

CHAPTER SIX

COSTS OF CHRONIC KIDNEY DISEASE

If you want the things you love
You must have showers.
So when you hear it thunder
Don't run under a tree.
There'll be pennies from heaven for you and me

ARTHUR JOHNSTON & JOHNNY BURKE, "PENNIES FROM HEAVEN"

94	overall costs of chronic kidney disease
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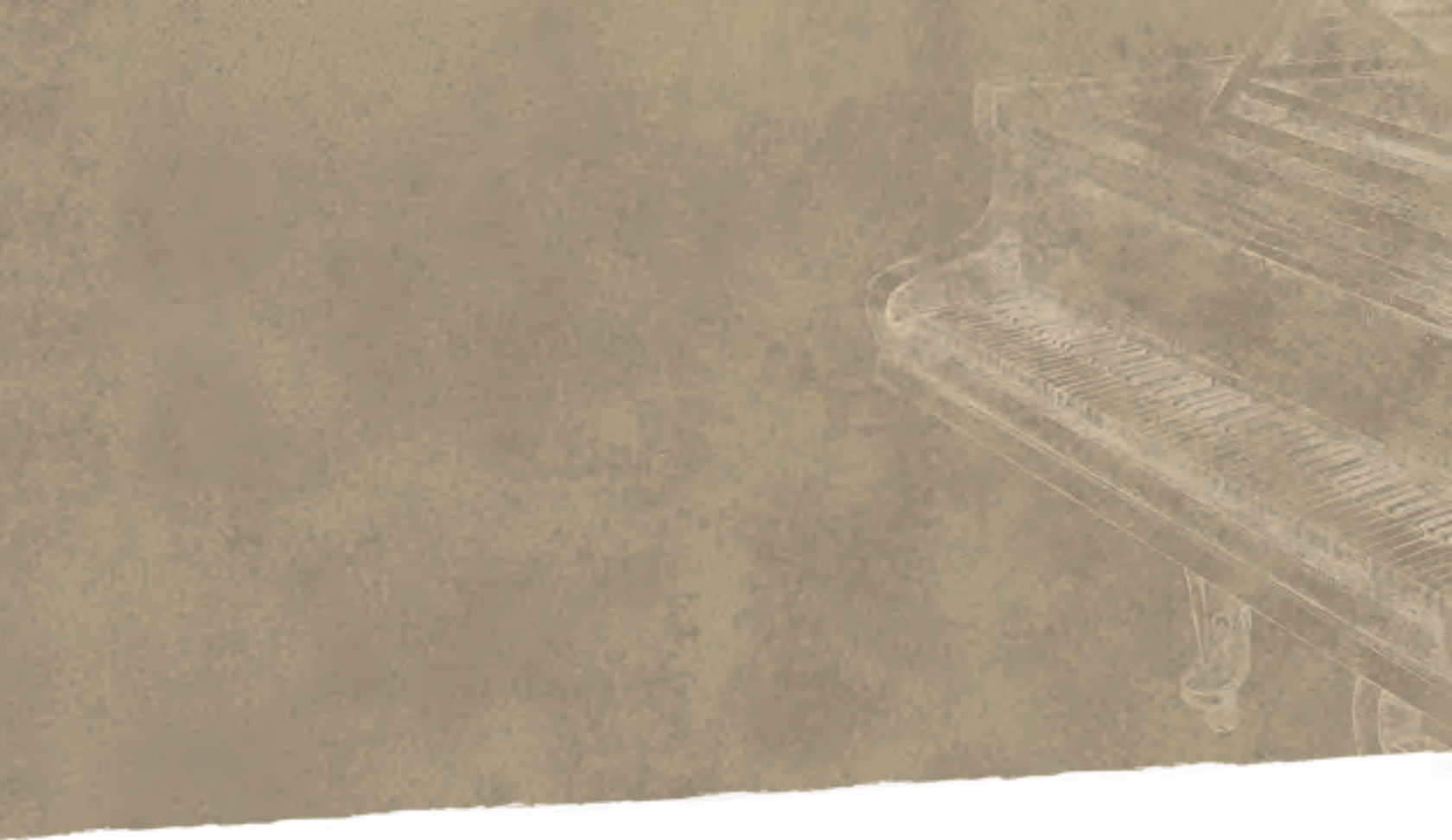
Determining the economic impact of CKD on the healthcare system is challenging on several levels. The case definition is dependent on reported data. A biochemical definition would be the most quantitative, but health plan datasets rarely contain this information on a large scale.

A definition of the CKD cohort using diagnosis codes, however, may represent only the more advanced — and thus most expensive — cases. In addition, CKD is a highly interactive disease, associated with cardiovascular disease, diabetes, stroke, and infectious complications.

Given these limitations, we have developed a method using diagnosis codes to create a point prevalent CKD cohort. In the 2009 ADR, “new” CKD patients were included in order to produce a period prevalent cohort parallel to that created for the ESRD population. These patients, however, accounted for a disproportionate percentage of overall costs, which could not be directly attributed to their CKD status. The reasons for this are numerous, but may include a high rate of acute kidney injury. This year we include only patients classified as having CKD on January 1 of a given year, resulting in a true point prevalent cohort. When compared to the 2009 ADR, costs reported here for CKD patients are thus significantly lower, while those for non-CKD patients are higher. It is unclear which method most accurately depicts true CKD costs. Each has its strengths and weaknesses, and the differences reflect the uncertainty involved in using claims to classify CKD.

