Marked variations in the utilization of selected health care services and subsequent health care costs exist in the United States.\(^1,2\) Even after taking into account the underlying health and diagnosis of the patient, variations in the use of selected services, particularly those whose benefits are less well established, cannot be explained fully. Variations in referral rates to subspecialists,\(^3\) treatment recommendations by internists, family physicians, gynecologists, surgeons, and psychiatrists,\(^4,5\) and use of invasive procedures\(^6\) have been described repeatedly in the care of adult patients. The extent to which variation exists in the care of children with chronic illness, and examination of the potential sources of this variation have been studied infrequently.\(^7\)

In studies of adults, several potentially mutable factors have been shown to influence variation, including provider specialty and training, professional socialization, organization of physician services, and payment.\(^8\) To examine whether specialty training or experience with children influences treatment recommendations in pediatric chronic illness, we examined whether a nephrologist’s experience treating children directly influences dialysis treatment recommendations for adolescents with end-stage renal disease (ESRD). The study of children with ESRD allows examination of variation in the utilization of selected health care services and subsequent health care costs.

Context  Children and adolescent patients with renal failure are frequently cared for by adult subspecialists. While peritoneal dialysis is used in less than 17% of adults with kidney failure, it is the preferred dialysis treatment for children. National data show that 45% of children receiving dialysis are treated with peritoneal dialysis and pediatric nephrologists report its use in 65% of patients receiving dialysis. Whether differences in peritoneal dialysis use among children are due to the pediatric experience of the clinician has not been examined.

Objective  To assess whether the pediatric experience of nephrologists directly affects treatment recommendations for children with kidney failure.

Design  Cross-sectional survey using 10 case vignettes per survey based on random combinations of 8 patient characteristics (age, sex, race, distance from facility, cause of renal failure, family structure, education, and compliance).

Setting and Participants  National random sample of office-, hospital-, and academic medical center–based adult and pediatric nephrologists, stratified by geographic region and conducted June to November 1999. Of 519 eligible physicians, 316 (61%) responded, including 191 adult and 125 pediatric nephrologists.

Main Outcome Measure  Treatment recommendations for peritoneal dialysis vs hemodialysis, compared based on nephrologists’ pediatric experience.

Results  After controlling for patient characteristics, pediatric nephrologists were 60% more likely than adult nephrologists to recommend peritoneal dialysis for identical patients (odds ratio, 1.61; 95% confidence interval, 1.35–1.92). This was true regardless of dialysis training, years in practice, practice setting, geography, or patient characteristics.

Conclusions  Our data indicate that pediatric specialization of clinicians influences treatment recommendations for children and adolescents with end-stage renal disease. Referring children to adult subspecialists may lead to differences in treatment choices and processes of care.
in practice patterns where the confounding issue of variable physician payment is lessened because nearly all children with ESRD are eligible for Medicare insurance.

More than 5000 children and adolescents in the United States are currently living with ESRD. Approximately 1000 children (aged ≤19 years) develop ESRD each year. A kidney donor is not available for renal transplantation, hemodialysis (HD) or peritoneal dialysis (PD) are the treatment options. Use rates of HD or PD for patients with ESRD vary remarkably among institutions and across national boundaries. While only 13% to 17% of adult patients receiving dialysis in the United States are treated with PD, 45% of pediatric patients receiving dialysis in national registries and 65% in voluntary pediatric nephrology groups are managed with this therapy. Although debate persists over the relative benefits of PD vs HD in terms of mortality and morbidity, most studies have shown that survival of those receiving the 2 therapies is comparable. However, PD is widely believed to be the treatment of choice for children and adolescents if transplantation is not immediately available. Although no prospective, randomized trials comparing PD and HD have been performed, PD has multiple advantages for children. These include steady state fluid and biochemical control, freedom from dietary and fluid restrictions, relative technical ease in infants and small children, absence of needle sticks, independence and relative normalization of daily routine because PD is a home modality, decreased dependence on antihypertensive medications to control blood pressure, and less anemia than with HD. Additionally, costs are lower with PD than with HD in children. Also, quality of life when receiving PD rather than HD may be better for adults and children, and PD may be a more cost-effective treatment because of lower fixed costs than those associated with in-center HD.

