Kidney Medicine

Hemodialysis Versus Peritoneal Dialysis Drug Expenditures: A Comparison Within the Private Insurance Market

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Rationale and Objective: Recent initiatives aim to improve patient satisfaction and autonomy by increasing the use of peritoneal dialysis (PD) in the United States. However, limited knowledge is available about the costs of different dialysis modalities, particularly those incurred by private insurers. In this study, we compared the costs of injectable dialysis drugs (and their oral equivalents) paid by insurers between privately insured patients receiving hemodialysis and PD.

Study Design: A retrospective cohort study.

Setting and Participants: From a private insurance claims database, we identified patients who started receiving PD or in-center hemodialysis between January 1, 2017, and December 31, 2020.

Exposure: Patients started receiving PD.

Outcomes: Average annual injectable drug and aggregate expenditures and expenditure subcategories.

Analytical Approach: Patients who started receiving PD were propensity matched to similar patients who started receiving hemodialysis based on the year of dialysis initiation, patient demographics, health, geography, and comorbidities. Cost ratios (CRs) were estimated from generalized linear models.

Results: We matched 284 privately insured patients who started receiving PD 1:1 with patients started receiving in-center hemodialysis. The average annual injectable drug expenditures for hemodialysis were 2-fold higher (CR: 1.99; 95% CI, 1.62-2.44) than that for PD. Compared those receiving PD, patients receiving hemodialysis incurred significantly lower nondrug dialysis-related expenditures (0.85; 95% CI, 0.76-0.94). The average annual expenditures for non–dialysis-dependent outpatient services were significantly higher among patients who underwent in-center hemodialysis (CR: 1.44; 95% CI, 1.10-1.90). Although aggregate and inpatient hospitalization expenditures were higher for in-center hemodialysis, these differences did not reach statistical significance.

Limitations: Small sample sizes may have restricted our ability to identify differences in some cost categories.

Conclusions: Compared with privately insured patients who started receiving PD, patients starting in-center hemodialysis incurred higher expenditures for injectable dialysis drugs, whereas differences in other expenditure categories varied. Recent increases in the use of PD may lead to reductions in injectable dialysis drug costs among privately insured patients.

Visual Abstract included

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In 2019, there were 567,000 patients in the United States who experienced kidney failure requiring dialysis therapy.[1] Health care is costly for patients receiving dialysis, with an average annual Medicare expenditure of $94,000.[1] Among patients with kidney failure and private health insurance, expenditures are even higher. One study found that private insurers paid over 3 times as much as Medicare for outpatient dialysis services.[2]

Patients with kidney failure can receive dialysis therapy at a dialysis center or at home. Among patients who receive dialysis at home, most undergo peritoneal dialysis (PD).[1] Although in-center hemodialysis and PD produce similar health outcomes in patients eligible for both modalities, PD may offer cost savings and quality-of-life advantages over in-center hemodialysis.[3-7]

Less intensive use of injectable dialysis drugs may represent a major source of cost savings from PD. In patients with Medicare, injectable drug costs incurred by dialysis providers were estimated to be 69% lower for patients receiving PD than that for those receiving in-center hemodialysis.[3] However, the use of Medicare claims data to examine injectable drug costs is limited because these drugs are part of the dialysis payment bundle and do not appear directly on the claims. Injectable dialysis drug costs can only be estimated from Medicare claims. Furthermore, differences in injectable dialysis drug costs inferred from Medicare claims data apply to dialysis providers rather than payers.

Unlike Medicare, injectable dialysis drugs are still reimbursed on a fee-for-service basis by many private health insurers. This enables a direct comparison of differences in drug costs among private health insurers across dialysis modalities. In this study, we used recent data from a private health insurer to examine differences in injectable dialysis drug expenditures between patients starting to receive in-center hemodialysis and those who have started receiving PD. We also compared aggregate expenditures and other expenditure subcategories.

PLAIN LANGUAGE SUMMARY

Recent initiatives aim to improve patient satisfaction and autonomy by increasing the use of peritoneal dialysis (PD) in the United States. However, limited knowledge is available about the costs of different dialysis modalities, particularly those incurred by private insurers. In this study, we compared the costs of injectable dialysis drugs (and their oral equivalents) provided by insurers between privately insured patients receiving hemodialysis and PD. We found that the average annual injectable drug expenditures for hemodialysis were 2.0-fold higher compared with those for PD. These findings suggest that the recent increase in the use of PD may lead to reductions in injectable dialysis drug costs among privately insured patients.

