# Supplementary Material

Supplementary Table 1. Targeted literature review search strategy

| **Medline (1946 to 2023 June 14)**  **Embase (1974 to 2023 June 14)** | | |
| --- | --- | --- |
| **Search No.** | **Search String** | **No. of Hits** |
| 1 | exp Renal Replacement Therapy/ | 431,646 |
| 2 | exp Renal Dialysis/ | 242,166 |
| 3 | dialysis.tw. | 278,848 |
| 4 | (hemodialysis or haemodialysis).tw. | 199,792 |
| 5 | (hemofiltration or haemofiltration).tw. | 10,892 |
| 6 | (hemodiafiltration or haemodiafiltration).tw. | 7,751 |
| 7 | or/1-6 | 584,088 |
| 8 | Economics/ | 270,557 |
| 9 | cost analysis/ | 135,899 |
| 10 | Cost allocation/ | 62,267 |
| 11 | Cost control/ | 93,665 |
| 12 | Cost savings/ | 77,505 |
| 13 | Cost allocation/ | 62,267 |
| 14 | Cost of illness/ | 50,522 |
| 15 | Cost sharing/ | 62,907 |
| 16 | deductibles/ | 62,064 |
| 17 | coinsurance/ | 1,810 |
| 18 | Health care costs/ | 212,043 |
| 19 | Direct service costs/ | 205,799 |
| 20 | Hospital costs/ | 34,939 |
| 21 | Health expenditures/ | 206,634 |
| 22 | Capital expenditures/ | 206,582 |
| 23 | Value of life/ | 149,359 |
| 24 | exp economics, hospital/ | 963,806 |
| 25 | exp economics, medical/ | 952,673 |
| 26 | (health?care adj2 cost$).ti,ab. | 42,727 |
| 27 | (cost adj2 estimate$).ti,ab. | 28,258 |
| 28 | (cost$ adj2 variable$).ti,ab. | 3,677 |
| 29 | (unit adj2 cost$).ti,ab. | 10,128 |
| 30 | (economic$ or pharmacoeconomic$ or price$ or pricing).ti,ab. | 796,785 |
| 31 | Cost effectiveness analysis/ | 252,290 |
| 32 | Cost of illness/ | 50,522 |
| 33 | Cost control/ | 93,665 |
| 34 | Economic aspect/ | 117,167 |
| 35 | Health care cost/ | 247,301 |
| 36 | Health care financing/ | 13,574 |
| 37 | Health economics/ | 33,903 |
| 38 | Hospital cost/ | 34,939 |
| 39 | (fiscal or financial or finance or funding).ti,ab. | 412,716 |
| 40 | Cost minimization analysis/ | 54,019 |
| 41 | (cost$ adj2 estimate$).ti,ab. | 44,255 |
| 42 | (cost$ adj2 variable$).ti,ab. | 3,677 |
| 43 | (unit adj2 cost$).ti,ab. | 10,128 |
| 44 | or/8-43 | 2,448,673 |
| 45 | 7 and 44 | 23,299 |
| 46 | exp renal dialysis/ec | 2,259 |
| 47 | 45 or 46 | 24,127 |
| 48 | conference abstract.pt. | 4,292,738 |
| 49 | 47 not 48 | 20,165 |
| 50 | exp animals/ not humans/ | 17,089,433 |
| 51 | (rat or rats or mouse or mice or murine).ti. or (human tissue or human cell or nonhuman or in vitro study or in vivo study).hw. | 11,785,671 |
| 52 | (letter or editorial or comment$ or note or case report).pt. | 4,820,440 |
| 53 | case study/ or letter/ or editorial/ or case report/ | 8,125,279 |
| 54 | or/50-53 | 30,067,030 |
| 55 | 49 not 54 | 14,197 |
| 56 | systematic review.pt. | 181,367 |
| 57 | systematic review.ti. | 366,027 |
| 58 | or/56-57 | 421,601 |
| 59 | review.pt. | 5,755,972 |
| 60 | 59 not 58 | 5,538,579 |
| 61 | 55 not 60 | 11,677 |
| 62 | limit 61 to yr="2016-current" | 3,507 |
| 63 | remove duplicates from 62 | 2,730 |
| 64 | limit 63 to english language | 2,662 |
| 65 | (china or chinese or uk or united kingdom or england or scotland or wales or canada or canadian or australia or australian or india$ or japan$ or korea$ or italy or italian or spain or spanish or france or french or ireland or mexic$ or portug$ or poland or brazil$ or austria$ or bangladesh$ or indonesia$ or colombia$ or cuba or cuban or denmark or danish$ or sweden or swedish or norway or norwegian or finland or finnish or greece or greek or german$ or netherlands or dutch or israel$ or romania$ or russia$ or singapore or switzerland or swiss or belgium or beligian or taiwan$ or thailand or ukrain$ or uruguay$ or united arab emirates or egypt$ or saudi arabia$).ti. | 2,772,064 |
| 66 | 64 not 65 | 2,319 |
| 67 | 66 and ((child$ or infant$ or adolescen$ or teenage$) and adult$).ti. | 9 |
| 68 | 66 not (child$ or infant$ or adolescen$ or teenage$ or qualitative).ti. | 2,228 |
| 69 | 67 or 68 | 2,237 |

Supplementary Table 2. Characteristics of included studies

| **First author, year** | **Outcome** | **Data source** | **Study sample** | **Results** |
| --- | --- | --- | --- | --- |
| US Renal Data Service, 2022 [1] | Medicare expenditure on dialysis | USRDS | Period-prevalent ESRD patients with ≥1 Medicare claim in 2020 | *Total spending in 2020*   * Hemodialysis: $28.5b * PD: $2.8b   Unadjusted PPPY spending on all dialysis: $94,511  *Inflation-adjusted FFS PPPY spending in 2020*   * Hemodialysis: $95,932 * PD: $81,525   *Inpatient costs (unadjusted PPPY)*   * Hemodialysis: $29,334 * PD: $27,656   *Outpatient costs (unadjusted PPPY)*   * Hemodialysis: $38,124 * PD: $35,545 |
