Patient Awareness and Initiation of Peritoneal Dialysis

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Background: Few US patients with kidney failure start treatment on peritoneal dialysis (PD) despite its potential survival, quality of life, and cost-saving benefits. We investigated patient awareness of PD and variables associated with PD selection, including dialysis unit ownership and geographic area.

Methods: In a cohort study, incident dialysis patients identified by the Centers for Medicare and Medicaid Services (CMS) and included in the United States Renal Data System (USRDS) were surveyed from 2005 to 2007 for the USRDS Comprehensive Dialysis Study. Participants reported whether PD had been discussed with them before they started regular treatment for kidney failure, and initial dialysis modality was verified in the USRDS patient registry.

Results: The proportion of patients in our study cohort who reported that PD had been discussed with them (61%) was higher than in previous surveys, but only 10.9% of informed patients initiated PD. With patient demographic and clinical characteristics controlled for, the proportion of informed patients who started PD differed substantially across large dialysis organizations. Substantial variation in selection of PD was also evident among patients starting dialysis in the 18 end-stage renal disease Network areas.

Conclusions: Despite patients' early awareness of PD as a treatment option, PD selection was low in this national cohort. Factors associated with PD selection merit continued study as CMS seeks to improve quality and cost-effectiveness of kidney patient care.


See also pages 107 and 110
treatment. Previous studies have pointed to variations in PD utilization rates across large dialysis organizations (LDOs) and across geographic areas, but whether these factors remain important for PD selection among informed patients is unknown.

We examined patient awareness and PD selection using the USRDS patient registry and information from a recent USRDS survey of a national cohort of patients who selected long-term dialysis therapy from 2005 to 2007. We identified patients in this cohort who reported that PD had been discussed with them prior to their initiation of long-term dialysis. Among those who reported having received pre-dialysis discussion of PD, the objective of our study was to compare patient sociodemographic and clinical characteristics, dialysis unit affiliation, and geographic location of patients who selected PD with those same aspects of patients who selected HD as initial treatment modality.

**METHODS**

**STUDY POPULATION**

The Comprehensive Dialysis Study (CDS) is a special USRDS data collection study of patients with ESRD who initiated long-term dialysis therapy. The CDS was designed as a prospective cohort study, with the aim of understanding factors contributing to physical, functional, and nutritional health status among patients starting dialysis. Outpatient dialysis units throughout the United States were selected from among the 4410 clinics listed in the April 2005 Dialysis Facility Compare database (https://www.cms.gov/DialysisFacilityCompare) of the Centers for Medicare and Medicaid Services (CMS) after that database was merged with the USRDS ESRD Facility File. Pediatric and transplant-only facilities were excluded as were facilities located outside of the 50 United States and the District of Columbia. The list of dialysis units was then sorted by ESRD Network, adjacent states within the Network, and number of annual incident patients per facility (SAS PROC SURVEYSELECT procedure). A sample of 335 facilities was selected using equal probability systematic random sampling. Use of systematic random sampling in conjunction with the sorted facility list yielded implicit geographical stratification (Network and state within Network) for the sample facilities. The selected units matched the total population of clinics closely on number of patients and dialysis stations, facility type (free-standing or hospital-based units), dialysis chain or nonchain affiliation, types of dialysis offered (HD or PD), and ESRD Network. Full details of the sampling plan are available from the authors on request.

Patients with ESRD, aged 18 years or older, who initiated long-term dialysis between June 1, 2005, and June 1, 2007, at one of the selected dialysis clinics were reported to the USRDS Coordinating Center through the CMS Standard Information Management System after the patient had been receiving long-term dialysis for at least 2 months but no more than 3 months. Patient lists were provided monthly to personnel at the USRDS Coordinating Center, who then contacted patients to request their participation in the study. Patients who consented were asked to participate in a structured interview administered by professional interviewers using a computer-assisted telephone interviewing system.

Patients who were interviewed were affiliated with 296 different dialysis clinics. Some clinics were disrupted by Hurricane Katrina during the study period, and a small number of clinics declined to provide information about the study to their patients. The dialysis clinics with which CDS participants were affiliated were located across all 18 ESRD Networks and in all states except Alaska and Vermont.

Of the 1646 patients interviewed, 3 patients were subsequently determined not to meet the study eligibility criterion of having started regular long-term dialysis for the first time, and 22 patients were unsure or did not provide a response to whether PD had been discussed with them, leaving a study cohort of 1621 patients who reported whether PD had been discussed with them prior to RRT (Figure 1). At the time of the interview, patients had been undergoing dialysis for approximately 4 months (median, 122 days; mean, 129 days).