METHODS

Study Population and Data Sources

We identified patients in the United States aged 18 and older who started receiving dialysis between January 1, 2017, and December 31, 2020, from a database of private health insurance claims. The claims database included information about patients with Blue Cross Blue Shield/Health Care Services Corporation insurance living in the following states: Illinois, New Mexico, Oklahoma, and Texas. Claims were merged from 2 separate batches that spanned a continuous period from July 1, 2016, to March 31, 2021 (Item S1).

We used outpatient dialysis claims to identify a cohort of patients who were new to dialysis. Patients were considered to be new to dialysis if they had an outpatient dialysis claim with a diagnosis of end-stage kidney disease (ESKD) and no dialysis claims in the preceding 6 months. For each patient new to dialysis, we considered their dialysis start date to be the date of their first outpatient dialysis claim. Then, we created a dialysis episode by tracking outpatient dialysis claims longitudinally. We considered a patient to continue receiving maintenance dialysis as long as consecutive dialysis claims occurred within 60 days of one another. In instances where there was no outpatient dialysis claim within 60 days of a previous claim, we considered the patient to have stopped receiving maintenance dialysis on the 60th day after the last outpatient dialysis claim. We used information from subsequent claims to examine reasons for stopping maintenance dialysis (Table S1).

To select a cohort of patients who were stable on dialysis, we required that patients in our study received maintenance dialysis for at least 90 days from the dialysis start date. Notably, we excluded patients who received a kidney transplant, stopped receiving dialysis, were lost to follow-up, or switched to a different insurance type in the first 90 days of dialysis. Because the focus of the study was on expenditures during in-center hemodialysis and home PD, we also excluded patients who received home hemodialysis in the first 90 days of ESKD. These same events (eg, loss of insurance coverage and kidney transplant) served as criteria for stopping follow-up if they occurred after the first 90 days of dialysis. We also stopped following up patients when claims were no longer available. We did not have direct information about patient mortality. Consequently, patient deaths appeared in our data either as a cessation of insurance coverage or as an absence of claims.

To ascertain comorbidities from health insurance claims, we required that the patients recorded at least 6 months of Blue Cross Blue Shield insurance coverage before the dialysis start date. Information about patient demographics came from insurance enrollment files, and area-level data on population density came from US Census data merged with zip codes of patient residence.

Study outcomes

The primary outcome was the average annual injectable dialysis drug expenditure per patient. This included medications that are injectable or that have an injectable equivalent: erythropoietin-stimulating agents, intravenous iron, vitamin D analogs (injectable and oral), and calcimimetics (injectable and oral). We used the documented amount paid by insurers to health care providers. We ascertained expenditures from each patient's first day of dialysis to ≤18 months (548 days) after starting dialysis. We also examined expenditures beginning on day 90 of dialysis.

Claims data were available through March 31, 2021. For each patient, we ascertained an average annual expenditure by dividing the aggregate spending over the patient's follow-up period by the number of follow-up months. Then, this was multiplied by 12 to generate the annualized expenditures. In addition to annual injectable dialysis drug expenditures, we also examined average aggregate expenditures and spending in the following payment subcategories: oral dialysis drugs (phosphate binders), other dialysis facility payments, inpatient, and other (ie, non–dialysis outpatient and physician fee) expenditures. Inpatient expenditures included hospitalizations, observation stays, emergency room visits, and acute and subacute rehabilitation payments. All claims submitted by outpatient dialysis facilities were considered to be related to dialysis. We also examined the overall dialysis expenditures by combining the injectable dialysis drugs and oral equivalents, oral phosphate binders, and other dialysis expenditure subcategories. All expenditure data were converted to 2020 US dollars (USD) using the consumer price index.[8]

Study Exposures and Covariates

The study's exposure was the use of PD. We adopted an intention-to-treat framework when analyzing this exposure.

Table 1. Baseline Characteristics Before and After 1:1 PS Match Among Patients Who Started Receiving Dialysis

