Burden of Dialysis, Health-related Quality of Life and Employment Among Patients Receiving Peritoneal Dialysis and In-center Hemodialysis: Findings from the DOPPS Program

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Running head: PD vs HD disease burden

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Abstract

Rationale & Objective
Patient-reported outcomes (PROs) and employment, their changes over time on dialysis, and factors impacting these outcomes can inform individuals deciding on kidney replacement therapy options.

Study Design
Observational cohort study.

Setting & Participants
7,771 HD and PD participants from 6 countries participating in the Peritoneal and Dialysis Outcomes and Practice Patterns Studies (PDOPPS/DOPPS).

Predictors
Patient-reported functional status (based on daily living activities), country, patient demographics, diabetes.

Outcomes
Kidney Disease Quality of Life (KDQOL) instrument physical and mental component summary scores [PCS, MCS], kidney disease burden score, and depression symptoms (CES-D score $\geq$10).

Analytical Approach
Linear regression (PCS, MCS, Burden); Logistic regression (depression symptoms); adjusted for predictors plus 12 additional comorbidities.

Results In both dialysis modalities, Japan had the highest PCS and employment [HD (55%); PD (68%)], whereas the US had the highest MCS score, lowest kidney disease burden, and lowest employment [HD (20%); PD (42%)]. After covariate adjustment, the association of age, sex, vintage, diabetes, and functional status on PROs was remarkably similar in both modalities, with females having lower PCS and kidney disease burden scores. Lower functional status (score <11) was strongly associated with lower PCS and MCS scores, a much greater burden of kidney disease, and greater likelihood of depression symptoms (CES-D>10). The median change in KDQOL-based PROs was negligible over 1 year in participants completing at least two annual questionnaires.

Limitations

Residual confounding. Generalizability to a country's dialysis population.

Conclusions
Variation exists in quality of life, burden, and depression across countries but did not appreciably change over time. Functional status remained one of the strongest predictors of all PROs. Routine assessment of functional status may provide valuable insights for patients and providers in anticipating outcomes and support needs for PD and HD patients.

Plain Language Summary

This is a report on quality of life (QOL) (mental well-being and physical functioning) on over 7700 dialysis patients in 6 countries. Mental well-being and depression were similar in HD and PD patients, although PD patients reported lower burden of kidney disease. QOL showed little change over 1 year for most HD and PD patients. In both HD and PD: (1) people having problems performing basic tasks of daily living had worse QOL and experienced substantially higher burden of kidney disease, and (2) physician-diagnosed depression is lower than patient-reported symptoms consistent with depression.. Levels of mental well-being in dialysis patients were similar to those in recent reports in persons having stage 3-5 chronic kidney disease (CKD) but self-reported levels of physical functioning were lower. This work emphasizes the importance of enhancing care team-patient communication and improving dialysis patient experiences and QOL through effective treatment/supportive care strategies.

Introduction

The effects that dialysis treatment can have on lifestyle, burden of disease, and quality of life (QOL) are important to patients receiving kidney replacement therapy, and for their care partners (1, 2). Moreover when facing the need for kidney replacement therapy, patients and their care partners, irrespective of the chosen dialysis modality have important questions regarding their expected quality of life, the burden dialysis will place on them or their loved ones, whether these factors will change over time, and what factors impact quality of life on dialysis. Another important consideration is maintaining vocational abilities, with employment identified as an important outcome in the hemodialysis (HD) arm of the Standardizing Outcomes in the Nephrology Study (SONG) study (2). A core outcome of the peritoneal dialysis (PD) arm of SONG (3) was maintenance of life participation activities.

Collectively and individually, the Dialysis Outcomes and Practice Patterns Study (DOPPS) and the Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS) have served as the largest international sources on different dimensions of QOL in dialysis patients, including disease burden, physical and mental QOL, employment, functional status and other patient reported outcomes(4). Here, we describe QOL measures among patients on PD and HD to better understand how they change over time and relate to other clinical, demographic factors and functional status. Such information can help inform individuals about likely patient-reported outcomes to be expected when starting dialysis and provide important insights into understanding how to improve quality of life on dialysis.

Methods

Patient sample

Data, including annual collections of Patient Questionnaires, from patients on PD in PDOPPS phase 1 (2014-2017) and phase 2 (2017-2019), and patients receiving in-center HD in DOPPS 5 (2012-2015), were used in this analysis. Study approval and patient consent were obtained as required by national and local ethics committee regulations. The DOPPS Program maintains institutional review board or ethical committee approvals in all participating countries. Analyses were limited to data from countries common to both PDOPPS and DOPPS: US, Canada, UK, Australia/New Zealand (ANZ), and Japan.