We begin by presenting data from Medicare on the chronic diseases associated with the greatest population-level expenditures. Congestive heart failure (CHF), for example, affects 9.6 percent of patients in the fee-for-service population, and accounts for 15.9 percent of costs. Nearly 23 percent of patients have diabetes; 32.4 percent of expenditures go toward their care. And while patients with CKD represent only 7.6 percent of the population, their care accounts for 22.3 percent of total expenditures.

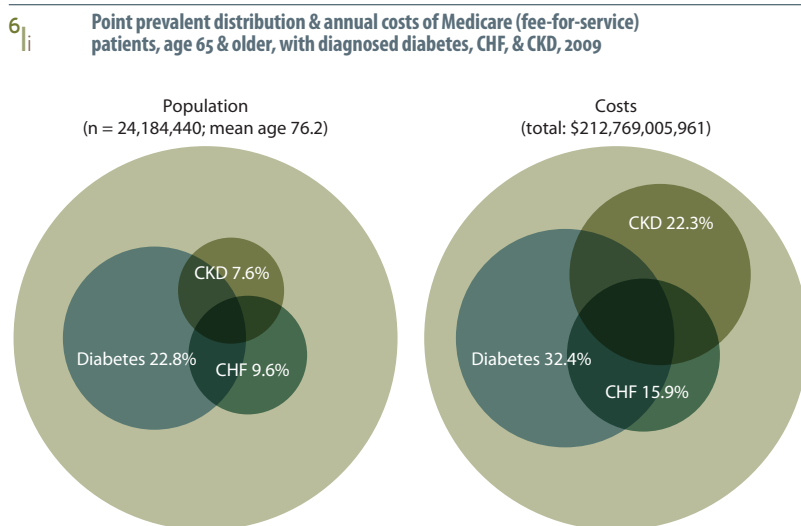
While patients in each of these populations may carry other major diagnoses such as arthritis, cataracts, hip fractures, and chronic lung disease, on a population level these three groups consume very large portions of the Medicare budget. On this basis alone, targeting the CKD population would have a large impact if improvements in care led to reduced hospitalizations, a major source of cost to the healthcare system. Overall, CKD patients incur per person per year (PPPY) costs of just over \$20,000, compared to \$6,800 for patients without ESRD, CKD, diabetes, or CHF (see Reference Table K.5 in this volume). CKD patients who also carry a diagnosis of heart failure incur up to \$35,000 PPPY. These costs approach 40–45 percent of the \$80,000 PPPY incurred by a hemodialysis patient (Figure 11.7, Vol-



ume Two). In addition, costs for inpatient/outpatient and physician/supplier services exceed \$20,000 per person per year, and Part D expenditures add an additional \$3,500 per year. CKD patients thus incur nearly half the costs of the hemodialysis population — a group which, with the exception of some populations with rare diseases, is the most expensive in the Medicare system.

We conclude this chapter with data on the Medicare Part D benefit, a program which began in 2006. In 2008, Part D costs accounted for 14 percent of total Medicare expenditures in the CKD population. CKD patients with both diabetes and congestive heart failure had the highest per person per year Part D expenditures that year, at \$4,645, in contrast to \$1,985 for all Medicare patients. Costs vary considerably in relation to the low income subsidy (LIS); net Part D costs for CKD patients with the LIS are more than three times higher than for their non-LIS counterparts, while out-of-pocket Part D costs range from \$122–\$154 in LIS patients to \$1,218–\$1,383 in patients without LIS. Given the large costs of Part D covered medications in CKD patients, and a relative lack of information on the effect of particular medications in this population, there is substantial opportunity for comparative-effectiveness and cost-effectiveness research using Part D data.

>> **Figure 6.1;** see page 126 for analytical methods. *Populations estimated from the 5 percent Medicare sample using a point prevalent model (see appendix for details). Population further restricted to patients age 65 & older, without ESRD. Diabetes, CHF, & CKD determined from claims; costs are for calendar year 2009.*



In 2009, overall per person per year (PPPY) costs for patients with CKD reached \$20,432 for Medicare patients age 65 and older, and \$16,682 for patients age 50–64 in the MarketScan database. Compared to costs for patients with CKD of Stages 1–2, costs for those with Stage 4–5 CKD were 39 percent greater in the Medicare population and 66 percent higher among MarketScan patients.

Among Medicare patients with both CKD and diabetes, PPPY costs for African Americans reached \$25,166 in 2009, 11.4 percent higher than the \$22,593 incurred by whites. Costs for those with Stage 4–5 CKD were 43 and 34 percent greater, respectively, for African Americans and whites than costs for their counterparts with CKD of Stages 1–2.

In 2009, costs for African American Medicare patients with both CKD and congestive heart failure were 14.8 percent higher than costs for whites with both diagnoses, at \$35,074 and \$30,566, respectively. And for patients with Stage 4–5 CKD, costs were 13.7 and 19 percent higher among whites and African Americans, respectively, than costs in those with CKD of Stages 1–2. >> Figures 6.2–4; see page 126 for analytical methods. *Point prevalent Medicare patients age 65 & older (5 percent Medicare sample, 6.2–4) & MarketScan patients age 50–64 (6.2).*