Because of the relatively low incidence of ESRD in children and the small number and wide geographic distribution of pediatric nephrologists, many children and adolescents with kidney disease may be treated by nephrologists who have little experience with pediatric patients. A recent cross-sectional study demonstrated a strongly positive association between the use of PD and the volume of pediatric patients treated at a dialysis facility, thus suggesting that pediatric experience may influence dialysis treatment choice. The percentage of pediatric patients dialyzed at a facility was associated with a greater probability that an individual pediatric patient would be treated with PD. This study did not, however, measure whether a pediatric nephrologist was involved in the care.

To address the possible biases and problems of case-mix inherent in a facility level, cross-sectional study, we used an experimental design to test whether the pediatric specialization of the treating physician independently influences treatment recommendations for children and adolescents with ESRD. Specifically, we tested the hypothesis that adult and pediatric nephrologists (in this article, “adult nephrologists” refers to nephrologists trained in internal medicine and nephrology and “pediatric nephrologists” to those trained in pediatric medicine and pediatric nephrology) make different dialysis treatment recommendations for pediatric patients.

METHODS

In a national study, we randomly selected adult and pediatric nephrologists to receive clinically representative case vignettes for which we elicited treatment recommendations. The study protocol was approved by the institutional review board of Johns Hopkins University.

Questionnaire Format

Nephrologists were surveyed by a mailed questionnaire containing 10 randomly generated case vignettes. No department affiliation was listed on the university letterhead, and the cover letter was personally signed by both an internist and a pediatric nephrologist. Each case vignette represented a hypothetical patient. Characteristics in the case vignettes included patient age (5-19 years), race (black or white), sex (male or female), cause of ESRD (acquired glomerular or congenital urologic disease), parental education (<high school, some high school, or some college), distance from a dialysis facility (<1 hour drive, 1-2 hours, or >2 hours), compliance (compliant, not compliant, or questionably compliant), and number of parents in the home (1 or 2). After clinical and social characteristics thought to potentially influence dialysis treatment recommendations were selected and categorized, characteristics were shuffled and combined by a computer-generated randomization procedure. Random combinations of these characteristics produced 1000 unique case vignettes that were sorted randomly by computer, and groups of 10 were printed onto 100 different surveys. After the vignettes were assembled, a covariance matrix was used to ensure that clinical characteristics in the vignettes were randomly assigned and were not collinear. The questionnaire was pretested for practicality and content validity by a panel of adult and pediatric nephrologists.

Nephrologists were asked to recommend an initial treatment modality (HD or PD, both were listed as treatment options) for each hypothetical case. We asked surveyed nephrologists to assume that theirs was the closest dialysis facility, that the patient had recently presented with renal failure, had never had a transplant, and had no other comorbid conditions.

In addition to the case vignettes, information was collected regarding physician demographics (race, sex, and years since fellowship), nephrology training, and practice. We asked physicians to estimate the percentage of their patients in the pediatric age group and to describe their exposure to pediatric patients and to PD and HD during nephrology training.

Sampling of Nephrologists

The nephrologists surveyed were drawn from the American Medical Association.
tion Physician Masterfile and from the mailing list of the American Society of Pediatric Nephrology. Four hundred adult and 200 pediatric nephrologists in all practice settings were randomly selected from the 10 geographic jurisdictions of the Health Care Financing Administration. After stratification by geographic region, nephrologists were chosen by simple random sampling with replacement using a computer program. The determination of pediatric vs adult nephrology was based on the physician’s self-reported specialization. Pediatric nephrologists were over-sampled to obtain a large enough sample for valid comparison with adult nephrologists. Our sample size of 400 adult and 200 pediatric nephrologists ensured that a 50% response rate would yield 80% power to detect a 20% difference with \( \alpha = .05 \). The first mailing of the survey was done in June 1999, follow-up reminders and surveys were sent out in September 1999, and telephone and fax follow-up was done in November of the same year.