**MEASURES**

During the telephone interview, patients were asked “Was peritoneal dialysis discussed with you before you started your regular treatment for kidney failure? If Yes, was this 12 months or more before you started?” Patients were also asked to indicate the highest education level they had completed, whether they were currently living alone, and whether they had smoked at least 100 cigarettes in their life.

Updated patient characteristics for respondents were obtained from 2008 USRDS Standard Analysis Files. This information included date of birth, sex, race, weight and body mass index (BMI), employment status at treatment start, diabetes status, number of cardiovascular conditions (congestive heart failure, atherosclerotic heart disease, other cardiac disease, cerebrovascular disease, or peripheral vascular disease), ability to ambulate or transfer, receipt of pre-ESRD care from a nephrologist, date of first ESRD service, initial type of dialysis used, and hemoglobin, serum creatinine, and serum albumin values at treatment start, as documented on CMS Form 2728 (ESRD Medical Evidence Report) submitted to CMS for all ESRD patients who initiate treatment for kidney failure.

We used the type of dialysis recorded on CMS Form 2728 at the first ESRD service date to define use of PD or use of HD at treatment start. Because patients may switch modalities early in their treatment, outcomes studies using USRDS data typically define initial dialysis modality using a “60-day rule,” ie, the patient’s modality 90 days after their first ESRD service date with continuous treatment on that modality for at least 60 days. However, our study does not use initial dialysis modality to predict subsequent outcomes. We did examine the congruence between patients’ modality at first ESRD service date and their modality at 90 days, and we report that information herein.

Dialysis chain ownership of the patient’s dialysis unit was identified in the CMS database used for facility sample selec-
tion. The USRDS defines an LDO as an organization that owns 100 or more free-standing dialysis clinics located in more than 1 state. There were 5 LDOs when the facility sample for the CDS was constructed in 2005, which became consolidated to 3 LDOs by 2006. Given that the consolidation occurred early during our study, these 3 consolidated LDOs were used in our analysis; they were assigned random codes LDO1 through LDO3. “Non-LDO” units included independent providers, units affiliated with academic medical centers, and small dialysis organizations in which 20 or more units are owned and/or operated by a corporation that controls fewer than 100 total units.

Patients’ ESRD Network is the geographic area containing the dialysis clinic where they initiated treatment. Eighteen Networks have been defined by CMS for administrative oversight of the ESRD program. The sample of dialysis facilities selected for the CDS was implicitly stratified by ESRD Network.

A measure of each dialysis unit’s rural vs urban location based on zip code was defined using a zip code approximation of Rural-Urban Commuting Area (RUCA) codes assigned to census tracts. The RUCA codes range from 1.0 to 10.6, with 1.0 indicating the least rural and 10.6, the most rural. (A national file is available from the University of Washington and can be downloaded at http://depts.washington.edu/uwrucha/ruca-download.php.)

### STATISTICAL ANALYSIS

Using USRDS registry data, we compared the characteristics of CDS participants who recalled whether PD had been discussed with them with characteristics of all other incident patients who started dialysis in the United States during the same time period. Among the subset of CDS participants who affirmed that PD was discussed with them before dialysis (n=990), patient sociodemographic, clinical, and dialysis unit characteristics were compared between patients who selected PD and those who selected HD as their initial treatment modality. To account for potential imbalance in patient characteristics in the 3 LDOs, we used a logistic regression model to assess the difference between LDOs in the proportion of patients selecting PD, after adjusting for patient characteristics; the model incorporated patient characteristics and affiliation with non-LDO and individual LDO units. In all analyses, variance estimation accounted for stratification by ESRD Network and patient clustering within dialysis units.

Statistical analyses were carried out using SAS software, version 9.2 (SAS Institute, Cary, North Carolina). The CDS was approved by institutional review boards at the location of the USRDS coordinating center (University of Minnesota), the USRDS Rehabilitation/Quality of Life Special Studies Center (Emory University), and the USRDS Nutrition Special Studies Center (University of California, San Francisco and University of California, Davis). All respondents provided informed consent. Patient anonymity was ensured at the coordinating center by assigning a universal USRDS identifier to all data obtained for a specific patient.

### RESULTS

Compared with 211,637 other US incident patients who began dialysis during the same period, CDS participants were more likely to be younger than 65 years and to be working; had higher average weight and BMI and fewer cardiovascular comorbid conditions; were more likely to be able to ambulate and transfer independently; had higher average serum creatinine and serum albumin concentrations; and were more likely to have been under the care of a nephrologist prior to initiating RRT (Table 1). There were no significant differences between CDS participants and the overall population of incident dialysis patients in sex, race, diabetic status, or average hemoglobin concentration.

