

Willem Blaeu, 1635



Costs of chronic kidney disease



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Determining the economic impact of CKD on the healthcare system is challenging on several levels. There is, for instance, considerable under-recognition of CKD (as noted in Chapters One, Two, and Three), which impacts associated hospitalization costs. 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 and 2010 ADRs, “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 (AKI). In 2012 and this year, we thus continue with the method discussed in the 2011 ADR, including only those patients classified as having CKD on January 1 of a given year. This creates a true point prevalent cohort and reduces the impact of AKI patients, thereby allowing us a more accurate assessment of the chronic disease condition and its associated costs.

When compared to those in 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. Additionally, there is emerging data to indicate that AKI patients have a high probability of underlying CKD and of CKD sustained after hospital discharge. These areas will be the subject of ongoing research to be sure the CKD population’s impact on the health care system is addressed.

We begin the chapter by presenting Medicare data on the chronic diseases associated with the greatest population-level expenditures: diabetes, congestive heart failure (CHF), and CKD. CHF, for example, affects 9.5 percent of patients in the fee-for-service Medicare population, and accounts for nearly 22 percent of expenditures. More than 34 percent of expenditures go toward the 24 percent of patients with diabetes. And patients with recognized CKD, who represent 9.2 percent of the point prevalent population, account for 18.2 percent of total expenditures. Patients with diabetes, CKD, and/or CHF thus account for 32.9 percent of the population, and 50.4 percent of costs. These assessments do not include ESRD patients on dialysis or with a kidney



Whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet... I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree, some time or other, cherish very nearly the same feelings towards the ocean with me.

Herman Melville  
MOBY DICK

transplant, who account for another 6.4 percent of fee-for-service expenditures. The combined CKD and ESRD populations are thus associated with 24 percent of the budget, a number greater than that associated with CHF.

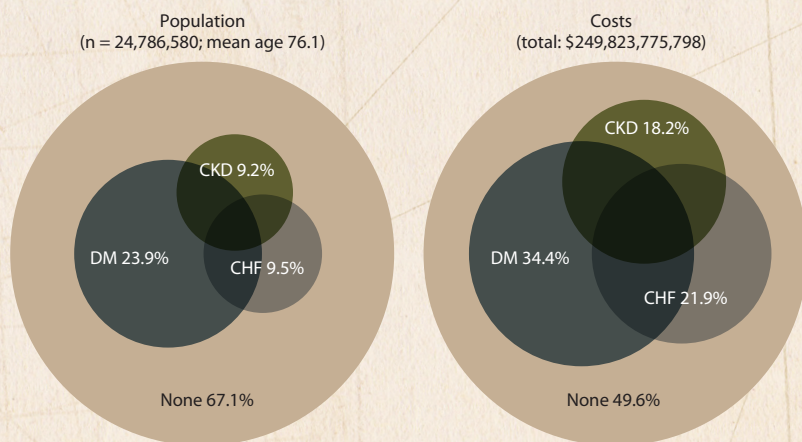
While patients in these three populations may carry other major diagnoses such as arthritis, cataracts, hip fractures, cancer, and chronic lung disease, on a population level they consume large portions of the Medicare budget. On this basis alone, targeting the CKD population would have a significant impact if improvements in care led to reduced comorbidities and hospitalizations. CKD patients incur per person per year (PPPY) costs of \$23,128 (Reference Table K.2), compared to \$11,103 for the average Medicare patient (Table K.1) and to \$8,245 per year for those without CKD, diabetes, CHF, or ESRD (Table K.5). Patients with CKD of Stages 4–5 have yearly expenditures of \$27,715, demonstrating the impact of more advanced disease and its increasing complications. In patients with both Stage 4–5 CKD and congestive heart failure, costs rise to \$37,794 for whites, and \$40,650 for blacks/African Americans. In addition, Part D expenditures account for \$3,367 PPPY. On a per person per year basis, CKD patients overall thus incur nearly half the costs of the hemodialysis population (see Figure 11.7 in Volume Two), a group

which, with the exception of some populations with rare diseases, is the most expensive in the Medicare system.