Study design

DOPPS and PDOPPS are international prospective observational cohort studies of practices and outcomes in HD and PD patients, respectively. DOPPS has been ongoing since 1996, and PDOPPS since 2014 with both cohort studies composed of national samples of randomly selected dialysis facilities and patients. Extensive details of DOPPS and PDOPPS have been described previously (5-8), with the current investigation based on data from the DOPPS phase 5 and PDOPPS phases 1 and 2, as described above. Analyses were carried out based on baseline cross-sectional data, whereas longitudinal analyses regarding changes over time in particular measures, utilized data from patients who had completed two consecutive patient questionnaires (approximately 1 year apart for most patients). Since direct comparisons of PD and HD patients are likely to be confounded, we analysed PD and HD patients separately while avoiding direct comparisons due to the inability to adequately account for residual confounding no matter how many measured covariates are included in a model.

Outcomes

All outcomes were patient-reported outcomes (PRO) - described separately by dialysis modality via the annual Patient Questionnaires. Primary outcomes were three QOL measures from the Kidney Disease Quality of Life instrument (KDQOL-SF™) (9); namely physical component and mental component summary scores [PCS, MCS] and burden of kidney disease score. Additional outcomes included depression symptoms and employment status. We also examined changes in these outcomes based on patients who completed two consecutive patient questionnaires (approximately 1 year apart for most patients).

Employment percentages were calculated as the percentage of patients who were employed full or part-time among all patients <65 years old who were either employed full or part-time, unemployed, disabled, or retired under the age of 50. We restricted to patients less than 65 years old, as they are less likely to be unemployed or retired by choice. Notably, patients with missing data on employment status or who were retired (over the age of 50), homemakers, students, and people with unknown/other employment status were excluded. We recognized that these age thresholds are arbitrary, as retirement age varies between countries and many older people continue working. These thresholds are a crude measure reflecting that the goal for younger people is usually to preserve the ability to work.

For depression, we used the 10-item Center for Epidemiologic Studies Depression Scale (CES-D), using a score of 10 (out of a maximum possible score of 30) as indicative of having symptoms of depression (10). In addition, we explored physician-diagnosed depression as reported based on a patient's medical record. We defined categories of continuous PRO scores, and calculated the proportion of patients, by dialysis modality and country, in the study sample who responded within each categorical range.

Statistical methods

Predictors

We performed analyses of the following predictors of PROs, all of which have been found previously to predict clinical outcomes in dialysis patients:

- Age groups (<50, 50-64 for employment; <50, 50-69, 70+ for other outcomes)
- Sex (male, female)
- Dialysis vintage groups (<1 year, 1-2 years, 2-4 years, 4+ years)
- Diabetes status (yes, no)
- DOPPS country
- Functional status score (<11, ≥ 11)

Functional status was determined from responses to both the Katz and Lawton & Brody instruments (11, 12) as described previously by Jassal et al (2016) (13).

Cross-sectional analyses: For analyses using the baseline patient questionnaire, we used generalized estimating equations with the binomial distribution and logit link to analyze depressive symptoms (CES-D ≥10 vs. <10) as a binary outcome, and used generalized estimating equations with the normal distribution and identity link to analyze continuous outcomes (PCS, MCS, and kidney disease burden score). We assumed an exchangeable working correlation to account for clustering within facilities. Models were adjusted for country, demographics (patient age, sex, dialysis vintage), 13 comorbid conditions, (coronary artery disease, cancer (non-skin), other cardiovascular disease, cerebrovascular disease, congestive heart failure, diabetes, gastrointestinal bleeding, hypertension, lung disease, neurologic disease, psychiatric disorder, peripheral vascular disease, and recurrent cellulitis/gangrene) and transplant waiting list status, with/without adjustment for functional status.

Longitudinal analyses: We calculated the percentages of patients whose responses stayed the same or changed for categorical outcomes. For continuous outcomes, we calculated the differences in the mean values for each outcome.

Multiple Imputation for missing data: For primary analyses involving statistical models, missing covariate values were multiply imputed using the Sequential Regression Multiple Imputation Method by IVEware (14). Results from 20 imputed data sets were combined for the final analysis using Rubin's formula (15). The proportions of missing data were <10% for all imputed covariates, except for transplant waiting list status (missing among 25% of patients), which was mainly due to a large fraction of US patients for whom this information was not reported. All analyses used SAS 9.4 (SAS Institute Inc., Cary, NC).