Baseline Characteristics	Before Matching			After 1:1 PS Matching		
	PD (n = 343)	HD (n = 1,068)	Standardized Difference	PD (n = 284)	HD (n = 284)	Standardized Difference
Age, y, mean ± SD	51.4 ± 10.8	52.2 ± 10.6	0.08	51.3 ± 10.8	51.2 ± 10.9	0.00
Sex: female, n (%)	134 (39.1)	376 (35.2)	0.08	108 (38.0)	96 (33.8)	0.09
Metropolitan, n (%)	291 (84.8)	948 (88.8)	0.12	251 (88.4)	240 (84.5)	0.11
Hospitalization before dialysis[a]						
1 hospitalization, n (%)	108 (31.5)	530 (49.6)	0.38	99 (34.9)	110 (38.7)	0.08
≥2 hospitalization >30 d apart, n (%)	25 (7.3)	156 (14.6)	0.24	25 (8.8)	24 (8.5)	0.01
Nephrologist visit before dialysis						
1 visit, n (%)	52 (15.2)	176 (16.5)	0.04	44 (15.5)	42 (14.8)	0.02
≥2 visits >30 d apart, n (%)	154 (44.9)	345 (32.3)	0.26	123 (43.3)	124 (43.7)	0.01
Coronary artery disease, n (%)	77 (22.4)	289 (27.1)	0.11	68 (23.9)	67 (23.6)	0.01
Cerebral vascular disease, n (%)	22 (6.4)	104 (9.7)	0.12	22 (7.7)	21 (7.4)	0.01
Congestive heart failure, n (%)	82 (23.9)	429 (40.2)	0.35	80 (28.2)	77 (27.1)	0.02
Cardiac arrhythmias, n (%)	44 (12.8)	260 (24.3)	0.30	41 (14.4)	39 (13.7)	0.02
Valvular disease, n (%)	39 (11.4)	180 (16.9)	0.16	35 (12.3)	23 (8.1)	0.14
Pulmonary circulation disorders, n (%)	11 (3.2)	70 (6.6)	0.16	11 (3.9)	<11	0.02
Peripheral vascular disorder, n (%)	36 (10.5)	159 (14.9)	0.13	34 (12.0)	31 (10.9)	0.03
Paralysis, n (%)	<11	<11	0.04	<11	<11	0.05
Other neurological disorders, n (%)	16 (4.7)	115 (10.8)	0.23	12 (4.2)	12 (4.2)	0.00
Chronic pulmonary disease, n (%)	36 (10.5)	136 (12.7)	0.07	31 (10.9)	31 (10.9)	0.00
Diabetes, with/without complications, n (%)	197 (57.4)	672 (62.9)	0.11	166 (58.5)	167 (58.8)	0.01
Hypothyroidism, n (%)	45 (13.1)	103 (9.6)	0.11	36 (12.7)	35 (12.3)	0.01
Liver disease, n (%)	20 (5.8)	93 (8.7)	0.11	16 (5.6)	17 (6.0)	0.02
Peptic ulcer disease, excluding bleeding, n (%)	<11	13 (1.2)	0.02	<11	<11	0.00
AIDS/HIV, n	<11	<11	0.05	<11	<11	0.00
Cancer, n (%)	<11	75 (7.0)	0.24	<11	<11	0.00
Rheumatoid arthritis/collaged vascular disease, n (%)	21 (6.1)	74 (6.9)	0.03	20 (7.0)	22 (7.7)	0.03
Coagulopathy, n (%)	16 (4.7)	159 (14.9)	0.35	16 (5.6)	14 (4.9)	0.03
Obesity, n (%)	66 (19.2)	272 (25.5)	0.15	63 (22.2)	55 (19.4)	0.07
Weight loss, n (%)	11 (3.2)	95 (8.9)	0.24	11 (3.9)	15 (5.3)	0.07
Blood loss anemia, n (%)	12 (3.5)	42 (3.9)	0.02	<11	13 (4.6)	0.07
Deficiency anemia, n (%)	52 (15.2)	220 (20.6)	0.14	44 (15.5)	43 (15.1)	0.01
Alcohol abuse, n (%)	<11	27 (2.5)	0.13	<11	<11	0.00
Drug abuse, n (%)	<11	21 (2.0)	0.09	<11	<11	0.00
Psychoses, n (%)	<11	<11	0.03	<11	<11	N/A
Depression, n (%)	29 (8.5)	106 (9.9)	0.05	23 (8.1)	21 (7.4)	0.03

Note: Instances with small cell count were replaced with <11 to preserve confidentiality. Values are presented m (%) unless specified.
Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; PS, propensity score; SD, standard deviation.
[a]Hospitalizations included any hospitalization, regardless of whether or not the patient received dialysis during the hospital stay.

Patients were considered to have tried to use PD if they had any outpatient claims for PD in the first 60 days of dialysis. Many patients are started on in-center hemodialysis but switch to PD early in the course of their treatment once they receive training and after a PD catheter is placed. Similarly, many patients who start receiving PD do not continue on this modality owing to various reasons. In both these scenarios, patients would be considered to have used PD as long as they received PD for any period in the first 60 days of dialysis. This intention-to-treat framework most directly informs medical decision making by characterizing the effort to use outpatient PD at any point during the early dialysis period, without making the use of PD contingent upon the initial modality or sustained PD use.