| Cervantes, 2023 [2] | Emergency Medicaid services’ dialysis expenditure for undocumented immigrants | Colorado Department of Health Care Policy and Financing | 444 undocumented immigrants receiving dialysis in Colorado, 2017-2021 | *Total annual expenditure*   * 2017: $19.5m * 2018: $19.9m * 2019: $6.8m (change in state Medicaid went into effect January 1) * 2020: $6.8m * 2021: $9.0m   *Monthly per-patient expenditure*   * 2017: $20,162 * 2018: $21,267 * 2019: $7,625 (change in state Medicaid policy went into effect January 1) * 2020: $7,506 * 2021: $5,574 |
| Khanna, 2023 [3] | Mean total cost of care of total hip arthroplasty | National Inpatient Sample database from HCUP, 2016-2019 | 383 dialysis patients and 367,373 nondialysis patients, all undergoing hip arthroplasty | *Mean total cost of care of total hip arthroplasty*   * Dialysis patients: $96,825 * Nondialysis patients: $66,849 (*P*<0.001) |
| Shafqat, 2023 [4] | Cost of emergency-only hemodialysis | EHR and accounting records at a high-volume public hospital and 4 private hospitals providing care in the same large academic system | 15,682 visits from 214 undocumented immigrants undergoing emergency hemodialysis, 2019-2020 | *Average cost of emergency-only hemodialysis by hospital setting*   * Total: $1,363 * Private: $1,302 * Public: $1,366   *Total annual cost*   * Total: $10.69m * Private: $0.37m * Public: $10.32m |
| Blackowicz, 2022 [5] | Mean per-person costs associated with all-cause hospitalization in people having hemodialysis with conventional high-flux dialyzer | Economic evaluation as part of an RCT  Cost of hospitalization comes from KFF | 171 adults receiving maintenance hemodialysis with a high-flux dialyzer for at least 3 months, 2017-2018 | $11,853 (compared with $5,756 with experimental Theranova dialyzer) |
| Danese, 2022 [6] | Mean (95% CI) difference in costs before and after parathyroidectomy | USRDS | 3,008 dialysis patients undergoing parathyroidectomy, 2015-2018 | *Any dialysis*   * Inpatient facility: $24,758 ($23,492, $26,340) * Outpatient facility: −$1,358 (−$1,747, −$910) * Physician/provider: $1,701 ($1,258, $2,228) * Prescription: −$201 (−$224, −$177) * All other: $415 ($308, $521) * Total: $25,314 ($23,777, $27,078)   *Hemodialysis*   * Inpatient facility: $23,877 ($22,570, $25,453) * Outpatient facility: −$1,359 (−$1,766, −$875) * Physician/provider: $1,337 ($873, $1,882) * Prescription: −$203 (−$227, −$177) * All other: $383 ($265, $493) * Total: $24,037 ($22,492, $25,827)   *Peritoneal dialysis*   * Inpatient facility: $34,102 ($28,825, $38,573) * Outpatient facility: −$1,354 (−$2,607, −$43) * Physician/provider: $5,557 ($4,233, $6,641) * Prescription: −$183 (−$258, −$94) * All other: $757 ($441, $1,051) * Total: $38,878 ($32,357, $44,492) |
| Kaplan, 2022 [7] | Mean (SD) annual Medicare payments per patient (in 2017 US$) | Medicare claims, ESRD Networks, CMS Medical Evidence Report (CMS-2728), and the CROWNWeb ESKD registry | 8,305 matched pairs of Medicare Parts A/B/D beneficiaries aged ≥67 who started either in-center hemodialysis or home PD between 2008 and 2015 | *Medicare expenditure per patient*   * Hemodialysis: $108,656 ($81,145) * PD: $91,716 ($62,380) (*P*=0.001)   *Total dialysis payment (includes IV dialysis drug and other dialysis)*   * Hemodialysis: $34,553 ($8,103) * PD: $34,257 ($9,247)   *IV dialysis drug*   * Hemodialysis: $7,332 ($5,290) * PD: $4,069 ($4,036)   *Other dialysis payment (includes payment for the dialysis procedure, oral dialysis drugs, additional treatments and add-ons, and clinician care in outpatient dialysis)*   * Hemodialysis: $27,221 ($8,364) * PD: $30,188 ($9458)   *Acute care*   * Hemodialysis: $37,922 ($59,616) * PD: $32,986 ($47,763)   *Rehabilitation*   * Hemodialysis: $13,608 ($26,899) * PD: $8,410 ($18,814)   *Other nondialysis (includes nondialysis Medicare expenditures, including Parts A, B, and D)*   * Hemodialysis: $22,573 ($19,395) * PD: $16,063 ($14,247)   *Dialysis access*   * Hemodialysis: $27,264 ($81,673) * PD: $23,075 ($12,7235)   *Multivariable models for hemodialysis vs PD:*   * Annual expenditure: 11% higher (estimate 1.11; 95% CI: 1.09-1.13) * IV dialysis drugs: 69% higher (1.69; 95% CI: 1.64-1.73) * Other dialysis-related expenditures: 9% lower (0.91; 95% CI: 0.91-0.92) * Rehabilitation: 35% (1.35; 95% CI: 1.26-1.45). * Dialysis access: 12% higher (1.12; 95% CI: 1.00-1.25) * Other nondialysis expenditures: 34% higher (1.34; 95% CI: 1.30-1.37) |