Results

We started with a sample of 3227 PD and 4544 HD patients (Figure 1). Analyses of the baseline patient-reported outcomes included a subset of these patients for each measure, depending on the number of patients who completed the measure, along with the additional age restriction for the employment results (Figure 1).

Patient characteristics

For HD patients, mean age was lowest in the US at 62.9 years, while ranging from 64.3 to 65.2 years in the other countries; 53% of US patients were male compared to 60-66% of patients being male in other countries (Table 1).Twenty-nine percent of UK HD patients had diabetes compared to 41-64% elsewhere. Transplant waitlisting varied from 4% in Japan to 16% in the UK, with 7-10% of HD patients on a transplant waiting list in all other countries. AV fistula use ranged from 93% in Japan to 41% in Canada.

For PD patients, the mean age was 59.6 years in the US, compared to 60.8-64.6 years in other countries; 55% of US patients were male compared to 61-66% in other countries. Similar to HD patients, diabetes prevalence among PD patients was lowest in the UK (26%), while 39-50% had diabetes elsewhere (Table 1). PD patients on a transplant waitlist ranged from 14% in Japan to 45-49% in all other countries.

The majority of Japanese patients had the highest possible (i.e., best) score of 13 on the functional status scale (61% HD, 67% PD patients), while approximatey one-third of patients in other countries were in this category.

Predictors of baseline patient-reported outcomes

Median kidney disease burden scores ranged from 44 to 56 (higher scores indicate lower burden) among PD patients across all countries. In the HD population, the median kidney disease burden scores ranged from 25 to 44 across all countries. In categorical analyses, 23%-39% of HD patients and 14-24% of PD patients had the highest burden range (burden score < 25); 8-25% of HD patients and 10-37% of PD patients had the lowest reported burden, with burden scores ≥ 75 (Figure 2A). Japanese patients generally had higher (i.e., better) PCS levels, with 29% and 36% of Japanese HD and PD patients, respectively, having PCS scores ≥ 50, versus 9-13% of HD patients and 11-16% of PD patients in other countries (Figure 2B). Smaller differences were seen across countries for MCS (Figure 2C). Regarding employment, 20-55% of HD and 42-68% of PD patients <65 years old were employed (Figure 2D). Similar trends in employment were seen across countries according to different age groups (Supplemental Table 1). Depressive symptoms (CESD≥10) were seen in more than one third of both PD and HD patients in most countries, except for US PD patients (28%) (Figure 2E).

Adjusted regression models showed strong associations of functional status with each of the PROs, and were consistent in PD and HD patients (Figures 3A and 3B). Compared to patients having better functional status (FS≥11), patients with poorer functional status (FS<11) had greater adjusted kidney disease burden (i.e. lower scores) among PD (-18.3, 95% CI: -20.8 to -15.8), and HD patients (-15.1, 95% CI: -17.1 to -13.2). Similarly, patients with poorer functional status (FS<11) had lower adjusted MCS and PCS scores (7-9 points lower), and were much more likely to report symptoms of depression [adjusted odds ratios of CES-D <10 = 0.28 (95% CI: 0.22, 0.35) for PD patients and 0.38 (95% CI:0.32, 0.46) for HD patients].

Other factors associated with the studied PROs were country (type 3 p-value<0.0001 for all models), sex, and less strongly, diabetes and age (type 3 p-value <0.05 for all models) (Figure 3A, Figure 3B). The association of age, sex, vintage (type 3 p-value <0.05 for MCS in PD, and PCS/diease burden for HD; type 3 p-value<0.1 for other outcomes), and diabetes with each PRO was similar in both modalities. Younger and male patients displayed better PCS. However, younger patients (<50 yrs old) had poorer MCS and greater likelihood of depression symptoms, though absolute differences were small. Dialysis vintage was not associated with outcomes. Substantial inter-country differences were seen in levels of some of the PROs. In covariate-adjusted analyses, all countries had lower (i.e., worse) MCS and lower (i.e., worse) kidney disease burden scores compared to the US. Patients in Japan had better adjusted PCS than other countries. The likelihood of having depression symptoms was greater in all countries compared to the US. In addition, the proportion of physician-diagnosed depression by country (Supplemental Table 2) varied significantly, with rates lowest in Japan and highest in the United States.

Longitudinal analyses of patient-reported outcomes

223 PD and 374 HD patients died, and 755 PD and 727 HD patients departed the study for other listed reasons during the interval for the 1-year longitudinal analysis (Figure 1). In part due to these factors, only 29%-50% (depending on the PRO measure) of the patients who completed a patient questionnaire at baseline also completed a second patient questionnaire, usually one year later (Figure 1). The median time between questionnaires was 1 year.