We included the following covariates: demographic, health, and geographic characteristics as listed in Table 1. Medical comorbidities from the Elixhauser index,[9,10] hospitalization frequencies, and pre-ESKD nephrology visits were ascertained from the past 6 months of insurance claims. The quarter when a patient started dialysis was also included in our model.

Statistical Analyses

We used a logistic regression propensity score model to match patients receiving PD in the first 60 days of ESKD to similar patients who only received in-center hemodialysis in the first 60 days. The propensity score model included all variables listed in Table 1 and the quarter when a patient started dialysis. Each patient starting to receive PD was matched on propensity score to a patient starting to receive in-center hemodialysis in the same index year, randomly selected with caliper 0.2 standard deviation. Follow-up for both patients in a matched pair was ended when the first patient met the criteria for stopping the follow-up.

We examined differences in baseline characteristics across dialysis modalities before and after matching, using a 10% standardized difference as a marker of heterogeneity.[11] In the matched cohort, we compared the average annual insurance expenditures among those using PD versus those receiving in-center hemodialysis. This was performed with injectable dialysis drug, aggregate, and subcategory expenditures. Then, we used generalized estimating equations with log links and robust standard errors to estimate the cost ratios (CRs) of mean annual expenditures between patients receiving hemodialysis and those receiving PD. Regression estimates from the generalized estimating equations model can be interpreted as the proportionate difference in mean expenditures associated with a model covariate.[12]

Additional Analyses

In an additional analysis, we compared injectable expenditures between PD and in-center hemodialysis using an as-assigned framework, where we only considered expenditures when patients actually received the assigned dialysis modality. In the as-assigned analysis, we did not follow-up patients if they were not receiving their assigned modality on day 60 of ESKD, and we stopped following up both patients with in-center hemodialysis and those receiving PD as a matched pair if either of them switched to a different modality. We examined the sensitivity of our findings to differences in prelude to dialysis expenditures.

Informed consent was waived owing to the data being deidentified.

RESULTS

Baseline Characteristics

We identified 1,401 patients aged between 18-68 years from the insurance database who started dialysis between July 1, 2016, and December 31, 2020, and met the criteria for enrollment in the study (Fig 1). Among these, 284 patients started receiving PD within the first 60 days of dialysis and were matched 1:1 with patients who started receiving in-center hemodialysis. The mean follow-up were 276 days [interquartile range (IQR), 140-415 days]. Reasons for becoming lost to follow-up were similar between the 2 groups (Table S1). Of the 284 patients assigned to the PD comparison group, 263 (92.6%) received PD on day 60 of ESKD, whereas 26 (9.2%) had at

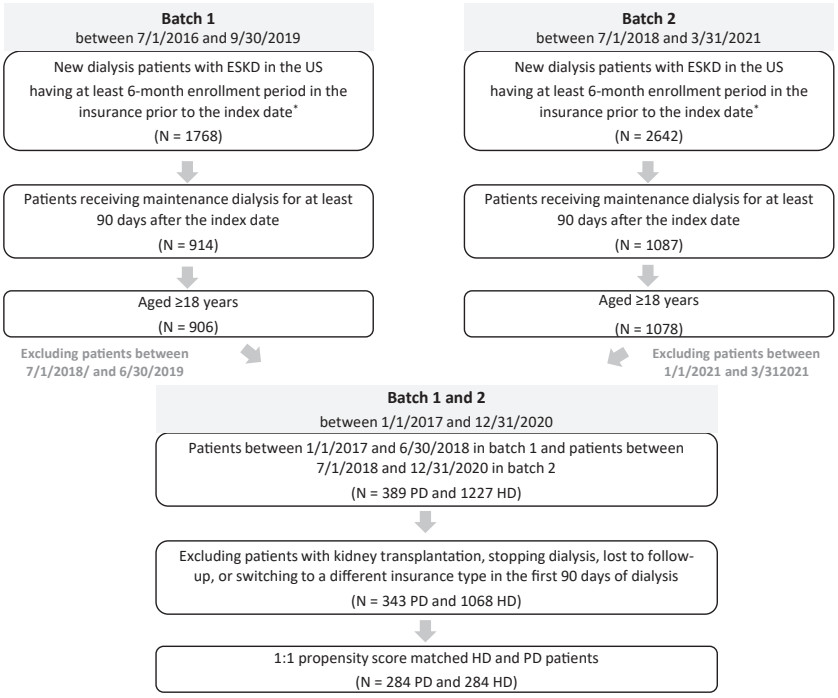

Figure 1. Flowchart. *Index date: the date when patients started receiving dialysis. ESKD, end-stage kidney disease; HD, hemodialysis; PD, peritoneal dialysis.