A total of 990 patients reported that PD had been discussed with them before dialysis (Figure 1). Of these patients, 641 began dialysis treatment at a unit affiliated with 1 of the 3 LDOs, and 349 began dialysis at a unit not affiliated with an LDO. Patients were receiving treatment at dialysis units located in all 18 ESRD Networks. Of the 108 patients who began PD treatment after having discussed PD with a health care provider beforehand (Figure 1), 99% remained on PD 90 days after treatment start. Similarly, 99% of the 882 patients who initiated HD remained on that modality 90 days after treatment start.

The proportion of patients who initiated PD in LDO units was similar to the proportion of patients who initiated PD in non-LDO units (10.8% vs 11.2%); the proportion of patients starting PD at LDO3 and the proportion of patients starting PD at the other 2 LDOs differed substantially (P = .07) (Figure 2). Logistic regression used in this analysis incorporated affiliation indicators of non-LDO and individual LDO units along with the other patient characteristics summarized in Table 2 except hemoglobin and serum albumin values. Hemoglobin and serum albumin concentrations were not significantly different across patients affiliated with non-LDO and LDO units; these variables were excluded from the regression model owing to the high amount of missing values for these measures (Table 2).

### Table 1. Characteristics of Study Participants and Other US Patients Initiating Long-term Dialysis During the Same Period

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study Participants (n=1621)</th>
<th>Other US Incident Dialysis Patients (n=211 637)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Younger age (&lt; 65 y)</td>
<td>61.8</td>
<td>50.4</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Female</td>
<td>45.2</td>
<td>44.3</td>
<td>.49</td>
</tr>
<tr>
<td>Black</td>
<td>28.3</td>
<td>28.8</td>
<td>.63</td>
</tr>
<tr>
<td>Working full or part time</td>
<td>12.8</td>
<td>10.4</td>
<td>.002</td>
</tr>
<tr>
<td>Diabetes</td>
<td>52.6</td>
<td>51.2</td>
<td>.28</td>
</tr>
<tr>
<td>Not able to ambulate or transfer independently</td>
<td>2.4</td>
<td>7.4</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cardiovascular conditions, mean (SD), No.</td>
<td>0.9 (1.1)</td>
<td>1.0 (1.1)</td>
<td>.03</td>
</tr>
<tr>
<td>Hemoglobin, mean (SD), g/dL</td>
<td>10.1 (1.8)</td>
<td>10.1 (1.7)</td>
<td>.48</td>
</tr>
<tr>
<td>Serum creatinine, mean (SD), mg/dL</td>
<td>6.9 (3.5)</td>
<td>6.6 (3.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Serum albumin, mean (SD), g/dL</td>
<td>3.2 (0.7)</td>
<td>3.1 (0.7)</td>
<td>.01</td>
</tr>
<tr>
<td>BMI, mean (SD)</td>
<td>29.8 (8.1)</td>
<td>28.4 (7.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Weight, mean (SD), kg</td>
<td>84.3 (22.9)</td>
<td>78.8 (22.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Had predialysis nephrology care</td>
<td>72.3</td>
<td>65.2</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Abbreviation: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).  
SI conversion factors: To convert hemoglobin and serum albumin to grams per liter, multiply by 10.0; serum creatinine to micromoles per liter, multiply by 88.4.  
*Unless otherwise indicated, data are reported as percentage of patients.
A higher proportion of incident patients surveyed in the CDS reported that PD had been discussed with them before dialysis than has been found in earlier studies. In the CDS, 58.6% of patients who initiated HD reported that PD had been discussed with them before they started treatment for kidney failure compared with 25% of incident HD patients who participated in the 1996-1997 USRDS Dialysis Morbidity and Mortality Study (DMMS): Wave 218 (a national study) and 30% of incident HD patients who participated in a survey conducted by ESRD Network 18 in Southern California.16 However, the proportion of all patients starting chronic dialysis in the United States who receive predialysis information about treatment options is unknown. The CDS yielded a sample of incident patients that differed in several important characteristics from the overall population of patients undergoing dialysis in the United States. Most importantly, CDS patients had a greater likelihood of employment and independent functioning (Table 1). Physicians may be more likely to present PD as a treatment option to patients with demographic and/or clinical characteristics such as these (ie, younger, healthier, and more likely to be employed) than to the general dialysis population. Patients who are younger, healthier, and more likely to be employed might significantly benefit from the advantages of PD, and it is important that an opportunity for education and discussion of treatment choices is made available.