We next present data on the Medicare Part D program, looking at the low income subsidy (LIS) and at out-of-pocket expenses. In 2011, Part D costs accounted for 8.5 percent of total Medicare expenditures in the CKD population. Out-of-pocket Part D costs vary considerably in relation to the LIS, ranging from \$137–\$155 in LIS patients to \$858–\$1,405 in patients without. Given the large costs of Part D-covered medications in CKD patients, and the observation that ACEI/ARB use is reduced in patients with advancing CKD despite complications from CHF, we need to strive for greater understanding of the risks and benefits of treatment in patients with CKD.

We conclude with data on the probability of receiving the CMS Kidney Disease Education System benefit, introduced in January, 2010. Use of this benefit, which gives pre-ESRD patients the opportunity to actively participate in planning their treatment, remains very low. **• Figure 7.1; see page 147 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 2011.*

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7.1 **Point prevalent distribution & annual costs of Medicare (fee-for-service) patients, age 65 & older, with diagnosed diabetes, CHF, & CKD, 2011**





In 2011, overall per person per year (PPPY) costs for patients with CKD reached \$22,348 for Medicare patients age 65 and older, and \$16,086 for patients age 50–64 in the Truven Health MarketScan (THMS) database. (These costs include Part D.) Compared to costs for patients with CKD of Stages 1–2, costs for those with Stage 4–5 CKD were 42 percent greater in the Medicare population and 81 percent higher among THMS patients.

Among Medicare patients with both CKD and diabetes, PPPY costs for blacks/African Americans reached \$27,651 in 2011, 10.9 percent higher than the \$24,932 incurred by whites. Costs for those with Stage 4–5 CKD were 45 and 39 percent greater, respectively, for blacks/African Americans and whites than were costs for their counterparts with CKD of Stages 1–2.

In 2011, costs for black/African American Medicare patients with both CKD and congestive heart failure were 19.7 percent higher than costs for whites with both diagnoses, at \$40,377 and \$33,735, respectively. And for patients with Stage 4–5 CKD, costs were 18 and 15 percent higher among blacks/African Americans and whites, respectively, than costs in those with CKD of Stages 1–2. + **Figures 7.2–4;** see page 147 for analytical methods. Point prevalent Medicare patients age 65 & older (5 percent Medicare sample, 7.2–4) & Truven HealthMarketScan patients age 50–64 (7.2). Includes Part D.

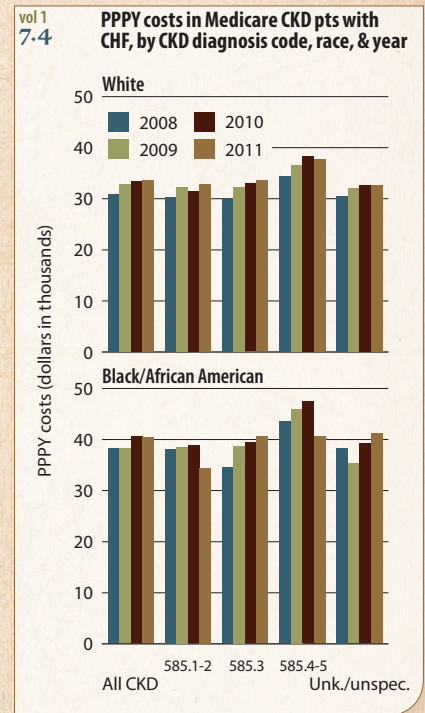
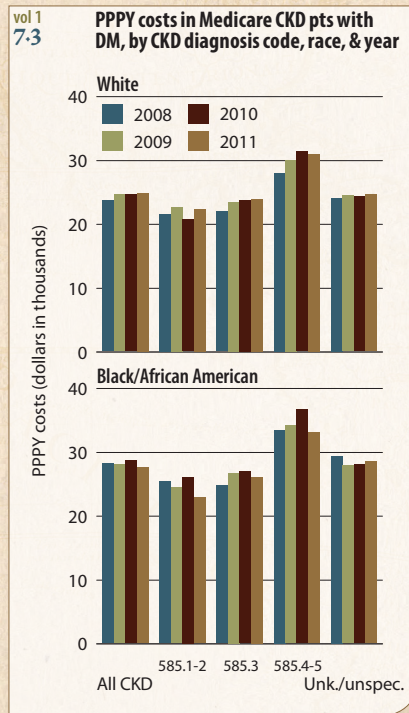
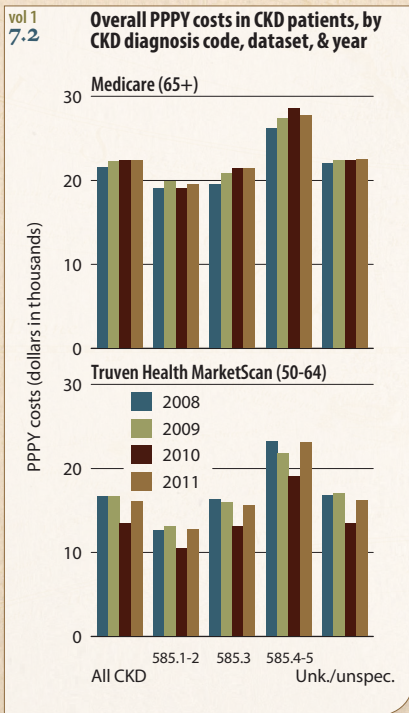
### icd-9-cm codes