Table 2. Annual Payments in PS-Matched Patients Receiving HD and PD

Annual Payment, 2020 USD	PD, Mean ± SD	HD, Mean ± SD	PD, Median (IQR)	HD, Median (IQR)
Injectable ESKD drug payment[a]	9,970 ± 12,696	19,814 ± 24,231	5,888 (701-13,862)	14,008 (5,726-26,312)
Erythropoietin-stimulating agents	6,091 ± 10,231	10,705 ± 16,747	1,404 (0-7,905)	5,598 (0-13,624)
Bone mineral disease drugs	398 ± 1,642	1,748 ± 5,367	0 (0-23)	0 (0-212)
Intravenous iron	3,481 ± 6,103	7,361 ± 7,522	1,651 (0-5,211)	5,927 (1,754-10,506)
Oral phosphate binder drug payment	622 ± 2,400	535 ± 2,166	0 (0-0)	0 (0-0)
Nondrug dialysis facility payment	106,134 ± 68,377	89,679 ± 54,771	119,954 (58,473-142,547)	84,162 (55,729-125,746)
Total dialysis payment	116,726 ± 74,002	110,028 ± 67,878	132,482 (63,573-155,575)	97,485 (70,652-145,835)
Inpatient hospitalization payment	11,916 ± 36,438	18,469 ± 55,803	0 (0-0)	0 (0-8,040)
Other payment	29,596 ± 46,079	42,736 ± 75,643	17,538 (7,410-39,573)	23,839 (10,549-50,844)
Aggregate payment	158,238 ± 97,052	171,232 ±128,546	158,915 (100,569-207,092)	146,342 (102,776-218,986)

Abbreviations: USD, US dollar; ESKD, end-stage kidney disease; HD, hemodialysis; IQR: interquartile range; PD, peritoneal dialysis.
SD, standard deviation.
[a]Injectable medications include erythropoietin-stimulating agents, intravenous iron, and injectable and oral vitamin D analogs and calcimimetics.

least 1 outpatient hemodialysis treatment during the entire follow-up period.

Before matching, patients starting to receive in-center hemodialysis were more likely to live in metropolitan areas compared with patients starting to receive PD. Patients starting to receive in-center hemodialysis were also more likely to have been hospitalized before dialysis initiation and showed more comorbidities, such as more cardiovascular disease (coronary, cerebrovascular, and peripheral vascular), heart failure, arrhythmias, valvular, pulmonary, neurology, and liver disease. Patients starting to receive in-center hemodialysis were also more likely to present with diabetes, cancer, coagulopathy, anemia, obesity, recent weight loss, and alcohol use. Patients starting to receive PD showed more non–dialysis-dependent nephrology care and were more likely to have been diagnosed with hypothyroidism. All baseline imbalances disappeared after propensity matching, except that patients starting to receive PD were more likely to live in metropolitan areas and to experience valvular disease in the propensity-matched cohort (Table 1).

Regression Results

Between matched pairs, the average annual injectable dialysis drug expenditures were $20,000 for in-center hemodialysis and $10,000 for PD. (Table 2) This corresponds to a 2-fold higher expenditure for in-center hemodialysis compared with the expenditures for PD [CR: 1.99; 95% confidence interval (CI), 1.62-2.44]. By contrast, nondrug dialysis-related expenditures were 15% lower for in-center hemodialysis compared with those of PD (CR: 0.85; 95% CI, 0.76-0.94). Higher injectable drug expenditures and lower nondrug dialysis-related expenditures among patients starting to receive in-center hemodialysis offset one another, such that overall dialysis expenditures were not significantly different between the 2 modalities (CR: 0.94; 95% CI, 0.85-1.04) (Fig 2; Table S2).

Patients starting to receive in-center hemodialysis incurred 55% higher inpatient expenditures than those starting to receive PD, although the confidence limits crossed the null value (CR: 1.55; 95% CI, 0.94-2.55). The average annual expenditures from other (ie, non-dialysis outpatient and physician fees) services were 44% higher among patients receiving in-center hemodialysis than those of patients receiving PD (CR: 1.44; 95% CI, 1.10-1.90). (Fig 1; Table S2).