Changes over time in the continuous PRO measures were generally small (Figure 4). For the categorical PRO measures, most patients remained in the category in which they started (Supplemental Figure 1).

Discussion

This is a large study describing PROs for patients on PD and HD. There were no large differences between the dialysis modalities other than a lower burden of kidney disease reported by PD patients. Unlike previous studies, we have not attempted to make any inferences regarding outcomes for PD versus HD patients since unmeasured residual confounding makes it difficult to meaningfully account for important differences in characteristics of patients choosing/selected for PD or HD. Rather we chose to explore the impact of common patient factors on PROs within each modality and found that the magnitude and direction of effects were very similar for both PD and HD by country, functional status, age, gender, and diabetes status. Among the tested predictors, poorer functional status (score <11) had the strongest association with lower PCS and MCS scores, greater kidney disease burden, and greater odds of screen positive depression (CES-D>10). PRO measures changed very little over time among those with two questionnaires approximately one year apart.

Most studies on quality of life on dialysis have been based on single centers or small study populations. This multi-center study fills this literature gap by providing data from large numbers of PD and HD patients exposed to different healthcare systems and policies across six countries. Across modalities, female sex was associated with modestly lower adjusted PCS scores and greater perceived burden of kidney disease - consistent with previous findings in dialysis and in other chronic diseases (16-18). A postulated reason is that men may be less likely than women to perceive physical weakness (19). Less clear is the difference by sex in burden scores which may relate to differences in perceived and actual support.

After adjustment, PCS scores were highest in Japanese patients and MCS scores highest in the US for both modalities. The high PCS scores may explain in part why Japanese patients had the highest rates of employment (55% HD, 68% PD) as they may have been more physically capable to maintan vocational abilities. Employment and higher PCS scores have both been previously associated with lower risks of hospitalization and mortality in previous analyses of Japanese HD patients in DOPPS, indicating these may be robust proxies for overall better health status (20). However, it was somewhat surprising to learn that despite the higher employment and physical functioning in Japan, adjusted MCS scores were lower and kidney disease burden was higher. In contrast, in the US, which had the lowest proportion of patients employed, adjusted MCS scores were highest, along with lowest kidney disease burden and lowest odds of having depression symptoms. Taken together these findings may indicate that mental health and well-being may be compromised at the expense of struggles to maintain employment which may in part be driven by unique social and cultural factors operating within Japan. Alternatively, in younger, healthier individuals capable of maintaining employment, dialysis treatments are seen as a greater burden and therefore more significantly impact mental health. Consistent with this was our observation that after adjustment for functional status, a trend towards worse mental health and higher perceived treatment burden was seen in younger individuals (<50 yrs old) compared to their older counterparts.

Relative to the US, the high proportion of screen positive depression in Japan may point to mental-health concerns among Japanese dialysis patients. A previous DOPPS analysis found that although rates of screen positive depression in Japanese hemodialysis patients were high,

rates of formal diagnosis and treatment rates were low (21). In our cohort, despite the high rates of screen positive depression, rates of a formal physician diagnosis of depression still remained the lowest of all countries at 2% and 3% of PD and HD patients respectively (Supplemental Table 2). In Japan, efforts are underway to improve depression diagnosis and treatment and the underated prevelance of depression has been reported in other chronic diseases (22). Similar rates of screen positive depression as Japan were seen in the UK, while rates of physician-diagnosed depression remained lower relative to other countries - particularly in HD patients. Taken together, efforts may be needed to improve awareness regarding depression diagnosis and treatment among ESKD patients.

Functional status was strongly associated with worse patient-reported outcomes across both modalities and for all outcomes. Morevoer, we have previously shown that poor functional status carries a high mortality risk in both PD and HD patients in PDOPPS (23) and DOPPS (12). It is likely that functional status serves as a proxy for frailty. Across many studies, frailty has consistenly emerged as a risk factor for falls, fractures, cognitive impairment, vascular access failure, and poor quality of life in dialysis patients (24-26). Taken together, predialysis assessment of functional status can be expected to serve as an important indicator about anticipated clinical and patient-reported outcomes after dialysis initiation independent of dialysis modality.

It is interesting to note that the MCS scores and rates of screen positive depression rates that we reported were similar to those observed in a recent study of over 5000 stage 3-5 chronic kidney disease (CKD) patients in the CKDopps (27). However, PCS scores were significantly lower in

the present study. Taken together, this observation suggests that dialysis initiation may be associated with declines in physicial functioning to a greater degree compared to domains of mental health status and depression. Indeed, in the CONTRAST (CONvective TRAnsport Study) very few patients were able to maintain their initial levels of physical functioning over the 2-years after dialysis initiation (28).