**Survey Follow-up**

Surveys returned as undeliverable were replaced by random selection of another pediatric or adult nephrologist from the same geographic region. Non-respondents after the second mailing were telephoned to verify that the selected nephrologists remained active in clinical practice at that address and had received the survey. A duplicate survey was faxed to those participants whose address was verified, and telephone follow-up was done within 2 weeks.

**Statistical Analysis**

Univariate analyses of the preferred strategies for dialysis management of patients described in the case vignettes were performed. We explored the geographic distribution, practice characteristics, and pediatric experience of respondents and nonrespondents to assess the possibility of nonresponse bias. In bivariate analyses testing, we explored how the treatment recommendations of the provider varied according to a nephrologist’s pediatric experience and according to patient characteristics in the vignettes. Dose-response effects were tested with a \( \chi^2 \) test for linear trend.

Multiple logistic regression analyses were conducted to examine the independent associations between physicians’ experience with children and their dialysis treatment recommendations, controlling for patient’s age, race, sex, and case of ESRD. We additionally adjusted for patient compliance, distance from a facility, number of parents in the home, and parental education. Possible correlations among nephrologists’ responses to the 10 separate case vignettes included in each questionnaire were accounted for using techniques for handling clustered data (generalized estimation equation).22

Pediatric experience was measured in 3 ways: by self-identification of pediatric nephrology as a subspecialty, by self-report of whether a respondent’s nephrology training included making treatment recommendations for patients aged 19 years and younger, and by whether a physician estimated that at least 5% of the patients he or she cared for in the last 5 years were aged 19 years and younger. Stratified analyses were performed to determine whether pediatric nephrologists were more likely than adult nephrologists to recommend PD vs HD regardless of practice setting, geographic region, years in practice, or proportion of nephrology training devoted to PD. Separate models were used to compare pediatric and adult nephrologists in different practice settings. Finally, stratified analyses of adult nephrologists were performed to examine whether increased exposure to PD or increased exposure to pediatric patients in training or practice was associated with an increased likelihood to recommend PD rather than HD.

**RESULTS**

**Response Rate**

Of 600 nephrologists selected in our national random sample, 81 were excluded because surveys were undeliverable \((n = 21)\), the surveyed physician had moved out of the region \((n = 29)\) or was no longer in practice \((n = 18)\), or the surveyed physician described himself or herself as never seeing patients in the pediatric age group and declined to make treatment recommendations in the survey \((n = 13)\). Of the 519 remaining nephrologists, 316 (61%) responded, including 191 of 351 (54%) adult nephrologists and 125 of 168 (74%) pediatric nephrologists.

**Characteristics of Nephrologists Surveyed**

The demographic, training, and practice characteristics of the responding and nonresponding adult and pediatric nephrologists are presented in Table 1. Among respondents, a higher percentage of pediatric than adult nephrologists were women. There were no differences in the racial distribution or years in practice. Nineteen percent of pediatric nephrologists compared with only 1% of adult nephrologists described their dialysis training as “mostly peritoneal dialysis.” Additionally, there were marked differences between responding adult and pediatric nephrologists in practice setting, with 93% of pediatric nephrologists based in academic medical centers vs 9% of nephrologists treating adults (Table 1).