| League, 2022a [8] | Prices paid by private insurers for dialysis | Health Care Cost Institute | 87,439 claims for hemodialysis sessions from 25,492 people aged <65 receiving dialysis via private insurance (<33 months after ESRD diagnosis), 2012-2019 | *Price for a dialysis session (paid by private insurers)*   * Mean (SD): $1,287 ($584) * Median (IQR): $1,476 ($737-$1,671)   Medicare base rate: $240  Highest possible rate paid by Medicare after case-mix and geographic adjustments: $1,081  *Mean (SD) price paid by private insurers for a dialysis session, per state (from most to least expensive)*   * West Virginia 1,791 (200) * Rhode Island 1,772 (722) * Hawaii 1,714 (417) * South Carolina 1,712 (713) * New Hampshire 1,667 (351) * Oregon 1,664 (371) * Michigan 1,645 (408) * Maine 1,640 (403) * Alaska 1,599 (491) * Connecticut 1,560 (704) * Iowa 1,530 (696) * North Carolina 1,493 (507) * Virginia 1,492 (634) * Nevada 1,490 (401) * Minnesota 1,481 (471) * Mississippi 1,478 (498) * Arizona 1,444 (539) * Oklahoma 1,432 (539) * Ohio 1,418 (571) * New Mexico 1,414 (721) * Delaware 1,404 (606) * District of Columbia 1,370 (605) * Idaho 1,368 (688) * Illinois 1,331 (584) * Wisconsin 1,318 (730) * New Jersey 1,309 (521) * Massachusetts 1,304 (665) * Georgia 1,296 (557) * Texas 1,294 (556) * Maryland 1,282 (475) * Tennessee 1,281 (607) * Colorado 1,278 (891) * California 1,276 (520) * Indiana 1,264 (575) * Washington 1,235 (470) * New York 1,230 (589) * Pennsylvania 1,198 (521) * Missouri 1,174 (570) * Nebraska 1,161 (602) * Florida 1,082 (658) * Kansas 1,055 (599) * Kentucky 1,009 (577) * Utah 1,005 (809) * Louisiana 960 (535) * Arkansas 950 (677) |
| League, 2022b [9] | Monthly expenditure on dialysis by employer-sponsored health insurance plans | For employer-sponsored health insurance plans: Health Care Cost Institute.  For Medicare data: USRDS 2020 reports | 12,392 people aged <65 years initiating dialysis via employer-sponsored insurance plans, 2015-2017 | *Total monthly spending, mean (SD)*   * Pre-dialysis: $5,025.39 (15,821.96) * Post-dialysis: $19,653.51 (22,353.74)   *Out-of-pocket spending, mean (SD)*   * Pre-dialysis: $260.86 (674.14) * Post-dialysis: $443.42 (1,025.63)   **Spending amount by category, mean (SD)**  *Outpatient dialysis*   * Pre-dialysis: $0.00 (0.00) * Post-dialysis: $9,679.59 (9,941.57)   *Nondialysis outpatient*   * Pre-dialysis $908.82 (2,970.48) * Post-dialysis $2,921.89 (5,926.37)   *Inpatient*   * Pre-dialysis: $2,585.59 (12,079.63) * Post-dialysis: $3,789.79 (14,282.83)   *Physician services*   * Pre-dialysis: $1,030.76 (2,454.07) * Post-dialysis: $1,945.84 (3,716.94)   *Prescription medication*   * Pre-dialysis: $218.43 (654.90) * Post-dialysis: $366.94 (885.20)   *Prescription drug spending with coverage*   * Pre-dialysis: $475.59 (1,047.02) * Post-dialysis: $816.36 (1,371.46)   *Mean (95% CI) adjusted difference from before first session to after session*   * Total monthly spending: $14,685.19 (14,413-14,957) * Out-of-pocket: $170 (162-178) * Dialysis: $9,897 (9,737-10,058) * Nondialysis outpatient: $1,847 (1,778-1,917) * Inpatient: $1,218 (1,102-1,334) * Physician services: $926 (893-959) * Prescription drugs: $332 (310-355)   First month of dialysis: $27,763 (95% CI: $27,239-$28,287) in additional healthcare spending compared to 12 months before starting dialysis. During the first 12 months after starting dialysis, additional healthcare spending was at least $15,000 (95% CI: $14,424-$15,226) higher per month compared to previous 12 months  *Mean (95% CI) spending in the first 12 months after starting dialysis*   * Private insurance: $238,126 ($234,961-$241,291) * Medicare: $80,509 ($80,089-$80,929) |
| Lin, 2022 [10] | Median Medicare Advantage price for hemodialysis treatment compared to what FFS Medicare would pay under the ESRD Prospective Payment System | Medicare Advantage claims data from the Health Care Cost Institute, 2016-2017 | 39,718 outpatients with 6,626,544 dialysis claims in 2016 and 2017 for which Medicare Advantage was the primary payer | Median Medicare Advantage price for hemodialysis treatment (percent of the FFS Medicare price), *P*<0.0001 for all   * In the entire sample: $296 (127%) * In-network: $300 (129%) * Out-of-network: $232 (95%)   Prevalent hemodialysis treatments made up 85% of in-network treatments (4,097,265 of 4,829,900 treatments)  Medicare paid 32.7% more for incident treatments than for prevalent hemodialysis treatments   * In-network prevalent: $301 (132%) * Out-of-network prevalent: $230 (96%) * Out-of-network incident (first 120 days): $243 (82%) |