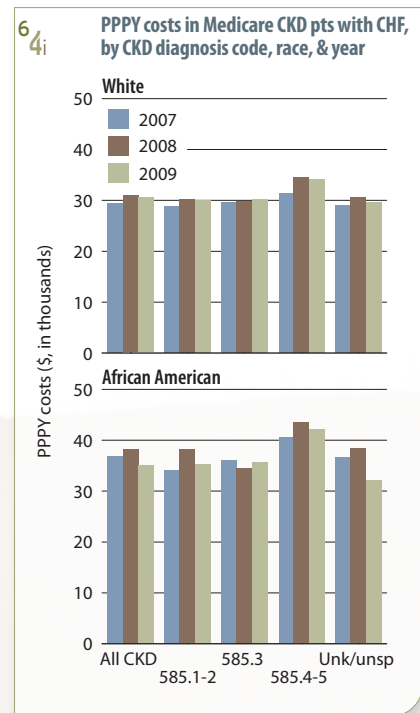
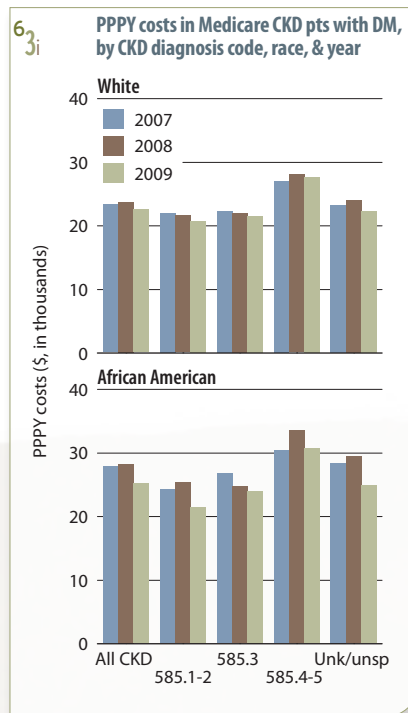
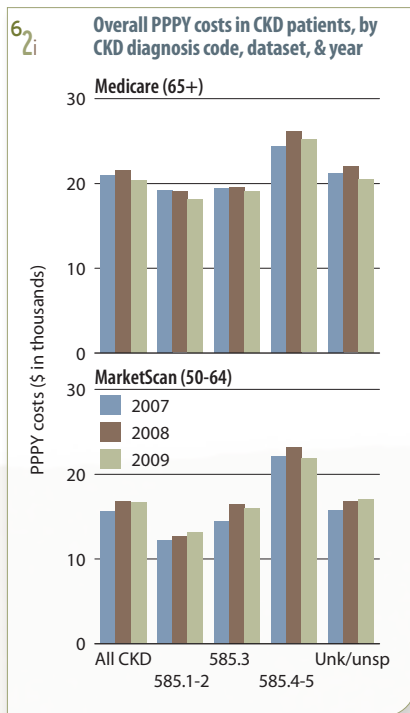
ICD-9-CM CODES

- 585.1 Chronic kidney disease, Stage 1
- 585.2 Chronic kidney disease, Stage 2 (mild)
- 585.3 Chronic kidney disease, Stage 3 (moderate)
- 585.4 Chronic kidney disease, Stage 4 (severe)
- 585.5 Chronic kidney disease, Stage 5 (excludes 585.6: Stage 5, requiring chronic dialysis.)*

Chronic kidney disease, unknown/unspecified

*In USRDS analyses, patients with ICD-9-CM code 585.6 are considered to have code 585.5; see Appendix A for details.

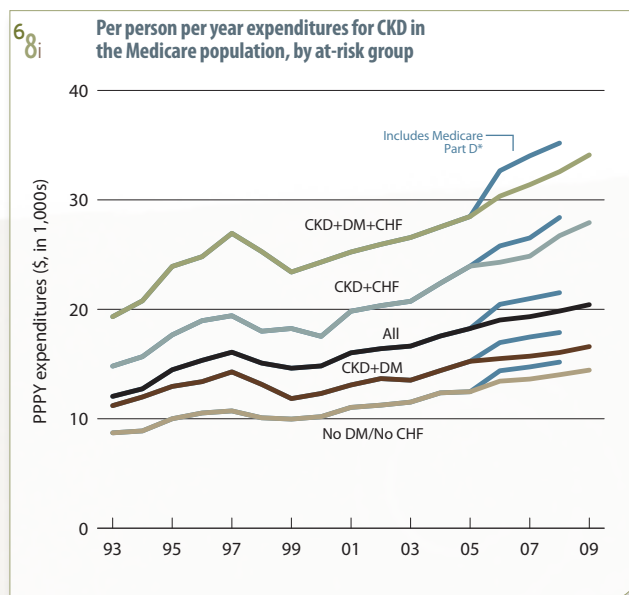
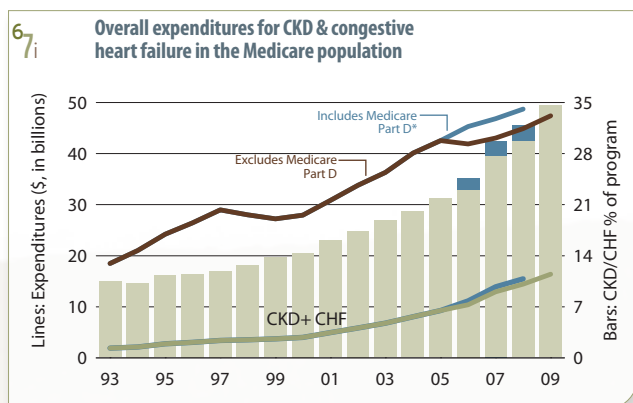
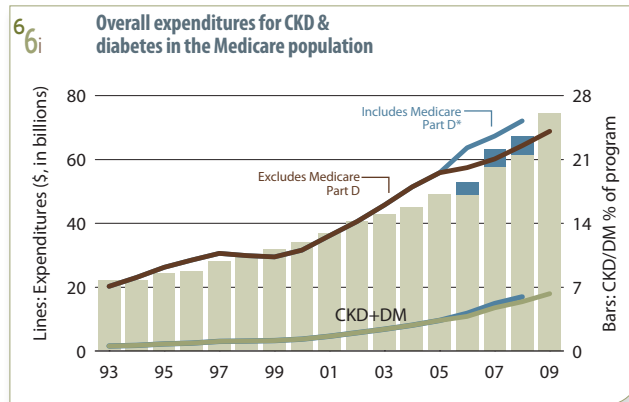
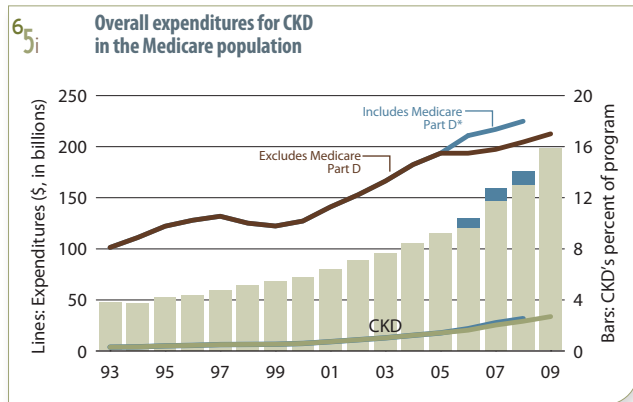
CKD stage estimates are from a single measurement. For clinical case definition, abnormalities should be present ≥ 3 months.