Forty-eight percent of nephrologists stated that their training included seeing patients aged 19 years and younger. Thirty-three percent of responding adult nephrologists stated that their training included making dialysis treatment recommendations for patients aged 19 years and younger. Additionally, 66% of responding adult nephrologists described themselves as the primary nephrologist caring for at least 1 patient aged 15 to 19 years in the past 5 years, and 6% claimed to have been the primary nephrologist caring for patients aged 1 to 9 years during the previous 5 years. Twenty-six percent of adult nephrologists described patients aged 19 years and younger as comprising at least 5% of their practice in the last 5 years.
Analysis of Nonresponse Bias
There were significant differences in response rates according to pediatric vs adult nephrology training, years in practice, and practice setting (Table 1). Pediatric nephrologists were more likely to respond than adult nephrologists. Physicians with more than 10 years in practice were less likely to respond than those who had finished nephrology training more recently. Nephrologists practicing in university settings were more likely than those practicing in independent dialysis centers to respond to the survey. There were no statistically significant differences in the response rates among nephrologists by geographic region (Table 1).

Dialysis Recommendations According to the Pediatric Experience of the Physician
Physicians with greater exposure to pediatric patients recommended PD rather than HD for a higher percentage of patients. This was true whether exposure to pediatric patients was measured as membership in a society of pediatric subspecialists (75% vs 71%; \( P=.01 \), \( \chi^2 \) test), exposure to pediatric patients during nephrology training (74% vs 70%; \( P=.02 \), \( \chi^2 \) test), or if more than 5% of a physician's current practice was composed of pediatric patients (74.2% vs 70.8%; \( P=.04 \), \( \chi^2 \) test). Practice setting (university hospital vs independent center, \( P=.06 \)), years in practice (\( \leq 10 \) years vs \( >10 \) years, \( P=.44 \)), and dialysis training that was mostly PD (\( P=.65 \)) were not significantly associated with the recommendation for PD.

Multivariate Analyses
Multivariate logistic regression analysis demonstrated that the odds of pediatric nephrologists recommending PD rather than HD were 60% greater than that of similar recommendations by adult nephrologists, even when patient age, race, sex, cause of ESRD, parental education, distance from the dialysis facility, compliance, and number of parents in the home were held constant (odds ratio [OR], 1.61; 95% confidence interval [CI], 1.35-1.92) (Table 2). When statistical techniques accounting for similarities of responses by individual nephrologists were used, the results were robust (OR, 1.57; 95% CI, 1.44-1.70).

The increased odds of recommending PD vs HD persisted whether pediatric experience was measured as membership in a pediatric subspecialty society, nephrology training that included exposure to children (adjusted OR, 1.3; 95% CI, 1.09-1.56), or patient population at least 5% pediatric (adjusted OR,1.57; 95% CI, 1.44-1.70).

When the description of dialysis training as “mostly peritoneal dialysis” was substituted for pediatric experience in the multivariate regression analysis, the adjusted odds of recommendations for PD vs HD were 1.52 (95% CI, 1.09-2.12). However, separate stratified analyses of adult and pediatric nephrologists did not show that training with PD explained the difference in treatment recommendations between the 2 specialties. Adult nephrologists whose training focused on PD (OR, 0.7; 95% CI, 0.3-1.9) or equally on PD and HD (OR, 1.1; 95% CI, 0.9-1.4) were no more likely to recommend PD than were nephrologists whose training was predominantly HD (OR, 1.0; reference).

Additionally, secondary analyses in which subspecialty and practice setting were combined demonstrated that university-based pediatric nephrologists were more likely to recommend PD than were those in university vs independent practice (adjusted OR, 1.57; 95% CI, 1.44-1.70).
gists were more likely to recommend PD vs HD (adjusted OR, 1.47; 95% CI, 1.21-1.77) compared with adult nephrologists at independent centers. University-based adult nephrologists did not demonstrate an increased odds of prescribing PD vs HD (adjusted OR, 0.88; 95% CI, 0.60-1.28) when compared with adult nephrologists at independent centers.