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- 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.)

CKD unspecified identified by multiple codes including 585.9, 250.4x, 403.9x, & others.

\*In USRDS analyses, patients with ICD-9-CM code 585.6 & with no ESRD 2728 form or other indication of ESRD 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  $\geq 3$  months.



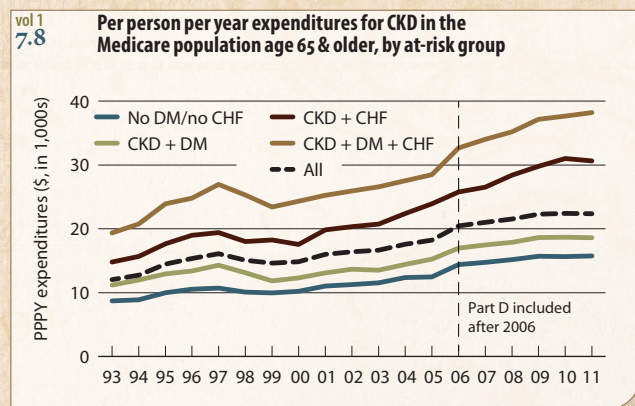
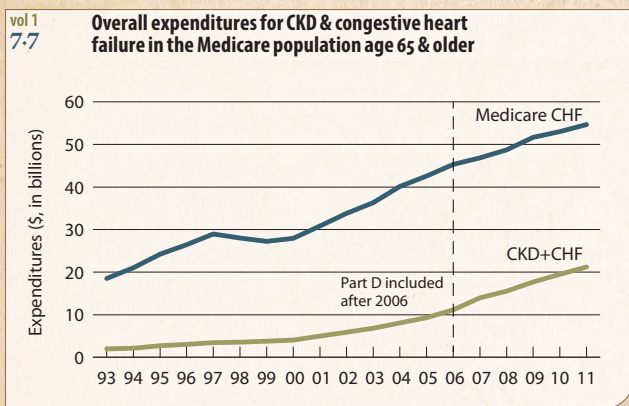
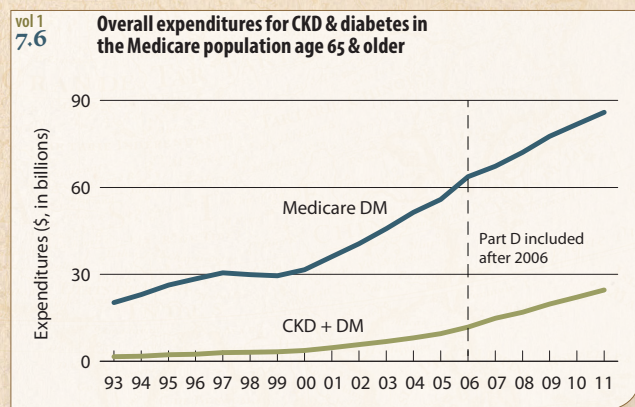
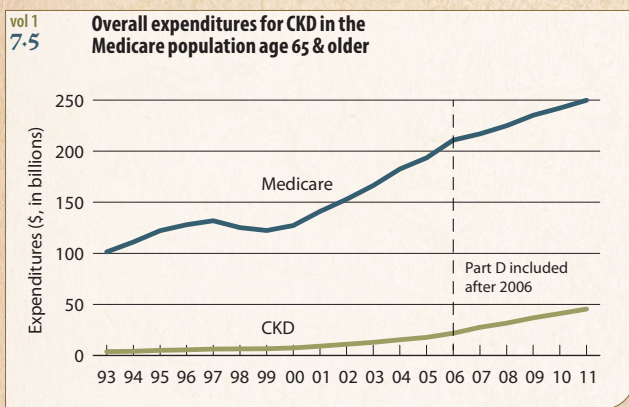