Total annual expenditures averaged $171,000 (2020 USD) for in-center hemodialysis and $158,000 for PD. In a fully adjusted model, the average annual expenditures for in-center hemodialysis were 8% higher (CR: 1.08; 95% CI, 0.97-1.21), but the difference was not statistically significant ($P = 0.2$).

Additional Analyses

In an as-assigned analysis of dialysis expenditures, baseline characteristics between the comparison groups remained balanced after propensity score matching (Table S3). The average annual injectable dialysis drug expenditure was 2.1-

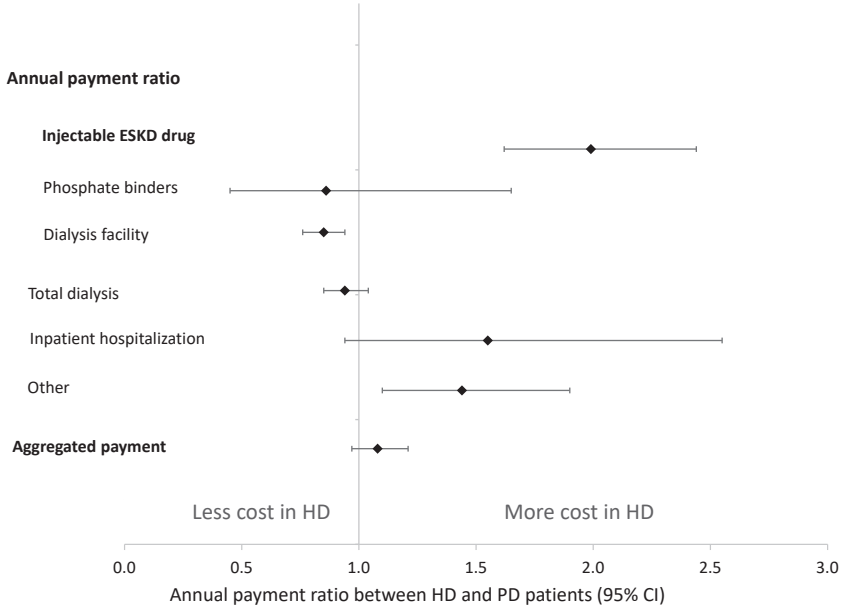

Figure 2. Expenditure differences measured as the ratio of hemodialysis:peritoneal dialysis expenditures. *Injectable medications include erythropoietin-stimulating agents, intravenous iron, and injectable and oral vitamin D analogs and calcimimetics. CI, confidence interval; ESKD, end-stage kidney disease; HD, hemodialysis; PD, peritoneal dialysis.

fold higher (CR: 2.14; 95% CI, 1.74-2.63) in patients receiving in-center hemodialysis than that for patients receiving PD (Table S4). Compared with the primary study results (which used an intention-to-treat study design), the magnitude of the difference in expenditures between in-center hemodialysis and PD in as-assigned analyses was similar or higher for total expenditures and in all cost subcategories except for inpatient expenditures. Results were not sensitive to adjustment for prelude to dialysis expenditures or the ascertainment of costs beginning on day 90 (Tables S5-S6).

DISCUSSION

We found that private health insurance expenditures for injectable dialysis drugs were substantially higher among patients receiving in-center hemodialysis than those of patients starting to receive PD. The annual expenditures for injectable dialysis drugs were ~$10,000 lower for patients receiving PD compared with matched patients receiving in-center hemodialysis. This finding is consistent with previous literature but complements it in an important way: previous studies have almost exclusively relied on Medicare data, which cannot be automatically assumed to generalize to the private insurance setting. A 2004 study of Medicare claims found that patients receiving PD required fewer and smaller doses of costly erythropoietin-stimulating agents than patients receiving in-center hemodialysis.[13]

In 2011, the expansion of Medicare's End-Stage Renal Disease Prospective Payment System (ESRD PPS) created a new economic incentive to administer fewer injectable drugs to patients receiving dialysis. This new economic incentive, combined with changing clinical recommendations, led to subsequent reductions in the use of injectable drugs among Medicare beneficiaries receiving dialysis.[14] During this time, the difference in estimated injectable drug costs between Medicare beneficiaries receiving in-center hemodialysis and those receiving PD narrowed, suggesting that the new economic incentives were applied differentially across the different dialysis modalities.[3]

New economic incentives to reduce the use of injectable drugs created from expansion of the ESRD PPS did not apply to privately insured patients whose dialysis care continued to be reimbursed on a fee-for-service basis. In a longitudinal analysis of Medicare spending, the difference in injectable drug costs across dialysis modalities narrowed over time, with expenditures becoming more similar across the 2 modalities. We did not have sufficient longitudinal follow-up data to assess whether cost differences across dialysis modalities changed similarly over time in the privately insured patient cohort. However, the large magnitude (ie, >2-fold) in the difference in injectable dialysis drug expenditures across dialysis modalities observed in our contemporary cohort suggests that any narrowing over time in cost differences across modalities may have been limited in the fee-for-service setting.