**Patient Factors Influencing Dialysis Treatment Recommendations**

Several patient factors included in the case vignettes influenced nephrologists’ recommendations for dialysis treatment (Table 2). Patients living further from the dialysis treatment facility were more likely to be recommended for PD, with those patients more than a 2-hour drive from the dialysis facility 4.8 times as likely as those less than 1 hour from the facility to be recommended for PD (OR, 4.8; 95% CI, 3.83-5.60). Additionally, younger patients were more likely than children and adolescents older than 10 years to be recommended for PD. The level of parental education also influenced dialysis recommendations, with children of college-educated parents more likely to be recommended for PD than children of parents with less than a high school education (OR, 1.57; 95% CI 1.27-1.93). Descriptions of patient compliance strongly influenced recommendations for PD. Patients described as “not compliant” (OR, 0.16; 95% CI, 0.13-0.20) or “questionably compliant” (OR, 0.48; 95% CI, 0.38-0.61) were much less likely than those described as “compliant” (OR, 1.0; reference group) to be recommended for PD.

**Association of Pediatric Specialization With Treatment Recommendations Across Different Practice Settings and Physician Characteristics**

Stratified analyses by physician characteristics revealed that regardless of geographic region, practice setting, years in practice, or exposure to PD during training, pediatric nephrologists were more likely to recommend PD vs HD (TABLE 3). Comparisons of adult and pediatric nephrologists in each strata of geographic region, practice setting, years in practice, or dialysis training consistently yielded ORs for the recommendation of PD of more than 1.0, suggesting that pediatric experience was robustly associated with PD recommendations.

**COMMENT**

More than one third of the children and adolescents with ESRD requiring dialysis in the United States are cared for in facilities that primarily serve adults. This is likely due to the uneven geographic distribution and small number of physicians who report a primary or secondary specialty of pediatric nephrology in the United States. Pediatric nephrologists, like most other pediatric subspecialists, are largely concentrated in urban academic medical centers and medical schools. Therefore, many children with unusual chronic illnesses, including ESRD, may be evaluated and treated by adult specialists who may have little experience with children. Since the causes, associated morbidities, and clinical outcomes of chronic illness differ dramatically between children and adults with similar diagnoses, adult- and pediatric-trained subspecialists may make different diagnostic and treatment recommendations. Additionally, social and developmental issues such as growth, sexual development, and school attendance may factor more heavily into the treatment recommendations made by practitioners with more exposure to children.

Rates of PD use among adult ESRD patients in the United States are low (13%-17% of all adult dialysis patients) compared with rates ranging from 37% in Canada to 51% for adults with ESRD in England. In contrast, estimates of PD use among pediatric patients in the United States ranges from 45% to 65%. Peritoneal dialysis is widely believed to be the preferred dialysis modality for children because it has been associated with improved quality of life and better growth and school attendance. Our study demonstrates that when caring for patients with identical clinical and social

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**Table 2. Association Between Pediatric Experience or Patient Characteristics and Dialysis Recommendations for Odds of Recommending Peritoneal Dialysis vs Hemodialysis**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted Odds Ratio</th>
<th>Adjusted Odds Ratio†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nephrology training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatric nephrology</td>
<td>1.45 (1.24-1.71)</td>
<td>1.61 (1.35-1.92)</td>
</tr>
<tr>
<td>Adult nephrology</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Patient distance from facility, h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>1-2</td>
<td>2.1 (1.72-2.48)</td>
<td>2.64 (2.16-3.23)</td>
</tr>
<tr>
<td>&gt;2</td>
<td>3.94 (3.21-4.84)</td>
<td>4.8 (3.83-5.60)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-9</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>10-14</td>
<td>0.78 (0.58-1.02)</td>
<td>0.61 (0.45-0.84)</td>
</tr>
<tr>
<td>15-19</td>
<td>0.64 (0.48-0.89)</td>
<td>0.48 (0.35-0.65)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>White</td>
<td>0.98 (0.84-1.15)</td>
<td>0.96 (0.81-1.14)</td>
</tr>
<tr>
<td>Parental education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;High school</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>High school</td>
<td>1.18 (0.98-1.42)</td>
<td>1.33 (1.08-1.63)</td>
</tr>
<tr>
<td>College</td>
<td>1.51 (1.25-1.82)</td>
<td>1.57 (1.27-1.93)</td>
</tr>
<tr>
<td>Compliance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliant</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Questionably compliant</td>
<td>0.53 (0.43-0.66)</td>
<td>0.48 (0.38-0.61)</td>
</tr>
<tr>
<td>Not compliant</td>
<td>0.19 (0.16-0.24)</td>
<td>0.16 (0.13-0.20)</td>
</tr>
</tbody>
</table>