| Wang, 2022 [11] | Diabetes complication costs in Medicare beneficiaries with T2D, in 2017 US dollars | CMS | 192,824 Medicare beneficiaries aged ≥65 with T2D and kidney failure treated with dialysis, enrolled in FFS plans, 2006-2017 | *Estimated costs of kidney failure treated by dialysis, as a complication of T2D*   * Unadjusted mean annual cost per person: $110,821 * Adjusted mean annual cost per person: $54,739   + After excluding those who switch to Medicare Advantage plans: $54,739   + Including those who switch to Medicare Advantage plans: $54,653   + Male enrollees: $52,550   + Female enrollees: $56,244   + White: $51,706   + Black: $58,732   + Hispanic: $58,283   + Asian/Pacific Islander: $66,517   + American Indian/Alaska Native: $46,698   + Dual-eligible enrollees: $60,482   + Medicare only enrollees: $49,321   + Excluding beneficiaries without Part D: $54,739   + Including beneficiaries without Part D: $51,585 |
| Weinhandl, 2022 [12] | Cost of care before and after conversion from PD to hemodialysis | USRDS | 68,743 patients aged ≥12 years who were newly diagnosed with ESKD in 2001-2017, initiated PD during the first year of ESKD, and discontinued PD in 2009-2018 | *Total cost of care ($/month) (costs include all-cause hospital admissions and hospital days, observation stays, ED encounters)*   * −12 months: $4,597 * −6 months: $5,549 * −1 month: $20,701 * +1 month: $13,302 * +6 months: $7,672 * +12 months: $6,846 |
| West, 2022 [13] | Cost of ED visits associated with hemodialysis | Nationwide Emergency Department Sample | 235,988 ED visits by people aged ≥18 years, associated with hemodialysis, in 2017 | *Mean (95% CI) cost per ED visit*   * Uninsured ED hemodialysis: $5,992 (4,947-7,038) * Insured ED hemodialysis: $10,986 (9,832-12,140) * Difference between insured and uninsured: $4,994 (4,885-5,102)   *Total across nation*   * Uninsured ED hemodialysis: $374.5 million * Insured ED hemodialysis: $1,899.3 million |
| Betts, 2021 [14] | Unit cost of dialysis (2020 US dollars) | Optum Clinformatics | T2D CKD patients, 2014-2019 (n=52,599) | * 4-month acute (SE): $87,538 ($6,691) * 4-month ongoing/post-acute (SE): $49,573 ($2,476) |
| US Renal Data Service, 2021 [15] | Medicare expenditure on dialysis | USRDS | Period-prevalent ESRD patients with ≥1 Medicare claim in 2019 | *Total spending in 2019*   * Hemodialysis: $29.0b * PD: $2.7b   *Inflation-adjusted PPPY spending in 2019*   * All dialysis: $93,354 * Hemodialysis: $94,608 * PD: $81,091 |
| Davis, 2021 [16] | All-cause direct healthcare care expenditures PPPM including Medicare payments and patient out-of-pocket liability from medical/‌ pharmacy claims | Medicare FFS Parts A/B/D claims linked to eGFR values from Prognos laboratory data | 7,840 incident dialysis users, 2019 | *Mean (SD) PPPM spending*   * 0-4 months: $8,763 ($7,010) * 12 months: $7,770 ($5,038) * 24 months: $7,350 ($5,397) |
| Duriseti, 2021 [17] | Cost impact of ICU conversion from CVVH to CVVHD | St. Elizabeth’s Medical Center, Boston, MA, US | Critically ill patients initiating CVVH (n=77) from June 2017-May 2018 and patients initiating CVVHD (n=60) from May 2018-February 2019 in the ICU | *Mean (SD) daily costs*   * Total treatment cost per 24 hours, CVVH: $1,813 ($2,143) vs CVVHD: $775 ($766); *P*<0.001 * Dispensed replacement fluid or dialysate, CVVH: $1,286 ($1,499) vs CVVHD: $436 ($558); *P*<0.001 * Extracorporeal circuit (cartridge and tubing), CVVH: $395 ($616) vs CVVHD: $253 ($247); *P*=0.04 * Repletion of electrolytes (calcium, potassium, magnesium), CVVH: $27 ($39) vs CVVHD: $12 ($12); *P*<0.001 * Heparin catheter-lock, CVVH: $1.0 ($2.6) vs CVVHD: $0.8 ($1.6), *P*=0.79 * Alteplase catheter-lock, CVVH: $0.6 ($1.6) vs CVVHD: $0.5 ($1.7); *P*=0.17 |
| Lin, 2021 [18] | Medicare spending between PD and hemodialysis among uninsured adults with incident ESKD | USRDS and Medicare | 58,539 uninsured adults starting dialysis between June 1, 2005, and December 31, 2014 | **Spending/patient (95% CI), months 7-12**  *Total spending*   * Hemodialysis: $14,208 ($13,838-$14,932) * PD: $13,506 ($10,987-$16,906)   *Inpatient spending*   * Hemodialysis: $49 ($47-57) * PD: $35 ($25-$56)   *Dialysis spending*   * Hemodialysis: $7,032 ($6,862-$7,406) * PD: $8,221 ($6,582-$10,282) |