In 1993, costs for Medicare patients with CKD accounted for 3.8 percent of overall Medicare expenditures. In 2009, excluding Medicare Part D drug benefits, costs reached \$34 billion, and accounted for nearly 16 percent of total Medicare dollars.

CKD patients with diabetes accounted for 26.1 percent of total Medicare diabetes costs in 2009, totaling \$18 billion — an eleven-fold increase since 1993. This rise demonstrates the enormous economic burden that diabetes presently imposes on the health-care system, and gives a sense of the future as well; the American Diabetes Association projects that, by 2050, 29 million Americans will be diagnosed with the disease.

Costs for CKD patients with CHF accounted for 34.6 percent of total Medicare CHF dollars in 2009 — \$16 billion of the \$47 billion spent by Medicare on patients with this disease. >> Figures 6.5–7; see page 126 for analytical methods. *Point prevalent Medicare CKD patients age 65 & older. *Medicare Part D data not available for 2009.*



In 2009, per person per year costs (excluding part D) for CKD totaled \$20,432 overall, and were highest in CKD patients with both diabetes and CHF, at \$34,121; costs for CKD patients with no diabetes or CHF, in contrast, totaled \$14,449 — nearly 58 percent lower. >> Figure 6.8; see page 126 for analytical methods. *Point prevalent Medicare CKD patients age 65 & older. *Medicare Part D data not available for 2009.*

6 Per person per year (PPPY) inpatient/outpatient & physician/supplier net costs (dollars) for CKD, by CKD diagnosis code, 2009					
	All CKD	585.1-2	585.3	585.4-5	Unk/unsp
Inpatient/outpatient					
Inpatient					
Medical DRG	2,699.27	2,387.89	2,573.43	3,045.93	2,756.32
Surgical DRG	2,758.89	2,440.22	2,672.09	3,609.14	2,671.49
Other DRG	3,008.03	2,622.84	2,697.00	4,158.71	3,011.24
Inpatient pass-through	182.30	152.21	161.81	250.10	185.25
Outpatient					
OP dialysis	3.54	0.07	0.50	27.14	0.60
OP EPO	56.05	17.22	78.60	177.83	18.89
IV vitamin D	0.33	0.00	0.03	2.78	0.01
IV iron	3.54	1.57	4.64	11.94	1.16
Other injectables	131.47	110.35	106.33	107.92	157.64
OP surgery	222.70	198.55	216.28	270.14	220.02
OP radiology	313.59	272.06	299.10	271.09	340.73
OP laboratory	245.22	204.19	263.35	344.75	216.69
OP pathology	14.48	14.97	14.65	14.40	14.30
Emergency hospital	119.79	107.87	114.85	136.82	121.17
Clinic	87.30	71.67	86.39	97.42	88.26
PT/OT	205.28	184.43	168.22	207.40	233.28
Pharmacy	42.18	42.68	43.19	46.45	40.40
Supplies	214.57	196.63	226.11	228.90	206.61
Other outpatient	273.27	240.58	280.05	300.29	268.10
Skilled nursing facility	2,311.40	1,842.95	1,925.59	2,819.44	2,532.06
Home health agency	1,497.93	1,408.63	1,323.40	1,776.77	1,564.42
Hospice	790.10	603.21	519.06	1,146.87	920.00
Total	15,181.23	13,120.80	13,774.65	19,052.21	15,568.65
Physician/supplier					
Inpatient surgery					
Physician	182.10	184.19	177.79	180.56	184.99
Anesthesia	44.91	44.18	43.50	44.58	46.06
Outpatient surgery					
Physician	451.16	475.68	479.52	415.46	436.31
Anesthesia	50.47	50.61	51.09	45.16	51.28
Nephrologist					
Hospital	61.32	49.05	68.33	144.34	39.08
Outpatient	51.26	51.36	79.76	121.48	15.48
Non-nephrologist					
Hospital	827.04	708.45	751.80	1,104.33	832.58
Outpatient	783.37	794.96	818.59	822.08	748.54
Dialysis	4.65	2.26	2.71	23.24	1.95
Vascular access	11.79	3.04	6.82	69.58	2.94
Peritoneal access	0.20	0.23	0.13	0.91	0.07
Laboratory	241.27	244.11	275.59	312.68	200.81
Pathology	91.57	96.85	96.04	87.41	88.63
Radiology	382.95	364.37	385.67	341.57	394.25
Ambulance	296.82	259.28	249.69	388.40	313.29
Durable medical equipment	260.84	254.78	225.87	292.91	277.72
Prosthetics	54.04	54.83	54.48	55.09	53.35
Diagnostic testing	91.93	95.90	98.33	90.57	87.27
Cardiovascular	135.57	140.12	141.86	138.79	129.79
Physical medicine	69.13	82.07	72.41	56.16	67.73
Ophthalmology	93.08	100.28	98.52	96.07	87.45
Immunosuppress drugs	5.00	4.13	6.57	10.50	2.80
Prescription drugs	567.45	467.53	720.80	761.07	436.41
Other physician/supplier	492.51	495.23	488.77	556.16	479.41
Total	5,250.43	5,023.48	5,394.63	6,159.09	4,978.18
Total inpt/outpt & phy/supplier	20,431.66	18,144.28	19,169.28	25,211.31	20,546.82