The financial significance of lower injectable drug expenditures is different when patients have private insurance from that of patients with Medicare. Medicare's bundled dialysis payment means that less use of injectable dialysis drugs in patients receiving PD (compared with that of those receiving in-center hemodialysis) does not necessarily translate into Medicare savings associated with PD. Although the system of case-mix adjustment might

shift some of Medicare's dialysis payments away from patients with lower use of injectable drugs, Medicare's payment bundle is not directly linked to the use of injectable dialysis drugs. Instead, under Medicare's payment system, lower injectable drug costs associated with PD are more likely to materialize in the form of relatively higher dialysis facility profits from PD. By contrast, private insurers benefit directly from relative reductions in the use of injectable drugs because these services are paid on a fee-for-service basis along with other dialysis expenditures.

When examining differences in overall costs, decreased expenditures for PD relative to in-center hemodialysis were not statistically significant. This finding contrasts with the previous analyses, which suggest that PD is less costly than in-center hemodialysis.[15,16] This discrepancy could be because of our limited statistical power, although confidence limits were relatively tight. It is possible that in a study with more subjects, PD would have been associated with a smaller but significant cost savings relative to in-center hemodialysis. Alternatively, it is possible that relatively higher nondrug dialysis expenditures for PD offset savings in other areas of care delivery. Even in Medicare fee-for-service beneficiaries, differences in expenditures across modalities may be limited in the first year of dialysis.[4]

Recent legislative initiatives have aimed to increase the use of PD in the United States. For example, the expansion of the ESRD PPS mandated equal reimbursement for hemodialysis and PD and included ancillary injectable drugs such as erythropoietic agents in the bundled payment. Because patients receiving PD require fewer of these costly medications, these changes—along with additional payments for home dialysis training—created financial incentives to provide more PD services. More recently, in 2019, the United States Department of Health and Human Services introduced new payment models in an initiative with the goal that 80% of patients with kidney failure receive home dialysis by 2025.[17]

Trends toward increased use of PD have spilled over into populations with private health insurance,[18] and private health insurers are also making efforts to increase the use of PD. Private health insurers and kidney-specific accountable care organizations recently launched the Innovate Kidney Care Initiative, which strives to increase access to home dialysis.[19] Private partnerships, such as that between Fresenius and Blue Cross/Blue Shield or Cigna,[20] aim to improve patient outcomes and satisfaction at lower costs; a potential mechanism for enacting these changes is through an increased use of PD. Other private organizations, such as CVS Health, have also recently launched initiatives to increase the use of home hemodialysis and PD.[21] Our findings suggest that savings in injectable drug costs associated with initiatives to increase the use of PD are also relevant to patients who are privately insured.

Our study needs to be considered in light of several limitations. Despite propensity matching, it is possible that there were unobserved differences between the patient population receiving in-center hemodialysis and PD, which could have biased our results. Our findings were limited to 1 private insurer that operates in several regions, potentially limiting the study's generalizability. Small sample sizes and relatively short follow-up durations may have restricted our ability to identify significant differences in cost categories across dialysis modalities, such as overall costs, and limited our ability to understand the underlying reasons for differences in non-dialysis dependent outpatient expenditures. An absence of longitudinal data prevented us from examining whether expenditure differences across modalities narrowed over time in patients with private insurance. We did not examine the extent to which differences in price versus quantity versus medication type contributed to expenditure variation. Finally, we did not have access to laboratory measurements to interpret how the differences in dialysis drug expenditures may have led to differences in clinically relevant parameters.

In conclusion, we found significantly lower expenditures for injectable dialysis drugs among privately insured patients receiving PD than those for patients receiving in-center hemodialysis. Differences in other expenditure categories varied. Future studies will need to examine the cost variation across dialysis modalities within larger samples and in other privately insured populations.

SUPPLEMENTARY MATERIAL

Supplementary Material (PDF)

Item S1: Structure of claims data.

