V ≥ 1.2, a mean hemoglobin ≥ 11 gm/dL or having an AV fistula as their vascular access. In the final multivariable logistic regression model to predict a mean serum albumun ≥ 4.0/3.7 gm/dL (BCG/BCP), males and patients with a mean hemoblobin ≥ 11 gm/dL were significantly more likely to achieve a mean serum albumin ≥ 4.0/3.7 gm/dL, and pediatric patients were less likely to achieve a mean serum albumin ≥ 4.0/3.7 gm/dL when receiving care from a pediatric nephrologist (OR [95% CI] 0.60 [0.42, 0.86], p < 0.01) (Table 3).

*Table 3: Final logistic regression model predicting a mean serum albumin ≥ 4.0/3.7 gm/dL(BCG/BCP)^*

Predictor	**OR (95% CI)^^**	**p-value**
Mean hemoglobin ≥ 11 gm/dL	2.3 (1.6, 3.2)	< 0.001
Male gender	1.9 (1.3, 2.6)	< 0.001
Pediatric nephrologist provides care (Adult nephrologist=referent)	0.60 (0.42, 0.86)	< 0.01

^ BCG/BCP – bromcresol green/bromcresol purple laboratory methods

^^ OR (95% CI) – Odds Ratio (95% confidence interval)

KEY OBSERVATIONS

• Pediatric patients have comparable Kt/V, hemoglobin, and iron stores when cared for by a pediatric nephrologist or an adult nephrologist.

• Pediatric patients taken care of by an adult nephrologist had higher mean serum albumin values.

• Pediatric patients have significantly higher serum calcium, lower serum phosphate, and lower intact PTH levels when their care is provided by a pediatric nephrologist.

• Although a significantly higher percentage of patients cared for by pediatric compared to adult nephrologists were prescribed growth hormone, there are several factors that may contribute to this finding. These include the older age range seen in pediatric patients followed by an adult nephrologist and the fact that not all pediatric patients may be candidates for growth hormone therapy because of either normal growth or advanced bone age. A more detailed analysis of this finding is underway and will subsequently be published.

NEXT STEPS

Further analysis will be conducted to more completely understand the associations of these intermediate outcomes of care by nephrologist category.

REFERENCES

1. Daugirdas JT. Second generation logarithmic estimates of single-pool variable volume Kt/V: an analysis of error. J Am Soc Nephrol 1993;4:1205-1213

2. The SAS System for Windows, v. 8.02. Cary, NC

3. Norusis MJ. SPSS for Windows Advanced Statistics. Release 10.0. Chicago, IL. 1999