*CI indicates confidence interval.
†Adjusted for all variables listed in the table except variable of interest.
and considering the unique problems, such as growth and developmental issues, of pediatric patients.

One possible explanation for these findings would be that internal medicine nephrologists do not consider PD as therapeutic a treatment modality as HD. Although HD is the predominant modality used in adult patients with ESRD in the United States, most studies show that PD and HD are equivalent therapies in terms of morbidity and mortality in adults. Most recent studies of prospective data in large cohorts of adult patients receiving HD and PD demonstrate that previously reported survival advantages for one modality vs the other are likely due to lower morbidity and lower burden of acute onset ESRD. Despite published studies documenting equivalence of the 2 therapies, the lower rates of recommendation of PD by adult nephrologists may reflect differences in attitudes toward this therapy. Respondents were not asked about their acceptance of PD.

Additionally, we did not address the availability of PD at a respondent’s facility. Our survey stated that all treatment options were available to each patient. Although our intent was to isolate how pediatric experience affects treatment recommendations, it is possible that the availability of PD as a treatment option at a respondent’s facility might explain the differential recommendations for PD reported. Additionally, we did not address the issue of physician payment and how this might affect recommendations for PD or HD. Reimbursement by Medicare for dialysis is divided into facility payment with the composite rate and physician payment with the monthly capitation payment. The monthly capitation payment to the physician is roughly the same whether a patient is treated with PD or HD. Our study goal was to isolate the physician recommendation. We therefore stated that all treatment options were hypothetically available to each patient and did not address facility issues or financial constraints.

The dose-response effect associated with descriptions of patient compliance and increasing distance from a dialysis facility demonstrate the validity of the physician responses to our survey. In a step-wise fashion, patients described as “questionably compliant” or “noncompliant” were much less likely than those described as “compliant” to be recommended for PD, a therapy requiring the patient to perform dialysis at home 7 days a week. Additionally, patients living at successively greater distances from the dialysis facility where HD would be performed for 3 hours a day, 3 times a week, were also more likely to be recommended for PD.

Low response rates to physician surveys frequently hamper the generalizability of results. Our 61% response rate surpasses the mean response rate of 54% for published physician surveys. Furthermore, bivariate analysis comparing responders with nonresponders demonstrated no differences in response rate by geographic region or race. Although pediatric nephrologists were more likely to respond than the adult nephrologists surveyed, adult nephrologists who encountered children or adolescents in their practices may have been more likely to respond to our questionnaire. The fact that 66% of adult nephrologists responding to our survey described themselves as having been the primary nephrologist for at least 1 patient aged 15 to 19 years lends credence to this supposition. Because this group of adult nephrologists would be the relevant comparison group to pediatric nephrologists, the differential response rate would be unlikely to influence the internal validity of our study results.

Much of the increased response among university-based physicians may be explained by the much higher response rate among pediatric nephrologists, almost all of whom are based in academic medical centers. Although the signature of a pediatric nephrologist on the cover letter of the survey in the small community of pediatric nephrologists may have made pediatric nephrologists more likely to respond, it would be unlikely to introduce bias in the treatment recommendation for PD or HD in the vignettes included in the survey.