The principal observation from the longitudinal analyses is the stability of outcome measures with very little variation over time for both the PD and HD patients. Longitudinal data are difficult to collect and analyse as patients die, become too ill to complete questionnaires, decide not to repeat questionnaires, do not complete all the sections, switch dialysis modalities, or transfer to a non-study unit. This is exemplified in a recent Korean study which collected KDQOL from 652 HD and 337 PD patients at 3 months, with only 301 HD and 191 PD patients completing questionnaires at 12 months, and even fewer at 24 months (29). The Korean study showed that patients on HD and PD experienced significant decreases in different HRQOL domains over two years but the degree of change in HRQOL over time was not different between dialysis modalities. A larger, retrospective study used the annual KDQOL collected in the Fresenius Medical Care North America (FMCNA) database. There was no reduction in patient numbers over time in this study, as only patients who had completed the KDQOL at 3 and then 12-15 months after starting dialysis were included (880 PD matched to 4234 in-center patients on HD) (30). This study showed that for those who remained on the same dialysis modality, there was no change in HRQOL.

Given the high drop-out of patients in longitudinal studies, the results need to be interpreted with caution. The relative stability in HRQOL reported by DOPPS and FMCNA data is only true for

patients who have survived and are well enough and/or are motivated to complete the questionnaires. Furthermore, these two studies and the Korean study enrolled patients at 3 months after starting dialysis so sicker patients (at dialysis initiation) would not have been included. The studies were therefore not designed to detect the decline in physical function that has been found in older patients in the first 6 months of dialysis therapy (29). With data collection at 12 months, fluctuations in quality of life measures when recorded monthly would also have been missed (31).

Overall, this study provides important information for patients and families when choosing a dialysis modality. Patient-reported outcomes were considerably poorer for patients having poorer functional status. Thus persons who need help with their daily activities will likely have worse physical and psychosocial functioning, experience a considerably greater burden of kidney disease, and have a higher risk of developing depression on dialysis. This adds to the information already available from previous studies that lower functional status is associated with higher patient mortality (12,20).

Our study has a number of limitations. Although using the same methodology, the DOPPS and PDOPPS surveys were carried out over different time periods. Also, due to the requirement that patients consent to participation and fill out at least one patient questionnaire, the patients on dialysis used in these analyses tend to be somewhat healthier than all patients on dialysis. As already discussed, the small number and low percentage of patients with longitudinal PRO data was expected. The percentage of patients reporting PROs also varied for different measures and

between PD and HD. This may have reduced our statistical power to detect trends in these measures.

In conclusion, patients on both PD and HD have impaired quality of life which largely did not change over a year. Functional status is significantly associated with worse patient-reported outcomes for patients on both modalities. This information should be shared with patients and families when making dialysis modality choices, and in considering additional supportive care approaches for these patients. The present study also serves as a call to action to the nephology and kidney community to develop evidence-based strategies to identify and effectively treat depression, address symptoms, enhance treatment team-patient communication, and develop novel therapeutic strategies in an effort to improve the patient experience on kidney replacement therapy.

Supplemental Materials Table of Contents

Article Information

Authors' Contributions

research idea and study design: JZ, DF, BB, EB, TK, RP, JP
data acquisition: JZ, DF, FF, HK, RP, JP
data analysis/interpretation: JZ, DF, KM, BB, JS, FF, EB, TK, HK, RP, JP
statistical analysis: JZ, KM
supervision or mentorship: KM, BB, FF, AF, JP

Each author contributed important intellectual content during manuscript drafting or revision and agrees to be personally accountable for the individual's own contributions and to ensure that questions pertaining to the accuracy or integrity of any portion of the work, even one in which the author was not directly involved, are appropriately investigated and resolved, including with documentation in the literature if appropriate.

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Table 1A. HD patients' characteristics by country