In 1993, total costs for Medicare patients age 65 and older with CKD accounted for just 3.8 percent of overall Medicare expenditures. In 2011, costs for these patients reached \$45.5 billion, 18 percent of total Medicare dollars. Part D expenditures accounted for 1.6 percent of Medicare dollars, up from 1.4 percent in 2010.

Part D expenditures for CKD patients with diabetes accounted for 29 percent of total Medicare diabetes costs in 2011, totaling \$24.6 billion — a sixteen-fold increase since 1993, and one that demonstrates the enormous economic burden that diabetes

imposes on the healthcare system. Total Medicare diabetes costs attributed to Part D increased to 2.4 billion in 2011, accounting for 2.8 percent of Medicare diabetes costs.

Costs for CKD patients with congestive heart failure accounted for 39 percent of total Medicare CHF dollars in 2011 — \$21.2 billion of the nearly \$54.7 billion spent by Medicare on patients with CHF. Part D costs for CKD patients with CHF rose to \$1.5 billion, accounting for 2.8 percent of Medicare CHF costs. ♦ **Figures 7.5–7;** see page 147 for analytical methods. *Point prevalent Medicare CKD patients age 65 & older.*



In 2011, per person per year costs (including Part D) for patients with CKD totaled \$22,348 overall, and were highest in patients with both diabetes and CHF as well, at \$38,202. Costs for CKD patients with no diabetes or CHF, in contrast, totaled \$15,759. ♦ **Figure 7.8;** see page 147 for analytical methods. *Point prevalent Medicare CKD patients age 65 & older. Includes Part D.*

CKD populations exclude patients receiving dialysis.



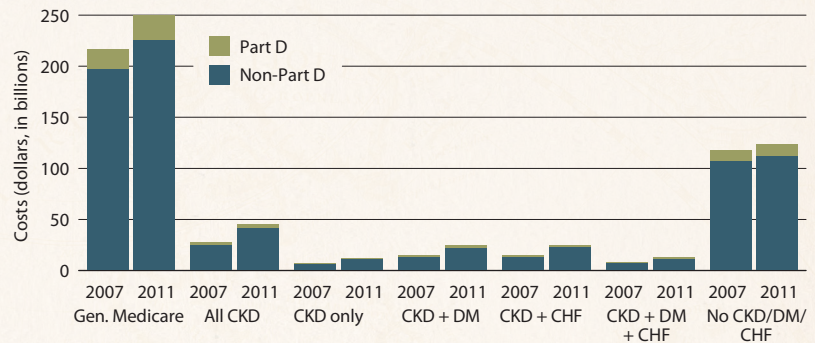
While total Part D costs in the general Medicare population rose just 21 percent between 2007 and 2011, costs for CKD patients grew 77 percent, to \$3.9 billion — approximately 16 percent of total Medicare Part D costs. This growth was due to a combination of rising drug costs and increased recognition of CKD.

The growth in costs between 2007 and 2011 varies by at-risk group. For patients with no CKD, diabetes, or congestive heart failure, costs rose just 8.6 percent. For those with both CKD and diabetes, in contrast, costs in 2011 were 110 percent higher than in 2007.