| Ng, 2021 [19] | Per-person annual excess spending on diabetes-related hemodialysis  Cost ratio (mean annual medical expenditures of enrollees with hemodialysis to those without any diabetes-related complications) | CMS data covering 8 states (AL, CA, CT, FL, IL, IA, NY, OK) | 251,935 adult diabetes patients enrolled in FFS Medicaid plan, 2008­­-2012 | *Mean (95% CI) for disability-based Medicaid eligibility*   * AL: $23,569 ($19,133-$28,707) * CA: $51,470 ($48,132-$55,883) * CT: $33,823 ($24,850-$44,637) * FL: $29,749 ($24,534-$35,967) * IA: $40,063 ($19,419-$49,485) * IL: $35,307 ($30,926-$40,012) * NY: $50,300 ($43,207-$59,287) * OK: $29,136 ($22,375-$38,705)   *Mean (95% CI) for non-disability-based Medicaid eligibility*   * AL: NR * CA: $41,298 ($30,100-$57,922) * CT: NR * FL: NR * IA: NR * IL: $22,481 ($14,646-$35,234) * NY: $40,354 ($17,593-$70,353) * OK: NR |
| Ng, 2021 [19] | Total excess annual spending on diabetes-related hemodialysis |  |  | *Disability-based Medicaid eligibility*   * AL: $5,255,887 * CA: $115,704,560 * CT: $5,208,742 * FL: $12,435,082 * IA: $2,523,969 * IL: $27,045,162 * NY: $31,085,400 * OK: $5,535,840   *Non-disability-based Medicaid eligibility*   * AL: NR * CA: $3,386,436 * CT: NR * FL: NR * IA: NR * IL: $3192,302 * NY: $1,412,390 * OK: NR |
| O’Donnell, 2021 [20] | Hospital costs between a novel triage pathway called fast track dialysis for unscheduled hemodialysis for ESRD patients presenting to the ED vs historical patients not treated via fast track | Single hospital (Emory, Atlanta, GA) | All patients with ESRD on hemodialysis aged >18 years who were considered low risk by ED clinical criteria, hemodynamic parameters, and electrocardiogram criteria were eligible for the pathway (n=93 met criteria; n=82 in historical cohort met criteria; note both are a very small subset of all patients) | *Charges, median (IQR)*   * Historical: $30,747 (14,482) * Fast track: $26,040 (14,114) |
| Pockros, 2021 [21] | Dialysis costs in US; study evaluated the association of the single-payer dominant system (Medicare for dialysis) with total healthcare costs by examining dialysis-specific expenditures as a function of total healthcare expenditures | Actual cost of dialysis in the US was derived from the Medicare PPS 2020 Final Rule. Actual costs included a $239 facility fee per session and a $240 supervising physician fee per month, assuming that Medicare reimbursed 100% of allowable charges | Estimated for dialysis patients in US in 2020 | * Predicted annual dialysis cost per patient in the US: $98,410 (95% CI: $62,827-$133,994) * Assuming 156 sessions per year, the actual annual dialysis cost per patient in the US is approximately $40,000, less than half of the predicted payment |
| Trish, 2021 [22] | Average monthly spending on outpatient dialysis | 2016 US Affordable Care Act-compliant individual market claims data held by a health care analytics firm; Medicare spending data source is USRDS | People with ESKD receiving ≥1 outpatient dialysis session through commercial insurance, representing 51,002 member-months in 2016 | *Average monthly spending for ESKD patients on outpatient dialysis*   * Individual market: $10,149 * Medicare: $3,364 * individual market spending as % of Medicare spending: 302% |
| Yeung, 2021 [23] | Reports dialysis costs (2016 $) | Data from literature review | Data from literature review | *Annual costs in 2016 dollars per person*   * Hemodialysis: $88,395 * PD: $68,139 |
| Marrufo, 2020 [24] | Total mean Medicare payments for dialysis before start of CEC model and increase in total payments after start of CEC model | Medicare | CEC beneficiaries with ESRD on dialysis, January 2014-March 2015 (n=73,094) and beneficiaries with ESRD on dialysis, not aligned to CEC facilities October 2015-December 2017 (n=60,464) | *Before CEC model*   * $2,595 PPPM   *Increase after start of CEC model*   * $15 PPPM (95% CI: $7-$24) |
| Sy, 2020 [25] | Dialysis costs for nonfrail and frail hemodialysis patients (inflated to 2017 US dollars) | USRDS, Medicare | Hemodialysis patients taking part in the ACTIVE/‌ ADIPOSE study, June 2009-August 2011 (n=425) | *Mean (95% CI) PPPYa*   * Nonfrail: $23,700 ($21,800-$25,600) * Frail: $22,000 ($19,900-$24,400)   Difference in expenditures: −7.0% (−14.9%, 1.7%) |
| Wang, 2020 [26] | Total treatment payments before, in the interim, and after implementation of VA payment reforms for dialysis | Medicare, USRDS, and VA Community Care claims | Veterans on dialysis under VA Community Care, 2006-2016 (n=24,870) | *Unadjusted average price paid for VAMC dialysis per treatment day (range [IQR])*   * 2006-2008: $47-$1,575 ($162-$318) * 2009-2010: $162-$613 ($192-$447) * 2011-2016: $40-$500 ($368-$334)   *Adjusted analysis of change in mean total payment per treatment day after policy implementation*   * −$197.07 (95% CI: −$210.02, −$184.11)   Adjusted analysis of mean total payment per treatment day after 2010: $250 |