	Overall	ANZ	Canada	Japan	UK	US
Number of patients	4544	320	417	1918	448	1441
Age, years	64.3(13.8)	65.2(13.9)	64.7(14.3)	65.0(12.3)	64.3(15.0)	62.9(14.8)
<50	714(16%)	42(13%)	63(15%)	247(13%)	79(18%)	283(20%)
50-70	2092(46%)	133(42%)	184(44%)	947(49%)	190(42%)	638(44%)
≥70	1728(38%)	145(45%)	167(40%)	724(38%)	179(40%)	513(36%)
Male, %	2747(61%)	201(63%)	248(60%)	1257(66%)	271(61%)	770(53%)
years of ESRD	2.82[0.79,6.61]	3.45[1.50,6.26]	1.89[0.45,4.15]	4.28[0.98,10.08]	2.45[0.85,5.53]	2.03[0.66,4.47]
<0.25	363(8%)	17(5%)	43(10%)	148(8%)	41(9%)	114(8%)
0.25-0.9	936(21%)	41(13%)	122(29%)	337(18%)	88(20%)	348(24%)
1-1.9	582(13%)	43(13%)	53(13%)	165(9%)	72(16%)	249(17%)
2-3.9	835(18%)	76(24%)	87(21%)	272(14%)	90(20%)	310(22%)
4+	1828(40%)	143(45%)	112(27%)	996(52%)	157(35%)	420(29%)
Body mass index, kg/m^2	25.6(6.8)	28.2(6.8)	28.0(6.5)	21.6(3.6)	26.8(6.2)	29.4(7.3)
Transplant waitlist, %	268(7%)	30(10%)	30(7%)	71(4%)	70(16%)	67(9%)
Coronary artery disease	1369(31%)	137(43%)	175(42%)	461(24%)	112(26%)	484(34%)
Cancer (non-skin)	579(13%)	43(14%)	71(17%)	203(11%)	66(15%)	196(14%)
Other cardiovascular disease	993(22%)	100(32%)	119(29%)	390(20%)	87(20%)	297(21%)
Cerebrovascular disease	479(11%)	46(15%)	61(15%)	192(10%)	48(11%)	132(9%)
Congestive heart failure	937(21%)	80(25%)	85(21%)	325(17%)	39(9%)	408(29%)
Diabetes	2153(48%)	132(42%)	213(51%)	772(41%)	126(29%)	910(64%)
Gastrointestinal bleeding	196(4%)	22(7%)	16(4%)	73(4%)	7(2%)	78(6%)
Hypertension	3751(84%)	258(82%)	379(91%)	1524(80%)	322(74%)	1268(89%)
Lung disease	397(9%)	43(14%)	66(16%)	74(4%)	25(6%)	189(13%)
Neurologic disease	300(7%)	25(8%)	25(6%)	101(5%)	23(5%)	126(9%)
Psychiatric disorder	645(14%)	58(18%)	84(20%)	77(4%)	51(12%)	375(26%)
Peripheral vascular disease	836(19%)	82(26%)	116(28%)	249(13%)	74(17%)	315(22%)

Recurrent cellulitis/gangrene	279(6%)	22(7%)	41(10%)	50(3%)	22(5%)	144(10%)
Vascular access type						
Fistula	3294(75%)	242(82%)	169(41%)	1746(93%)	284(72%)	853(61%)
Graft	408(9%)	17(6%)	24(6%)	121(6%)	21(5%)	225(16%)
Catheter	694(16%)	37(13%)	222(54%)	12(1%)	91(23%)	332(24%)
Albumin, g/dL	3.68(0.46)	3.65(0.51)	3.54(0.44)	3.67(0.43)	3.64(0.55)	3.77(0.46)
Potassium, mEq/L	4.78(0.71)	5.01(0.70)	4.78(0.71)	4.78(0.72)	4.92(0.72)	4.67(0.67)
Phosphorus, mg/dL	5.18(1.45)	5.17(1.59)	5.18(1.43)	5.34(1.34)	4.79(1.44)	5.07(1.53)
White blood count, *1000 cells	6.61(2.24)	7.23(2.21)	7.31(2.50)	5.92(1.99)	7.12(2.37)	7.07(2.20)
Serum creatinine, mg/dL	8.81(3.05)	8.17(2.30)	7.60(2.75)	10.2(2.9)	7.90(2.65)	7.67(2.84)
Calcium, mg/dL	8.90(0.77)	9.13(0.77)	8.93(0.79)	8.76(0.75)	9.26(0.78)	8.93(0.73)
Ferritin, ng/mL	434(454)	457(346)	438(337)	135(226)	498(457)	748(473)
Beta 2 microglobulin, mg/dL	2.60(0.90)	NA	NA	2.60(0.89)	NA	NA
C-react protein (CRP), mg/dL	4.19(34.32)	1.82(3.12)	NA	4.63(39.17)	3.10(4.82)	NA
Hemoglobin, g/L	10.7(1.3)	11.3(1.5)	10.8(1.5)	10.5(1.2)	10.9(1.4)	10.9(1.3)
Help fill PQ, %	1120(26%)	93(30%)	108(27%)	338(19%)	107(25%)	474(34%)
Difference in 2 PQ completion date, years	0.98[0.88,1.04]	NA	0.97[0.65,1.05]	0.99[0.92,1.03]	0.95[0.76,1.03]	0.93[0.70,1.05]
Functional Status (FS)						
FS<8	459(12%)	31(10%)	42(12%)	160(10%)	64(16%)	162(13%)
8≤FS<11	748(19%)	73(24%)	73(20%)	170(10%)	127(32%)	305(24%)
11≤FS<13	1148(29%)	109(36%)	146(41%)	320(20%)	128(33%)	445(36%)
FS=13	1599(40%)	88(29%)	98(27%)	995(61%)	75(19%)	343(27%)

Table 1B. PD patients' characteristics by country.