Among Medicare patients with chronic kidney disease, per person per year (PPPY) net inpatient/outpatient costs are generally higher for those in a later stage of the disease. In 2009, for example, total costs for patients with Stage 4-5 CKD were 45 percent higher than costs for those in Stages 1-2, at \$19,052 and \$13,120, respectively. Costs associated with medical and surgical DRGs accounted for 35-38 percent of total inpatient/outpatient costs, while home health agency and skilled nursing accounted for 24-26 percent.

Physician/supplier costs in 2009 totaled \$6,159 PPPY for patients with Stage 4-5 CKD, 22.6 percent higher than the \$5,023 for patients with Stage 1-2. Prescription drugs accounted for 9-13 percent of total physician/supplier costs. >> Table 6.a; see page 127 for analytical methods. *Medicare CKD patients age 65 & older, 2009.*

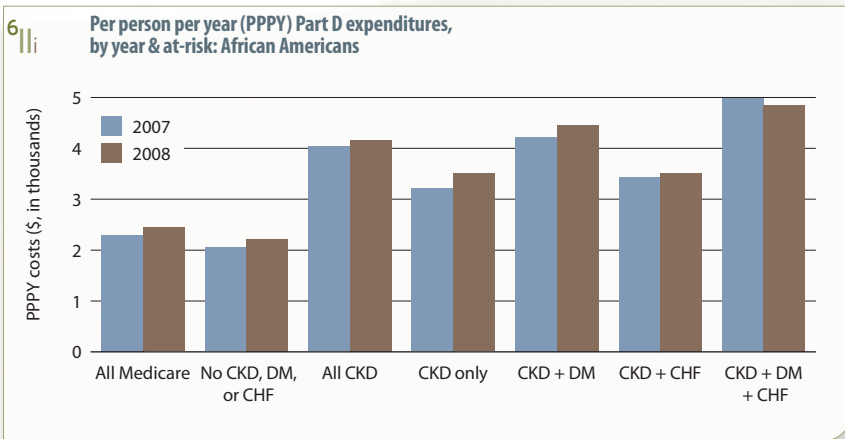
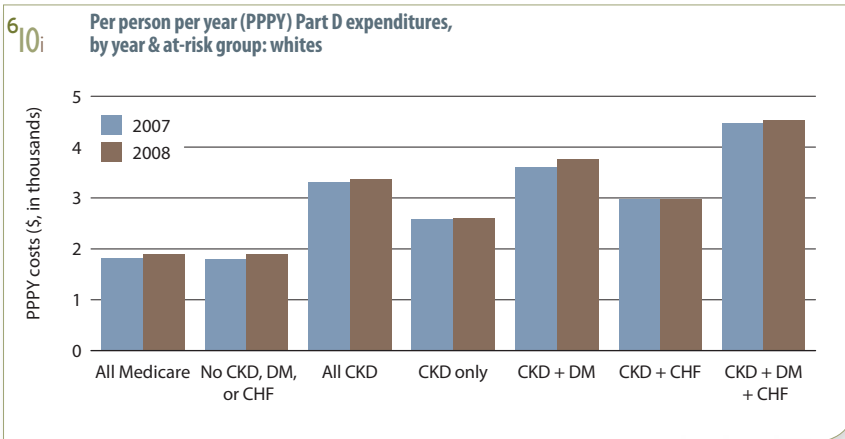
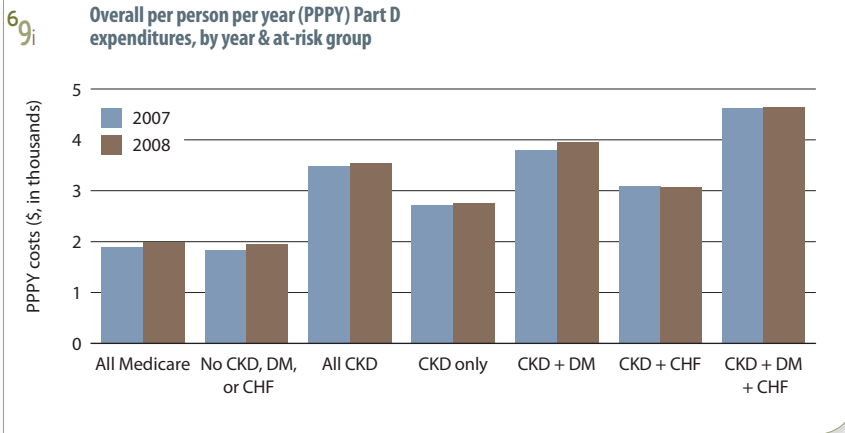
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CKD stage estimates are from a single measurement. For clinical case definition, abnormalities should be present ≥ 3 months.