| Wagner, 2020 [27] | Total costs and access-related costs for TDC, AVF, and AVG | USRDS | 27,064 incident hemodialysis patients, 2008-2011 | *Mean (95% CI) annualized total costs per year*   * TDC: $104,719 ($103,298-$106,139) * AVF: $103,932 ($102,100-$105,765) * AVG: $119,829 ($116,127-$123,532)   *Mean (95% CI) access-related costs per year*   * TDC: $13,625 ($13,426-$13,825) * AVF: $16,864 ($16,533-$17,194) * AVG: $20,961 ($20,267-$21,654)   *Mean (SD) reintervention costs*   * Additional AVF: $3,525 ($232) * Additional AVG: $3,804 ($352) * Open intervention: $3,102 ($358) * Endovascular intervention: $3,569 ($113) |
| West, 2020 [28] | Cost of ED visits for hemodialysis | 2017 Texas ED data set | Adults visiting ED for acute hemodialysis indication in 2017 (n=33,829) | *Mean (95% CI) cost per patient*   * Insured: $3,238.70 ($3,202.94-$3,274.47) * Uninsured: $2,101.74 ($2,074.00-$2,129.47)   *Total cost across state*   * Insured: $75.9m * Uninsured: $21.8m |
| Al-Balas, 2019 [29] | CMS reimbursement for access procedures and complications, annual vascular access-related costs | Single hemodialysis center (University of Alabama at Birmingham) | 308 patients with advanced CKD undergoing pre-ESRD AVF placement, 2006-2012 | **CMS reimbursement (2015) per patient**  *Surgical procedures*   * New AVF: $3,923 * New AVG: $4,067 * Surgical access revision: $4,025   *Percutaneous procedures*   * Thrombectomy: $2,996 * Transluminal angioplasty: $2,451 * Catheter exchange: $786 * Hospitalization secondary to catheter-related sepsis: $13,528 |
| Childers, 2019 [30] | Revenue (representing costs to payers), per patient-year and per treatment | Annual financial statements of dialysis provider DaVita Inc, 2017 | 197,800 patients from 2,510 clinics throughout the US | *Revenue per patient-year*   * Government payer: $35,424 * Commercial payers: $148,722   *Revenue per treatment*   * Government payer: $248 * Commercial payers: $1,041 |
| Deshpande, 2019 [31] | Inpatient and outpatient utilization (adjusted to 2016 US dollars) | 5% Medicare sample from CMS | Medicare patients on hemodialysis, HCV- (n=279,496) and HCV+ (n=12,167), 2005-2016 | **Mean (SD) inpatient utilization PPPY**  *Total charges*   * HCV-: $210,340 ($312,997); HCV+: $277,257 ($380,100)   *Total payment*   * HCV-: $58,690 ($82,548); HCV+: $79,351 ($89,391)   *Medical payment*   * HCV-: $53,582 ($76,399); HCV+: $74,007 ($85,199)   *Patient payment*   * HCV-: $2,710 ($5,487); HCV+: $3,412 ($6,404)   **Mean (SD) outpatient utilization PPPY**  *Total charges*   * HCV-: $375,931 ($358,420); HCV+: $419,068 ($354,831)   *Total payment*   * HCV-: $38,242 ($27,856); HCV+: $43,198 ($27,357)   *Medical payment*   * HCV-: $30,260 ($22,375); HCV+: $34,322 ($21,991)   *Patient payment*   * HCV-: $7,717 ($5,648); HCV+: $8,709 ($5,601) |
| Lew, 2019 [32] | Overall PD costs in outpatient and inpatient settings pre- and post-remote RBM intervention | CMS claims data | Patients receiving PD enrolled in a telehealth project that included RBM of blood pressure and weight via 2-way video conferencing (n=269) | *Median (IQR) outpatient costs*   * Total: $638.96 ($2,309.03) * Pre-RBM intervention: $511.41 ($1,990.30) * Post-RBM intervention: $652.61 ($2,319.02)   *Median (IQR) inpatient hospital costs*   * Total: $10,761.42 ($14,745.51) * Pre-RBM intervention: $10,835.30 ($6,488.66) * Post-RBM intervention: $10,678.88 ($15,308.17) |
| Nguyen, 2019 [33] | Net change in PPPM costs for ESRD patients receiving emergency dialysis | Parkland Hospital EHRs; ED and hospital claims from 80 hospitals within 100 miles of Dallas from a comprehensive regional all-payer claims database (North Texas Health Information and Quality Collaborative), and data manually abstracted from medical records from 30 participating dialysis centers | 181 uninsured adults with ESRD receiving emergency dialysis, Parkland Hospital (safety-net hospital), TX, February 2015  105/181 enrolled in scheduled dialysis, 76/181 remained on emergency dialysis | *Net change in adjusted worst-case scenario PPPM costs*   * Emergency only: $1,452 * Enrolled in scheduled dialysis: −$4,316   *Net change in adjusted best-case scenario PPPM costs*   * Emergency only: $1,455 * Enrolled in scheduled dialysis: −$4,711 |