The importance of communicating early information about RRT options to patients with chronic kidney disease is a strong theme in literature addressing factors associated with dialysis modality selection. Mehrotra et al,16 who studied patients in the Southern California ESRD Network, concluded that having PD presented as a treatment option during pre-ESRD education, and the duration of time spent discussing treatment options, were the most important determinants of PD selection. We acknowledge that there is potential respondent error in patients’ recall of whether PD was discussed before dialysis, a limitation shared with other surveys that ask about patient experience. The CDS did not obtain information about the content, duration, or patient satisfaction with predialysis information. However, we found a significantly higher proportion of Comprehensive Dialysis Study18 participants who reported that PD had been discussed with them before dialysis than has been found in other surveys.

Figure 2. Percentage of Comprehensive Dialysis Study18 participants with whom peritoneal dialysis (PD) was discussed before dialysis who then chose to undergo PD, by large dialysis organization (LDO). P=.07 for LDO3 vs LDO1 and LDO2.

### Table 2. Characteristics of Patients Who Started Treatment With PD vs HD After Discussing PD With Their Health Care Providers Beforehanda

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Treatment</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PD</td>
<td>HD</td>
</tr>
<tr>
<td></td>
<td>(n=108)</td>
<td>(n=882)</td>
</tr>
<tr>
<td>PD discussed &gt;=12 mo before regular treatment startedb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Younger age (&lt;65 y)</td>
<td>37.4</td>
<td>34.7</td>
</tr>
<tr>
<td>Female</td>
<td>53.7</td>
<td>43.5</td>
</tr>
<tr>
<td>Black</td>
<td>18.5</td>
<td>28.2</td>
</tr>
<tr>
<td>High school graduateb</td>
<td>92.6</td>
<td>77.5</td>
</tr>
<tr>
<td>Working full or part time</td>
<td>27.8</td>
<td>13.8</td>
</tr>
<tr>
<td>Living alone</td>
<td>15.7</td>
<td>21.2</td>
</tr>
<tr>
<td>Diabetes</td>
<td>47.2</td>
<td>53.4</td>
</tr>
<tr>
<td>Ever smokedc</td>
<td>55.1</td>
<td>60.2</td>
</tr>
<tr>
<td>Not able to ambulate or transfer independently</td>
<td>1.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Cardiovascular conditions, mean (SD), No.</td>
<td>0.6 (0.8)</td>
<td>0.9 (1.1)</td>
</tr>
<tr>
<td>Hemoglobin, mean (SD), g/dLc</td>
<td>11.3 (1.5)</td>
<td>10.1 (1.7)</td>
</tr>
<tr>
<td>Serum creatinine, mean (SD), mg/dLb</td>
<td>6.0 (2.2)</td>
<td>6.9 (3.4)</td>
</tr>
<tr>
<td>Serum albumin, mean (SD), g/dLd</td>
<td>3.6 (0.6)</td>
<td>3.2 (0.7)</td>
</tr>
<tr>
<td>BMI, mean (SD)e</td>
<td>29.6 (6.4)</td>
<td>29.5 (8.0)</td>
</tr>
<tr>
<td>Weight, mean (SD), kgb</td>
<td>82.7 (20.0)</td>
<td>84.0 (22.7)</td>
</tr>
<tr>
<td>LDO-owned dialysis unit</td>
<td>63.9</td>
<td>64.9</td>
</tr>
<tr>
<td>Rurality index of dialysis unit (higher index means more rural)</td>
<td>2.5 (2.6)</td>
<td>2.2 (2.5)</td>
</tr>
<tr>
<td>Had predialysis nephrology carec</td>
<td>92.3</td>
<td>78.8</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); HD, hemodialysis; LDO, large dialysis organization; PD, peritoneal dialysis.

Si conversion factors: To convert hemoglobin and serum albumin to grams per liter, multiply by 10.0; serum creatinine to micromoles per liter, multiply by 88.4.

a Unless otherwise indicated, data are reported as percentage of patients.
b Missing values, <=1%.
c Missing values, 11%.
d Missing values, 25%.
e Missing values, 2%-5%.

Compared with patients who started treatment with HD, patients who started PD treatment were more likely to have completed high school and more likely to be work-

**COMMENT**
tively small. Patients with a higher educational level and lower cardiovascular disease burden were more likely to use PD. Hemoglobin and serum albumin concentrations were significantly higher among patients who initiated PD. Although most patients may have no contraindications to either PD or HD, sociodemographic and clinical differences between patients who start PD and those who start HD may reflect physician attitudes about which patients will benefit more from PD.