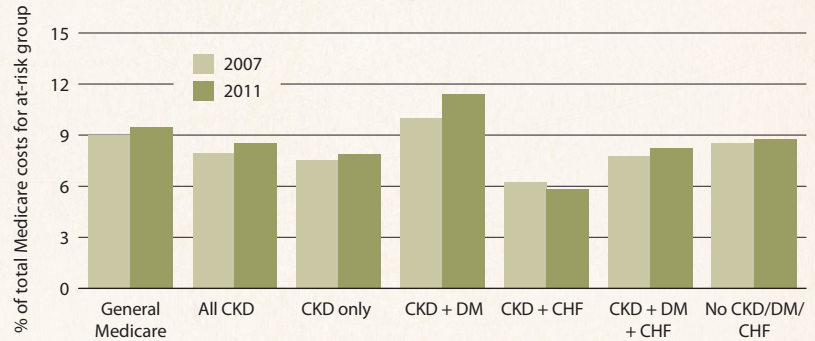
In the CKD population, Part D costs accounted for 8.5 percent of total Medicare costs in 2011, a proportion similar to that seen in the prior year (2012 ADR). The proportion of Part D to total Medicare costs was greatest for patients with CKD and diabetes, at 11.4 percent, and lowest for those with CKD and congestive heart failure, at 5.8 percent. This difference is likely due to the fact that most medications used to treat CHF (beta-blockers, angiotensin converting enzyme inhibitors, and diuretics) are available as generics, while many new, brand-name only insulin products are currently used to manage diabetes.

♦ **Figures 7.9–10;** see page 147 for analytical methods. *Point prevalent Medicare CKD patients age 65 & older, 2007 & 2011; 5 percent Medicare sample.*

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7.9 Overall Medicare Part D & non-Part D costs, by at-risk group & year



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7.10 Part D costs as a proportion of total Medicare costs for each at-risk group, 2007 & 2011



### icd-9-cm codes

- 585.1 Chronic kidney disease, Stage 1
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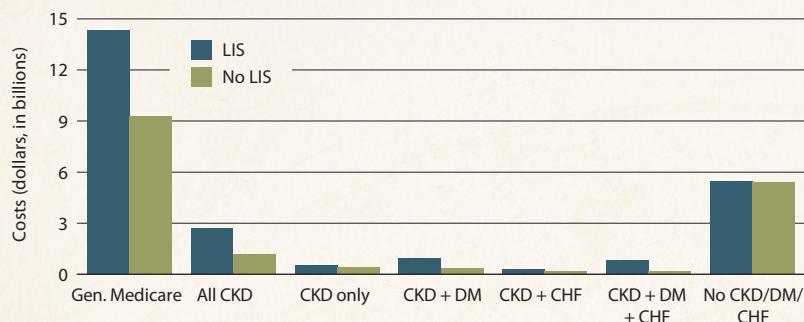
CKD unspecified identified by multiple codes including 585.9, 250.4x, 403.9x, & others.

\*In USRDS analyses, patients with ICD-9-CM code 585.6 & with no ESRD 2728 form or other indication of ESRD 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  $\geq 3$  months.



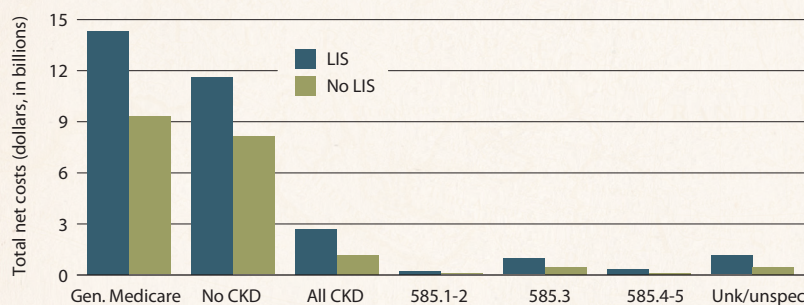
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7.11  
**Total Part D costs, by at-risk group & low income subsidy (LIS) status, 2011**



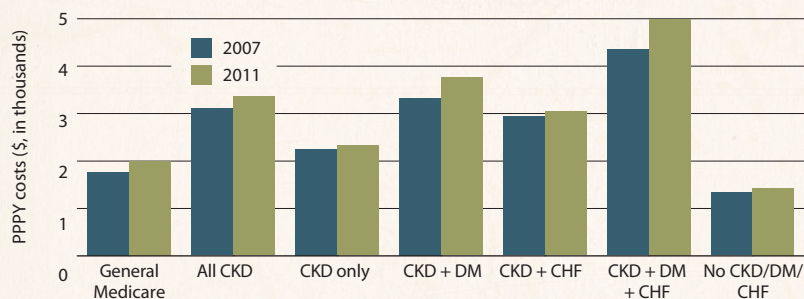
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7.a  
**Total PPPY Part D costs (\$) for Part D enrollees, by LIS status, 2011**