| Nordyke, 2019 [34] | Total dialysis costs (adjusted to 2017 US dollars) | USRDS | Incident ESRD patients, January 2012-June 2014 (n=41,779) | **Mean cost per dialysis month**  *Access-related*   * AVF: $1,699 * AVG: $2,656   *All-cause*   * AVF: $8,508 * AVG: $9,605   **Cost per month in 6-month increments post-placement**  *Access-related*   * 1-6 months, AVF: $7,983; AVG: $8,837 * 7-12 months, AVF: $6,461; AVG: $7,274 * 13-18 months, AVF: $5,932; AVG: $6,606 * 19-24 months, AVF: $5,946; AVG: $6,753   *All-cause*   * 1-6 months, AVF: $1,664; AVG: $2,247 * 7-12 months, AVF: $757; AVG: $1,286 * 13-18 months, AVF: $5,600; AVG: $1,158 * 19-24 months, AVF: $5,141; AVG: $1,027 |
| van der Tol, 2019 [35] | Annual public funding per patient for hemodialysis and PD  Percentage of public health expenditures spent on public funding of dialysis | Online survey of heads of nephrology departments, July-December 2016 | 90 survey respondents worldwide | *Annual funding per patient in the US*   * Hemodialysis: $36,036 * PD: $36,036 * Percentage of public health expenditure spent on public funding of dialysis: 1.10% |
| Axelrod, 2018 [36] | Cost and cost-effectiveness of dialysis over 10 and 20 years (in 2016 US dollars) | USRDS, University Health System Consortium | USRDS registry data and SRTR patient-level data, 2005-2015, and Medicare claims data 2003-2012 (N not reported) | *Cost of dialysis over 10 years*   * Mean: $292,117; median: $324,534   *Cost per QALY over 10 years*   * Mean: $72,476; median: $72,926   *Cost of dialysis over 20 years*   * Mean: $478,840; median: $538,778   *Cost per QALY over 20 years*   * Mean: $67,929; median: $67,785 |
| O’Hare, 2018 [37] | Medicare spending on hemodialysis for patients in the last year of life, by group:  Group 1 (n=60,881): Escalating spending trajectory through all 4 quarters of last year of life  Group 2 (n=260,132): Low spending Q1-Q3, escalation in Q4  Group 3 (n=236,291): Moderate spending Q1-Q3, escalation in Q4  Group 4 (n=82,162): High spending Q1-Q4 | Medicare, USRDS | 639,466 Medicare beneficiaries on maintenance hemodialysis in the last year of life, 2000-2014 | **Median (IQR)**  *Total spending*   * Group 1: $193,930 ($154,650-$250,396) * Group 2: $78,670 ($61,064-$97,120) * Group 3: $149,408 ($123,503-$180,818) * Group 4: $279,321 ($239,679-$253,089)   *Inpatient spending*   * Group 1: $128,541 ($90,275-$186,588) * Group 2: $26,189 ($11,813-$45,796) * Group 3: $72,842 ($47,929-$104,552) * Group 4: $187,146 ($141,929-$253,089)   Stratified by time of death in relation to ESRD onset, median (IQR)  **<1 year after ESRD onset**  *Total spending*   * Group 1: $189,298 ($153,159-$241,651) * Group 2: $77,350 ($60,073-$95,203) * Group 3: $147,264 ($122,147-$178,435) * Group 4: $271,395 ($235,790-$326,695)   *Inpatient spending*   * Group 1: $124,310 ($88,384-$177,960) * Group 2: $24,377 ($10,957-$42,853) * Group 3: $70,548 ($46,240-$101,570) * Group 4: $178,991 ($137,022-237,443)   **≥1 year after ESRD onset**  *Total spending*   * Group 1: $201,910 ($157,784-$268,310) * Group 2: $93,282 ($74,860-$115,960) * Group 3: $163,343 ($134,459-$194,132) * Group 4: $309,268 ($256,436-$399,183)   *Inpatient spending*   * Group 1: $136,809 ($94,253-$203,948) * Group 2: $48,110 ($29,368-$73,634) * Group 3: $88,713 ($60,966-$122,088) * Group 4: $215,380 ($160,317-$303,301) |
| Thamer, 2018 [38] | Vascular access costs PPPY | USRDS | People aged ≥66 years initiating hemodialysis, 2010-2011  Cohort 1: Initiated hemodialysis with a mature AVF, n=2,704 | **Mean (SD)**  *Maintain primary patency (no surgical or endovascular procedure in the year following AVF surgical creation)*   * Year 1: $6,442 ($8,882) * Year 2: $4,279 ($11,378) * 2.5 years (annualized): $5,560 ($8,368)   *Primary patency loss (≥1 surgical or endovascular procedure performed on the AVF within 1 year of surgical creation)*   * Year 1: $15,009 ($16,896) * Year 2: $7,403 ($14,178) * 2.5 years (annualized): $11,761 ($15,871)   *Secondary patency loss (3 months of continuous CVC use after first AVF use or creation of a subsequent permanent vascular access within 1 year of the index AVF creation date)*   * Year 1: $18,104 ($16,6553) * Year 2: $13,106 ($20,304) * 2.5 years (annualized): $16,428 ($14,865)   *AVF nonuse*   * Year 1: $30,687 ($60,013) * Year 2: $13,686 ($17,432) * 2.5 years (annualized): $29,710 ($59,959) |