Between 2007 and 2008, Medicare Part D expenditures per person per year (PPPY) rose 4.4 percent overall and 1.6 percent for patients with CKD, to \$1,985 and \$3,547, respectively. Costs rise with patient complexity, reaching \$3,963 for those with CKD and diabetes, and \$4,645 for those with an additional diagnosis of congestive heart failure (CHF). Costs for patients with no CKD, diabetes, or CHF showed the greatest one-year increase, at 6.3 percent, but these patients were the least costly, with PPPY costs of \$1,944.

At \$4,162 PPPY, Part D drug costs in African American CKD patients were 23.8 percent greater in 2008 than costs among their white counterparts — differences that can be attributed to different levels of LIS coverage. Costs for African Americans with CKD, diabetes, and CHF reached \$4,853, 7 percent greater than the costs incurred by white patients with the same diagnoses. This is important in context of the upcoming implementation of the ESRD prospective payment system, which will include certain oral drugs.

Not all drugs are covered through the Medicare Part D benefit. Notable exclusions particularly relevant to CKD include all over-the-counter medications (e.g. calcium carbonate) and vitamins and minerals (e.g. cholecalciferol, ergocalciferol). Oral vitamin D hormones (calcitriol, paricalcitol, doxercalciferol) are covered under the Part D benefit, but not all plans cover all available products. >> Figures 6.9–11; see page 127 for analytical methods. *Populations & costs estimated from 5 percent Medicare sample; include point prevalent patients with Medicare as primary payor, enrolled in Part D, & not enrolled in Medicare Advantage. CKD, diabetes, & CHF defined from claims. Medicare net pay estimated from Part D as sum of plan payment & low income subsidy.*

In terms of frequency of use, the top 25 drugs covered by Medicare Part D in 2008 represent key cardiovascular drug classes, diabetes agents, gastrointestinal agents, and pain products used in patients with CKD.

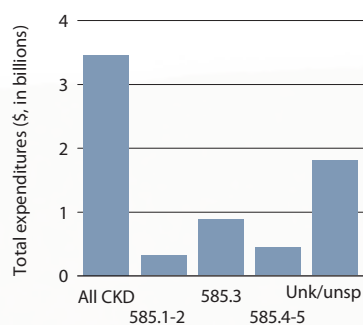
Net cost rankings are based on a combination of frequency of use (based on total days supply) and cost. Metoprolol makes the top 25 list primarily due to frequency of use; total days supply reached nearly 83 million, with a total cost of \$34 million (about \$0.41 per day). Olanzapine (an atypical antipsychotic), in contrast, with a total days supply of 4.2 million, cost \$54 million — about \$13 per day. And in contrast to both of those oral agents, the net cost of epoetin alfa, a parenteral product, was about \$31 per day; data on total days supply for parenteral medications, however, may not be as accurate as data for oral medications.

Total costs for Medicare Part D medications in CKD patients reached \$3.5 billion in 2008, representing 14.4 percent of total Medicare CKD expenses. The proportion varies by CKD stage, with Part D drugs accounting for 17 percent of costs in Stage 1–2 CKD patients, and 13 percent for those with CKD of Stages 4–5. >> Table 6.b & Figures 6.12–13; see page 127 for analytical methods. *Includes Part D claims for all CKD patients, defined from claims on a point prevalent basis, for calendar years 2008. Costs are estimated net pay: sum of plan covered payments & low income subsidy amounts. Counts & costs obtained from 5 percent Medicare sample, & scaled up by a factor of 20 to estimate total Medicare CKD costs.*

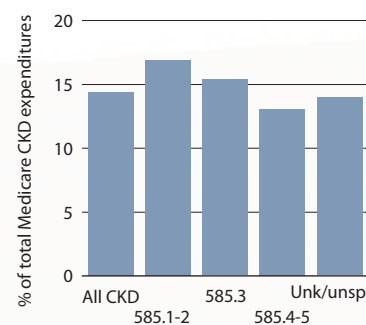
6.b.i Top 25 drugs used in general Medicare Part D enrollees with CKD, by frequency & net cost, 2008