Table S1: Reasons for Lost to Follow-Up of the Matched Hemodialysis and PD Pairs.

Table S2: Annual Private Insurance Payment Difference Between Modalities.

Table S3: Baseline Characteristics After 1:1 PS Match Among Patients Receiving New Dialysis Used in As-Assigned Analysis.

Table S4: Annual Payment Difference Between Modalities: As-Assigned Analysis.

Table S5: Annual Medicare Payment Difference Between Modalities: Adjusting for Annual Payment Before ESKD.

Table S6: Annual Payment Difference Between Modalities: Sensitivity Analysis Starting From Day 90.

ARTICLE INFORMATION

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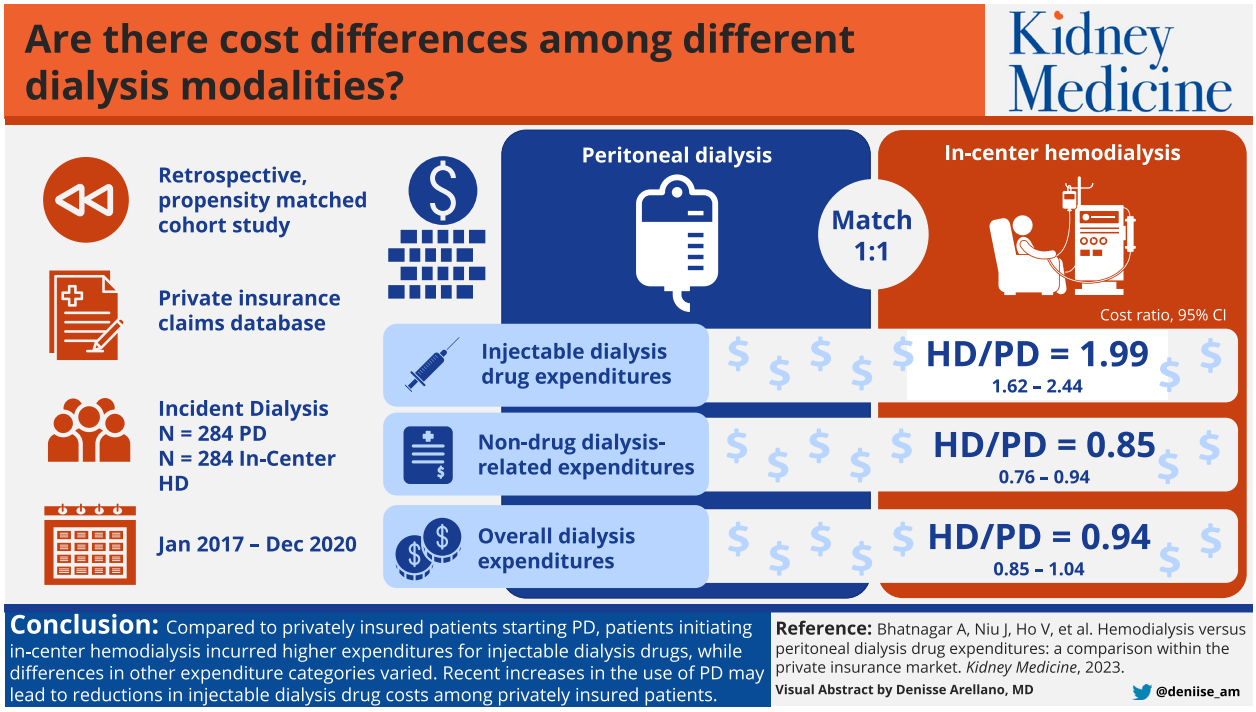
Are there cost differences among different dialysis modalities?
Kidney Medicine
Retrospective, propensity matched cohort study
Private insurance claims database
Incident Dialysis
N = 284 PD
N = 284 In-Center HD
Jan 2017 – Dec 2020
Peritoneal dialysis
Match 1:1
In-center hemodialysis
Cost ratio, 95% CI
Injectable dialysis drug expenditures
HD/PD = 1.99
1.62 – 2.44
Non-drug dialysis-related expenditures
HD/PD = 0.85
0.76 – 0.94
Overall dialysis expenditures
HD/PD = 0.94
0.85 – 1.04
Conclusion: Compared to privately insured patients starting PD, patients initiating in-center hemodialysis incurred higher expenditures for injectable dialysis drugs, while differences in other expenditure categories varied. Recent increases in the use of PD may lead to reductions in injectable dialysis drug costs among privately insured patients.
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