| Thamer, 2018 [38] | Vascular access costs PPPY | USRDS | People aged ≥66 years initiating hemodialysis, 2010-2011  Cohort 2: Initiated hemodialysis with CVC and a maturing AVF, n=3,530 | *Maintain primary patency**(no surgical or endovascular procedure in the year following AVF surgical creation)*   * Year 1: $21,514 ($35,849) * Year 2: $3,779 ($10,039) * 2.5 years (annualized): $17,234 ($36,001)   *Primary patency loss (≥1 surgical or endovascular procedure performed on the AVF within 1 year of surgical creation)*   * Year 1: $28,154 ($25,872) * Year 2: $9,395 ($23,526) * 2.5 years (annualized): $20,506 ($23,583)   *Secondary patency loss (3 months of continuous CVC use after first AVF use or creation of a subsequent permanent vascular access within 1 year of the index AVF creation date)*   * Year 1: $28,980 ($28,137) * Year 2: $15,357 ($32,506) * 2.5 years (annualized): $24,116 ($25,318)   *AVF nonuse*   * Year 1: $55,475 ($86,397) * Year 2: $15,253 ($31,403) * 2.5 years (annualized): $51,745 ($86,782) |
| Thamer, 2018 [38] | Vascular access costs PPPY | USRDS | People aged ≥66 years initiating hemodialysis, 2010-2011  Cohort 3: Initiated hemodialysis with CVC only and underwent AVF creation within 9 months of hemodialysis initiation, n=3,901 | *Maintain primary patency (no surgical or endovascular procedure in the year following AVF surgical creation)*   * Year 1: $8,576 ($13,994) * Year 2: $5,749 ($23,764) * 2.5 years (annualized): $7,871 ($14,183)   *Primary patency loss (≥1 surgical or endovascular procedure performed on the AVF within 1 year of surgical creation)*   * Year 1: $16,428 ($17,536) * Year 2: $8,423 ($20,446) * 2.5 years (annualized): $13,282 ($16,942)   *Secondary patency loss (3 months of continuous CVC use after first AVF use or creation of a subsequent permanent vascular access within 1 year of the index AVF creation date)*   * Year 1: $18,989 ($16,721) * Year 2: $17,350 ($28,477) * 2.5 years (annualized): $17,808 ($15,764)   *AVF nonuse*   * Year 1: $32,405 ($104,025) * Year 2: $17,000 ($33,334) * 2.5 years (annualized): $31,630 ($103,941) |
| Damien, 2016 [39] | Aim was to evaluate the total health care cost for patients with CKD by identifying the drivers of total cost for these patients | MEPS data, 2002-2011 | Patients on dialysis | Dialysis patients average yearly expenditures: $48,225  Expenditures in MEPS are composed of direct payments for care provided during the year, including out-of-pocket payments and payments by private insurance, Medicaid, Medicare, and other sources  Expenditures included the sum of the following expenses: emergency, inpatient, outpatient, office visits, medical equipment/supply, prescription drugs, and other home health care |
| Wetmore, 2016 [40] | PPPM-adjusted total costs for outpatient dialysis and related injectable medications | Medicare | ESRD patients on maintenance hemodialysis in facilities that enrolled 100% into the PPS in 2011 (4,363 facilities included, with a mean of 47.05 patients per facility in Q4 2011) | *Median PPPM-adjusted total costs for outpatient dialysis and related injectable medications*   * 2009 Q1: ~$2,400 * 2009 Q2: ~$2,500 * 2009 Q3: ~$2,500 * 2009 Q4: ~$2,450 * 2010 Q1: ~$2,400 * 2010 Q2: ~$2,400 * 2010 Q3: ~$2,350 * 2010 Q4: ~$2,300 * 2011 Q1: ~$2,300 * 2011 Q2: ~$2,400 * 2011 Q3: ~$2,400 * 2011 Q4: ~$2,300   *Medicare-reimbursed amounts for outpatient transfusions and related activities (PPPM)*   * Q1 2009: $5.20 ± $11.51 * Q4 2011: $5.68 ± $13.71 |

aStudy also reports: Mean (95% CI) PPPY for those who survived study period:

* Nonfrail: $23,100 ($21,200-$25,200); frail: $20,900 ($18,700-$23,400). Difference in expenditures: −9.4% (−18.0% to 0.0%).

Mean (95% CI) PPPY for those who did not survive study period:

* Non-frail: $31,100 ($27,100-$37,700); frail: $27,700 ($23,100-$33,200). Difference in expenditures: −10.9% (−24.5% to 5.2%).

Key: AVF=arteriovenous fistula; AVG=arteriovenous graft; CEC=comprehensive end-stage renal disease care; CI=confidence interval; CKD=chronic kidney disease; CMS=Centers for Medicare & Medicaid Services; CVC=central venous catheter; CVVH=continuous veno-venous hemofiltration; CVVHD=continuous veno-venous hemodialysis; ED=emergency department; EHR=electronic health record; ESKD=end-stage kidney disease; ESRD=end-stage renal disease; FFS=fee-for-service; HCUP=Healthcare Cost and Utilization Project; HCV=hepatitis C virus; ICU=intensive care unit; IQR=interquartile range; IV=intravenous; MEPS=Medical Expenditure Panel Survey; NR=not reported; PD=peritoneal dialysis; PPPM=per person per month; PPPY=per person per year; QALY=quality-adjusted life-year; RBM=remote biometric monitoring; RCT=randomized controlled trial; SD=standard deviation; SE=standard error; SRTR=Scientific Registry of Transplant Recipients; T2D=type 2 diabetes; TDC=tunneled dialysis catheter; US=United States; USRDS=United States Renal Data System; VA=Veterans’ Affairs; VAMC=Veterans’ Affairs medical center.

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