We did not find that PD treatment selection varied significantly by whether patients initiated dialysis at an LDO unit or a non-LDO unit (Table 2), but there was a trend for patients’ selection of PD to differ among the 3 LDOs (Figure 2). The LDO with the highest proportion of patients selecting PD was a for-profit organization, as was the LDO with the smallest proportion of patients selecting PD. Thus, the differences across LDOs observed in this study cannot be reduced to a profit vs not-for-profit explanation.

Variation in PD utilization was also evident across ESRD Network regions (Figure 3). Although more use of PD might be expected in less populated areas where patients must travel greater distances to a dialysis clinic, we did not observe a significant association between increasing rurality of dialysis facility location and patients’ selection of PD (Table 2). McClellan et al recently showed that dialysis units in which patients were least likely to have received predialysis nephrology care were clustered geographically, and differences in availability of predialysis care may contribute to geographic variation in PD selection. The existence of geographic variation in pre-ESRD care may be related to inadequate dissemination of evidence-based practice guidelines and ambiguities in the state of clinical practice. Low detection rates of chronic kidney disease by primary care physicians and limited availability of nephrology manpower are additional possibilities. Geographic variation in availability of pre-ESRD care could be targeted by ESRD Networks for quality improvement initiatives.

A survey of American nephrologists’ attitudes toward dialysis modality utilization found that respondents believed that a form of PD should be used by 30% or more of patients, whether the objective was maximizing survival, wellness, and quality of life or maximizing cost-effectiveness. Vonesh et al concluded that the risk of death is generally lower for PD patients than for HD patients during the first year or 2 of dialysis. The early survival advantage may be related to better preservation of residual renal function with PD, and it is possible that increased early PD use might help to reduce the high first-year mortality that characterizes dialysis patients. In an earlier study, our research group found that plant and dialysis treatment options are reviewed. A program, to provide increased flexibility for greater use of PD and other home treatment regimens. However, PD and other home training programs require multiple system supports, especially physician and staff education, training, and experience, and health care providers must believe in the sustainability of newly created and expanded home dialysis programs. In fact, Medicare education benefit. Reimbursement is available for up to 6 educational sessions conducted by a physician, nurse, or physician assistant for patients with pre-ESRD (stage 4 chronic kidney disease) for whom transplant and dialysis treatment options are reviewed. A curriculum to assist professionals in providing this patient education, titled Your Treatment, Your Choice, is available at no charge from the National Kidney Foundation.

The Medicare Improvements for Patients and Providers Act of 2008 also calls for a new bundled payment structure for dialysis care to be phased in by CMS starting in January 2011. The new payment system will create a per-treatment case-mix adjusted payment for ESRD that includes dialysis services, relevant diagnostic and clinical laboratory tests, and dialysis-related drugs. A representative of the CMS has described this new structure combined with required performance standards (not yet specified) as an effective way to encourage high-quality, cost-effective care. The CMS has acknowledged support for home dialysis and has proposed to reimburse for PD at the same rate as it reimburses in-center HD to provide an incentive for dialysis clinics to expand PD programs. The CMS also has proposed to reimburse home training costs, regardless of whether the clinic offers a home training program, to provide increased flexibility for greater use of PD and other home treatment regimens. However, PD and other home training programs require multiple system supports, especially physician and staff education, training, and experience, and health care providers must believe in the sustainability of newly created and expanded home dialysis programs. In fact, Medicare payouts with no accountability mechanism might not encourage health care providers to create or expand such programs because the money will be disbursed with or without such improvements.

The new proposed payment structure has elicited extensive reaction from the renal community during an extended comment period. Some observers believe that only LDOs will survive within the new structure. The Government Accountability Office has urged CMS to begin monitoring access to, and quality of, dialysis care as soon as possible after implementation of the new payment system.
In conclusion, we found that among a large group of patients who reported that PD was discussed with them before dialysis as a treatment option, PD selection remained limited and varied substantially depending on the LDO that owned the patient’s dialysis unit. Geographic differences in PD selection also exist. While “PD is not a panacea for every patient,” greater PD selection could have many benefits, ideally facilitating the use of “the appropriate form of RRT, in the appropriate patient, at the appropriate time in the course of ESRD” and helping to contain kidney disease treatment costs. Factors associated with patient counseling and RRT choices, including PD selection, merit continued study as CMS seeks to improve quality and cost-effectiveness of health care for patients with kidney disease.

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Author Contributions: Ms Zhang had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Kutner and Wasse. Analysis and interpretation of data: Kutner, Zhang, and Huang. Drafting of the manuscript: Kutner. Critical revision of the manuscript for important intellectual content: Kutner, Zhang, Huang, and Wasse. Statistical analysis: Zhang and Huang. Obtained funding: Kutner. Administrative, technical, and material support: Kutner. Study supervision: Kutner and Wasse.

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