	Overall	ANZ	Canada	Japan	UK	US
Number of patients	3227	205	506	842	229	1445
Age, years	61.6(14.2)	63.7(13.6)	60.8(14.2)	64.1(12.9)	64.6(14.1)	59.6(14.8)
<50	660(21%)	32(16%)	114(23%)	123(15%)	31(14%)	360(25%)
50-70	1573(49%)	101(49%)	234(46%)	438(52%)	105(46%)	695(48%)

≥70	994(31%)	72(35%)	158(31%)	281(33%)	93(41%)	390(27%)
Male, %	1929(60%)	134(65%)	306(61%)	552(66%)	141(62%)	796(55%)
years of ESRD	1.58[0.62,3.35]	1.38[0.57,2.75]	1.28[0.36,2.80]	1.67[0.53,3.73]	1.18[0.35,2.51]	1.73[0.84,3.41]
<0.25	457(14%)	32(16%)	110(22%)	135(16%)	49(21%)	131(9%)
0.25-0.9	676(21%)	42(21%)	104(21%)	166(20%)	56(25%)	308(21%)
1-1.9	730(23%)	56(27%)	107(21%)	157(19%)	47(21%)	363(25%)
2-3.9	725(23%)	44(22%)	101(20%)	191(23%)	34(15%)	355(25%)
4+	639(20%)	31(15%)	84(17%)	193(23%)	43(19%)	288(20%)
Body mass index, kg/m^2	27.1(6.0)	28.2(4.7)	27.8(5.9)	23.1(3.6)	26.9(4.9)	29.3(6.3)
Transplant waitlist, %	841(36%)	91(45%)	242(49%)	114(14%)	104(46%)	290(49%)
Coronary artery disease	695(22%)	63(31%)	131(26%)	143(17%)	56(25%)	302(21%)
Cancer (non-skin)	342(11%)	40(20%)	75(15%)	77(9%)	31(14%)	119(8%)
Other cardiovascular disease	439(14%)	41(20%)	83(17%)	108(13%)	37(16%)	170(12%)
Cerebrovascular disease	301(9%)	21(10%)	59(12%)	103(12%)	19(8%)	99(7%)
Congestive heart failure	439(14%)	14(7%)	58(12%)	153(18%)	14(6%)	200(14%)
Diabetes	1428(45%)	84(41%)	236(47%)	327(39%)	59(26%)	722(50%)
Gastrointestinal bleeding	62(2%)	4(2%)	17(3%)	9(1%)	3(1%)	29(2%)
Hypertension	2767(87%)	185(91%)	452(91%)	790(95%)	168(74%)	1172(82%)
Lung disease	170(5%)	17(8%)	35(7%)	20(2%)	10(4%)	88(6%)
Neurologic disease	134(4%)	13(6%)	28(6%)	40(5%)	5(2%)	48(3%)
Psychiatric disorder	409(13%)	20(10%)	63(13%)	22(3%)	17(8%)	287(20%)
Peripheral vascular disease	383(12%)	32(16%)	90(18%)	56(7%)	27(12%)	178(12%)
Recurrent cellulitis/gangrene	45(1%)	3(2%)	19(4%)	7(1%)	0(0%)	16(1%)
Albumin, g/dL	3.46(0.48)	3.25(0.50)	3.51(0.48)	3.33(0.50)	3.41(0.55)	3.56(0.43)
Potassium, mEq/L	4.24(0.64)	4.46(0.66)	4.21(0.63)	4.23(0.69)	4.37(0.65)	4.20(0.61)
Phosphorus, mg/dL	5.10(1.35)	5.37(1.48)	4.96(1.27)	5.07(1.28)	4.87(1.35)	5.15(1.39)
White blood count, *1000 cells	7.35(2.55)	7.74(2.44)	7.95(2.69)	6.40(2.11)	7.63(2.39)	7.65(2.65)
Serum creatinine, mg/dL	8.48(3.65)	7.70(2.95)	7.52(3.13)	9.22(3.17)	7.07(2.52)	8.68(4.15)
Calcium, mg/dL	8.88(0.76)	9.12(0.74)	9.01(0.71)	8.60(0.79)	9.16(0.67)	8.93(0.72)
Ferritin, ng/mL	469(480)	369(307)	294(318)	188(231)	517(618)	673(515)
Beta 2 microglobulin, mg/dL	5.12(8.16)	NA	NA	5.16(8.19)	NA	NA