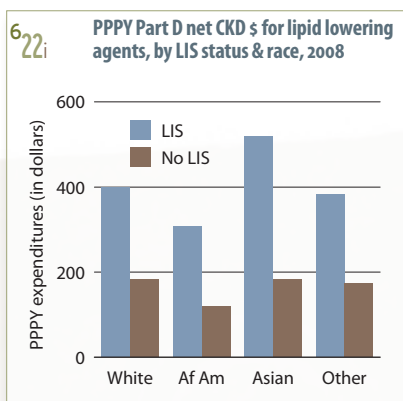
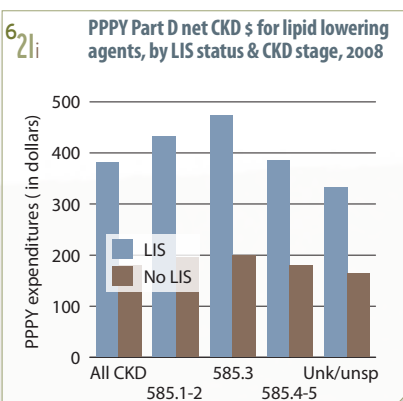
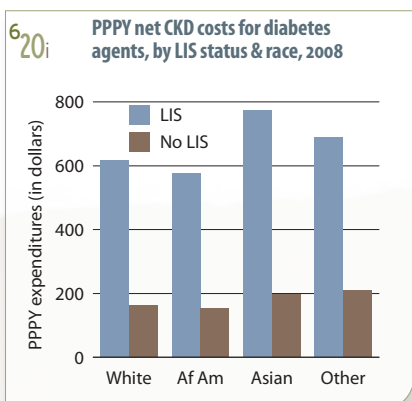
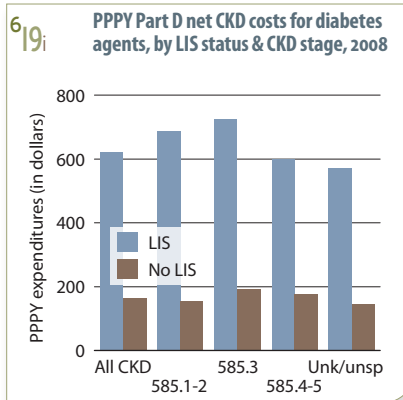
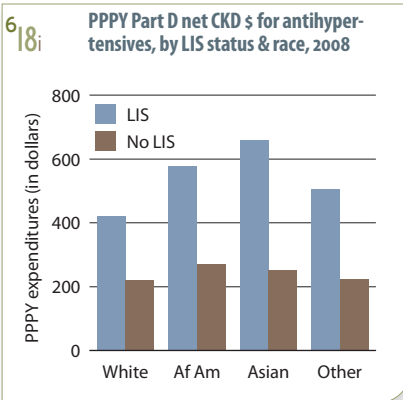
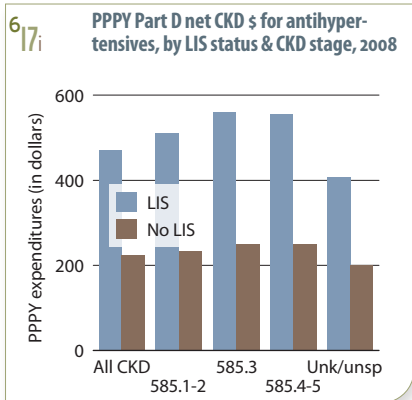
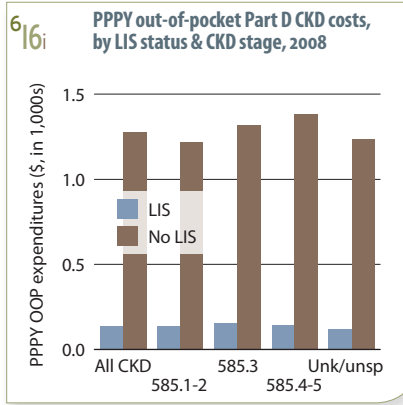
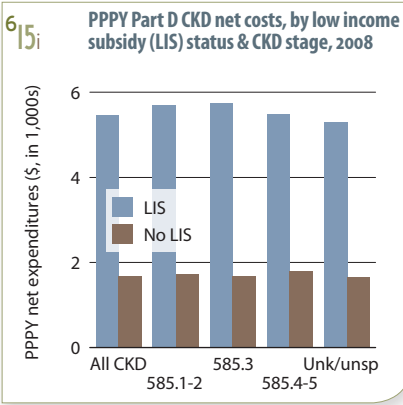
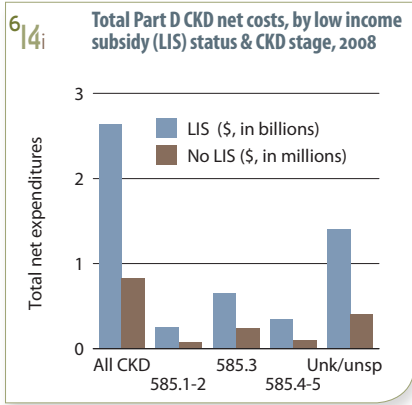
By frequency Generic name	Total days supply	By net cost Generic name	Total days supply	Total cost (dollars)
Furosemide	98,263,980	Insulin	57,306,100	216,338,309
Metoprolol	82,771,680	Clopidogrel bisulfate	42,948,880	147,942,079
Levothyroxine	66,592,840	Atorvastatin	39,770,520	103,917,726
Amlodipine	57,646,460	Esomeprazole	16,890,100	74,884,205
Lisinopril	57,618,380	Donepezil	15,384,400	73,700,764
Insulin	57,306,100	Epoetin alfa	2,347,640	72,171,582
Simvastatin	55,716,900	Pioglitazone	15,295,480	69,714,092
Potassium chloride	49,107,660	Quetiapine	10,274,540	66,579,908
Clopidogrel bisulfate	42,948,880	Fluticasone/salmeterol	10,572,720	58,795,748
Warfarin	40,822,300	Pantoprazole	18,258,040	54,473,602
Atorvastatin	39,770,520	Olanzapine	4,227,440	54,274,719
Omeprazole	38,402,480	Lansoprazole	11,037,940	51,130,307
Carvedilol	31,465,000	Tamsulosin	17,785,220	41,358,016
Allopurinol	28,527,520	Omeprazole	38,402,480	39,837,448
Atenolol	27,094,380	Oxycodone	5,423,060	38,846,363
Isosorbide mononitrate	26,050,360	Valsartan	20,438,180	38,315,357
Hydrochlorothiazide	23,970,640	Risperidone	6,121,000	36,936,794
Glipizide	22,564,140	Memantine	9,217,060	35,619,517
Hydrocodone/acetaminophen	22,022,540	Metoprolol	82,771,680	33,774,508
Metformin	21,258,480	Tiotropium	8,041,340	32,189,884
Gabapentin	21,255,260	Aripiprazole	2,214,080	32,003,516
Digoxin	20,859,600	Escitalopram oxalate	13,436,920	31,238,942
Valsartan	20,438,180	Fentanyl	5,794,640	31,193,936
Clonidine	18,283,520	Simvastatin	55,716,900	29,851,348
Pantoprazole	18,258,040	Lidocaine	3,801,960	29,060,959