	General Medicare		All CKD	
	LIS	No LIS	LIS	No LIS
All	3,462	1,003	5,486	1,781
65-74	3,474	956	6,314	2,011
75+	3,452	1,061	5,050	1,654
Male	3,565	1,001	5,411	1,836
Female	3,241	1,006	5,522	1,732
White	3,647	1,016	5,631	1,795
Blk/Af Am	3,148	913	4,924	1,497
Other race	3,151	855	5,688	1,881

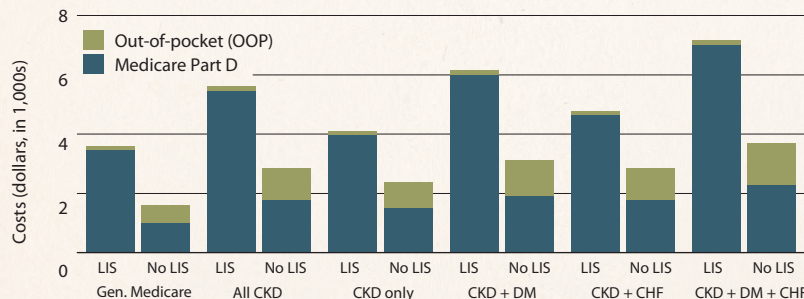
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7.12  
**Total estimated Part D costs, by low income subsidy (LIS) status & CKD diagnosis code, 2011**



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7.13  
**Total per person per year (PPPY) Part D costs, by at-risk group, 2007 & 2011**



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**Per person per year (PPPY) Medicare Part D & out-of-pocket costs, by low income subsidy (LIS) status & at-risk group, 2011**



When total Part D costs are shown by low income subsidy (LIS) status, a larger proportion of Medicare Part D costs are attributable to patients receiving the LIS. Per person per year (PPPY) Part D costs are also greater for patients with the LIS, at \$3,462 and \$5,486 in the general Medicare and CKD populations, respectively, compared to \$1,003 and \$1,781 in their non-LIS counterparts.

While total PPPY Part D costs (including out-of-pocket costs) rose between 2007 and 2011 in both the CKD and general Medicare populations, growth was larger for general Medicare patients, at 13 versus 8 percent. Costs for patients with CKD, diabetes, and CHF rose 15 percent.

Out-of-pocket (OOP) costs in 2011 were higher for CKD patients than for those in the general Medicare population and, in the CKD population, were far lower in patients with the LIS than in those without. The greatest OOP expenses, of \$1,404 PPPY, were borne by patients with CKD, diabetes, and CHF. + Figures 7.11-14 & Table 7.a; see page 147 for analytical methods. 7.11: point prevalent Medicare CKD patients age 65 & older, 2011; 5 percent Medicare sample. 7.12: includes Part D claims for all CKD patients, defined from claims. 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 factor of 20 to estimate total Medicare CKD costs. 7.13-14: point prevalent Medicare CKD patients age 65 & older, 2011. In 7.14, costs are estimated from the Medicare 5 percent sample.

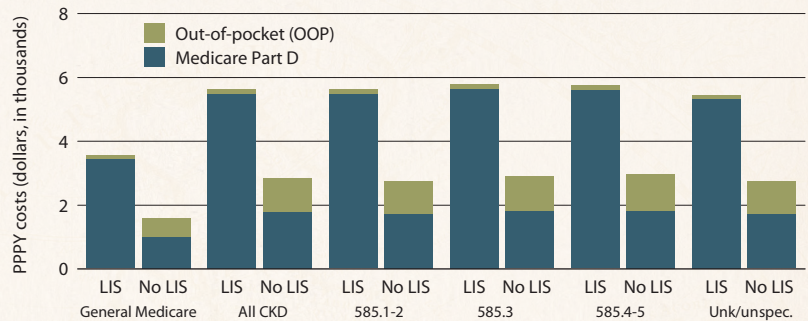
CKD populations exclude patients receiving dialysis.