Table 3. Association Between Pediatric Specialization and Treatment Recommendations Across Practice Settings and Providers*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>Adjusted Odds Ratio† (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northeast</td>
<td>100</td>
<td>2.5 (1.8-3.5)</td>
</tr>
<tr>
<td>Southeast</td>
<td>89</td>
<td>1.0 (0.7-1.4)</td>
</tr>
<tr>
<td>Midwest</td>
<td>62</td>
<td>2.2 (1.5-3.3)</td>
</tr>
<tr>
<td>West</td>
<td>66</td>
<td>1.3 (0.9-2.0)</td>
</tr>
<tr>
<td>Practice setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent center</td>
<td>146</td>
<td>6.6 (0.8-57.7)</td>
</tr>
<tr>
<td>University hospital</td>
<td>133</td>
<td>1.6 (1.1-2.4)</td>
</tr>
<tr>
<td>Other</td>
<td>38</td>
<td>1.0 (0.25-3.6)</td>
</tr>
<tr>
<td>Years in practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤10 y</td>
<td>102</td>
<td>1.9 (1.4-2.6)</td>
</tr>
<tr>
<td>11-20 y</td>
<td>127</td>
<td>1.4 (1.0-1.9)</td>
</tr>
<tr>
<td>&gt;20 y</td>
<td>87</td>
<td>1.7 (1.2-2.4)</td>
</tr>
<tr>
<td>Dialysis training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mostly peritoneal dialysis</td>
<td>148</td>
<td>8.5 (1.8-41.0)</td>
</tr>
<tr>
<td>Mostly hemodialysis</td>
<td>26</td>
<td>1.4 (1-1.19)</td>
</tr>
<tr>
<td>Equally peritoneal and hemodialysis</td>
<td>127</td>
<td>1.6 (1.2-2.1)</td>
</tr>
</tbody>
</table>

*CI indicates confidence interval. †Odds ratio of pediatric vs adult nephrologist recommendation of peritoneal vs hemodialysis for different physicians in different practice settings and different backgrounds. The odds ratios compare pediatric to the adult nephrologist reference group. Odds ratio adjusted for patient age, race, sex, cause of end-stage renal disease, compliance, parental education, and number of patients in the home.
Finally, the use of case vignettes to isolate and define the effect of physician practice from other effects of the health care system on treatment decisions is a unique strength of our study. Case vignettes have been shown to approximate the gold standard of standardized patient interviews in studies focusing on the process of care provided in actual clinical practice. The use of clinical vignettes in which social factors and clinical characteristics can be randomly combined avoids the potential confounding effects of selection bias in observational studies. In actual practice, comorbid conditions, socioeconomic determinants, and geographic constraints may dictate which patients visit generalists or pediatric or adult subspecialists.

In this study we removed these potential confounding factors by using a survey with randomized case vignettes. We demonstrated that the pediatric specialization of the provider independently influences dialysis treatment decisions. These conclusions are strengthened by the national representation of nephrologists in our sample. Stratified sampling by geographic location ensured that we sampled nephrologists from both urban and rural areas because geography may influence treatment recommendations. The design of the questionnaire, including random combinations of patient characteristics in the clinical vignettes, ensured that we measured the independent effects of patient and provider characteristics on physician recommendations. When caring for patients with identical characteristics, physicians with greater experience with pediatric ESRD were more likely to recommend PD. The recommendation of PD may translate to lower costs and improved outcomes for adolescents with kidney failure. Our study suggests that physicians making treatment plans for children and adolescents with renal disease should consider consultation with nephrologists with experience in treating children. Additionally, increased awareness of the unique clinical problems facing pediatric patients during the training of all nephrologists should be encouraged.

Author Contributions: Study concept and design: Furth, Hwang, Yang, Neu, Fivush, Powe. Acquisition of data: Furth, Hwang, Yang, Powe. Analysis and interpretation of data: Furth, Hwang, Yang, Powe.

Drafting of the manuscript: Furth, Hwang, Yang. Critical revision of the manuscript for important intellectual content: Furth, Hwang, Neu, Fivush, Powe. Statistical expertise: Furth, Hwang, Yang, Powe. Obtained funding: Furth, Hwang, Yang, Powe.

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