6.12: Total Part D costs, by CKD stage, 2008



6.13: Part D costs as a proportion of total Medicare CKD expenditures, 2008





In 2008, overall net Part D CKD costs — a total of \$3.5 billion — were dominated by costs for patients with the low income subsidy (LIS). Per patient per year (PPPY) costs were similar across CKD stage, and varied from \$5,287 in LIS patients with CKD of an unknown/unspecified stage to \$5,734 in those with Stage 3 CKD; costs for these patients were three times higher than those of patients without LIS. Out-of-pocket Part D PPPY costs ranged from \$122–\$154 in LIS patients to \$1,218–\$1,383 in patients without LIS. Figures 6.17–22 illustrate PPPY costs for various drug classes by LIS status and CKD stage or race.

Costs for patients with Stage 3 CKD are higher than for patients with CKD of other stages, and Asian patients with LIS have higher Part D costs than do their counterparts of other races. There is less cost variability in patients without LIS. >> Figures 6.14–22; see page 127 for analytical methods. *Includes Part D claims for all CKD patients, defined from claims on a point prevalent basis, for calendar years 2008. Costs are estimated net pay: sum of plan covered payments & low income subsidy amounts. Costs obtained from 5 percent Medicare sample, & for Figure 6.14 are scaled up by a factor of 20 to estimate total Medicare Part D net costs for CKD.*

PER PERSON PER YEAR COSTS IN MEDICARE CKD PATIENTS WITH DIABETES, 2009

» WHITE \$22,593 » AFRICAN AMERICAN \$25,166 (FIG 6.3)

PER PERSON PER YEAR COSTS IN MEDICARE CKD PATIENTS WITH CONGESTIVE HEART FAILURE, 2009

» WHITE \$30,566 » AFRICAN AMERICAN \$35,074 (FIG 6.4)

OVERALL MEDICARE EXPENDITURES FOR CKD, 2009 \$33.8 billion

EXCLUDES PART D

» 15.9% OF TOTAL MEDICARE DOLLARS » UP FROM 5.8% IN 2000 (FIG 6.5)

MEDICARE EXPENDITURES FOR PATIENTS WITH CKD AND DIABETES, 2009 \$18 billion

EXCLUDES PART D

» 26.1% OF MEDICARE DIABETES DOLLARS » UP FROM 12.0% IN 2000 (FIG 6.6)

MEDICARE EXPENDITURES FOR PATIENTS WITH CKD AND CONGESTIVE HEART FAILURE, 2009 \$16.4 billion

EXCLUDES PART D

» 34.6% OF MEDICARE CHF DOLLARS » UP FROM 14.4% IN 2000 (FIG 6.7)

PER PERSON PER YEAR EXPENDITURES FOR CKD IN THE MEDICARE POPULATION, 2009 \$20,432

EXCLUDES PART D

» NO DM OR CHF \$14,449 » CKD + DM \$16,605 » CKD + CHF \$27,933 » CKD + DM + CHF \$34,121 (FIG 6.8)

PER PERSON PER YEAR MEDICARE PART D EXPENDITURES, 2008 \$1,985

» NO CKD, DM, OR CHF \$1,944 » CKD ONLY \$2,754 » CKD + DM \$3,963 » CKD + CHF \$3,069 » CKD + DM + CHF \$4,645 (FIG 6.9)

ALL CKD

» WHITE \$3,362 » AFRICAN AMERICAN \$4,162 (FIGS 6.10-11)

CKD + DIABETES

» WHITE \$3,765 » AFRICAN AMERICAN \$4,460 (FIGS 6.10-11)

TOTAL MEDICARE PART D CKD COSTS, 2008 3.46 billion

COST IN MILLIONS

» 323 STAGE 1-2 » 883 STAGE 3 » 445 STAGE 4-5 (FIG 6.12)

TOTAL MEDICARE PART D NET COSTS, BY LOW INCOME SUBSIDY (LIS), 2008

LIS

» ALL CKD \$2.6 BILLION » STAGE 1-2 \$248 MILLION » STAGE 3 \$646 MILLION » STAGE 4-5 \$343 MILLION (FIG 6.14)

NO LIS

» ALL CKD \$822 MILLION » STAGE 1-2 \$74 MILLION » STAGE 3 \$237 MILLION » STAGE 4-5 \$102 MILLION (FIG 6.14)