C-react protein (CRP), mg/dL	1.02(2.73)	1.74(3.77)	NA	0.57(1.59)	2.81(4.97)	NA
Hemoglobin, g/L	11.0(1.5)	11.4(1.5)	11.1(1.5)	10.9(1.3)	11.1(1.4)	11.0(1.5)
Help fill PQ, %	562(18%)	36(18%)	99(21%)	137(17%)	47(21%)	243(17%)
Difference in 2 PQ completion date, years	1.03[0.89,1.23]	0.99[0.82,1.15]	1.10[0.86,1.42]	1.07[0.98,1.32]	1.03[0.78,1.22]	0.95[0.81,1.09]
Functional Status (FS)						
FS<8	157(5%)	12(7%)	17(4%)	47(6%)	18(9%)	63(5%)
8≤FS<11	380(13%)	29(16%)	70(15%)	64(8%)	43(21%)	174(13%)
11≤FS<13	987(34%)	74(40%)	186(41%)	145(19%)	73(35%)	509(38%)
FS=13	1423(48%)	70(38%)	181(40%)	512(67%)	76(36%)	584(44%)

Mean (standard deviation), or median [25th, 75th percentile], or percentage are shown.
Abbreviations: ESRD, End stage renal disease; PQ, patient questionnaire.
All characteristics, including functional status, were collected at baseline, except difference in 2 PQ completion date.

Figure Titles and Legends

Figure 1. Title: PD and HD patient exclusions and numbers completing each patient-reported factor. Legend: Abbreviations: PD, peritoneal dialysis; HD, hemodialysis; PQ, patient questionnaire; FS, functional status; MCS, mental component summary; PCS, physical component summary; CES-D, Center for Epidemiologic Studies Depression Scale; Burden Score, kidney disease burden score. Employment restricted to patients under 65 years old.

Figure 2A. Title: Burden of kidney disease score by PD/HD and by country. Legend: Burden score includes questions on the effects of kidney disease on interference with patient lives, time spent, frustration, and burden to family.
Figure 2B. Title: Physical Composite Score (PCS) categories by PD/HD and by country
Figure 2C. Title: Mental Composite Score (MCS) categories by PD/HD and by country
Figure 2D. Title: Employment by PD/HD and by country among patients under the age of 65
Figure 2E. Title: Center for Epidemiologic Studies Depression scale (CES-D) by PD/HD and by country

Figure 3A. Title: Adjusted associations for PD patients between patient characteristics and patient-reported outcomes: PCS, MCS, Burden Score, and CES-D < 10. Legend: MCS, mental component summary; PCS, physical component summary; CES-D, Center for Epidemiologic Studies Depression Scale; Burden Score, kidney disease burden score. Linear models on PCS, MCS, and Burden Score and logistic model on CES-D < 10 were adjusted for country, demographics (patient age, sex, ESRD vintage [i.e., time on RRT]), 13 comorbidity conditions, transplant waiting list status, and functional status. CES-D < 10 indicates scores less likely to be associated with depression diagnosis.

Figure 3B. Title: Adjusted associations for HD patients between patient characteristics and patient-reported outcomes: PCS, MCS, Burden Score, and CES-D < 10. Legend: MCS, mental component summary; PCS, physical component summary; CES-D, Center for Epidemiologic Studies Depression Scale; Burden Score, kidney disease burden score. Linear models on PCS, MCS, and Burden Score and logistic model on CES-D < 10 were adjusted for country, demographics (patient age, sex, ESRD vintage [i.e., time on RRT]), 13 comorbidity conditions, transplant waiting list status, and functional status. CES-D < 10 indicates scores less likely to be associated with depression diagnosis.

Figure 4. Title: Changes over one year in MCS, PCS, and burden of kidney disease score, among HD and PD patients. Legend: MCS, mental component summary; PCS, physical component summary; Burden, kidney disease burden score

Supplemental Figure 1. Title: Changes over one year in employment status, CES-D, and functional status score, for HD and for PD patients. Legend: CES-D, Center for Epidemiologic Studies Depression Scale, FS, functional status. Employment status limited to patients under the age of 65.