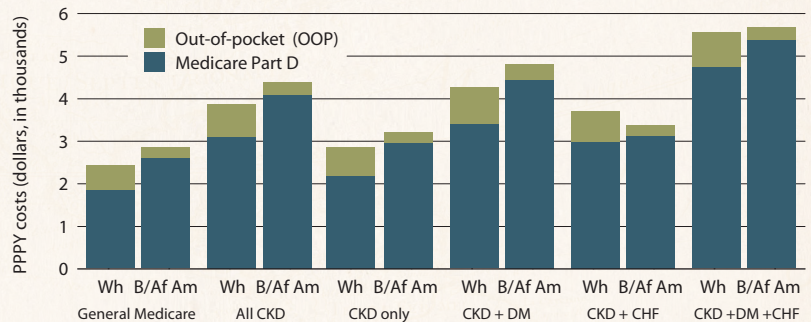
Per person per year (PPPY) Medicare Part D costs are greatest in patients receiving the low income subsidy (LIS), while out-of-pocket (OOP) costs are far higher in non-LIS patients. Average OOP costs in 2011 ranged from \$586 PPPY in general Medicare patients without the LIS to \$1,142 PPPY in patients with CKD of Stages 4–5.

White patients in both the general Medicare and CKD populations have always had higher OOP costs, on average, than blacks/African Americans, as they are less likely to receive the LIS. In 2011, white patients with both CKD and diabetes had the highest OOP costs, at \$849 PPPY. OOP expenses in non-LIS patients, however, will continue to fall as the coverage gap continues to phase out. • **Figures 7.15–16**; see page 147 for analytical methods. *Point prevalent Medicare CKD patients age 65 & older, 2011.*

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7.15 Per person per year (PPPY) Medicare Part D & out-of-pocket costs, by low income subsidy (LIS) status & CKD diagnosis code, 2011



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7.16 Overall per person per year (PPPY) Medicare Part D & out-of-pocket costs, by race & at-risk group, 2011



### icd-9-cm codes

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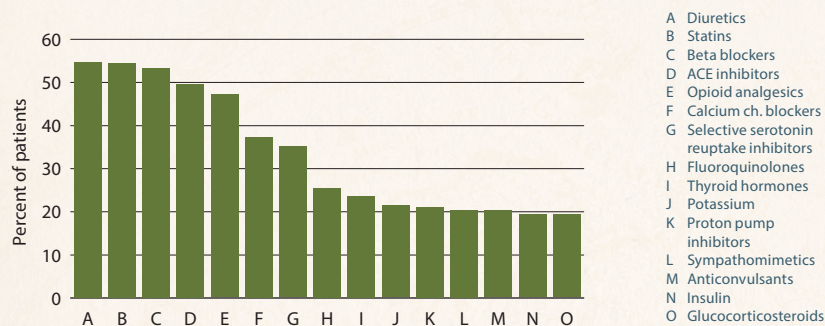
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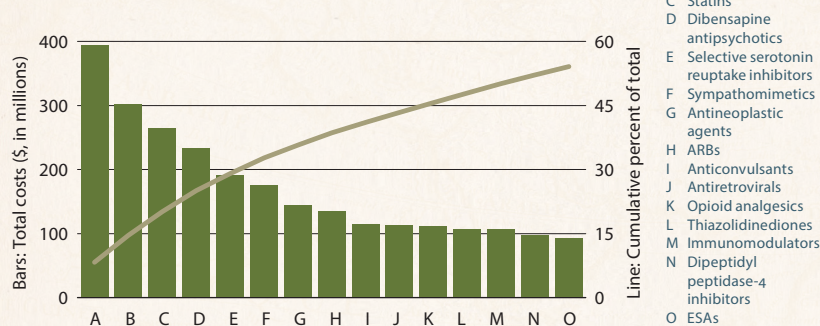
CKD stage estimates are from a single measurement. For clinical case definition, abnormalities should be present ≥3 months.



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7.17 **Top 15 drug classes used by Part D enrollees with CKD, by percent of patients & drug class, 2011**



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7.18 **Top 15 drug classes used by Part D enrollees with CKD, by net costs & drug class, 2011**



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7.b **Top 15 drugs used by Part D enrollees with CKD, by percent of patients & net cost, 2011**

Generic name	Percent of patients	Generic name	Total cost (dollars)
Furosemide	38.7	Insulin	394,404,860
Simvastatin	29.4	Clopidogrel	277,601,420
Hydrocodone	29.4	Atorvastatin	142,820,280
Amlodipine	28.1	Quetiapine	135,719,520
Lisinopril	25.2	Esomeprazole	129,682,620
Levothyroxine	25.1	Fluticasone/salmeterol	100,221,540
Omeprazole	23.9	Pioglitazone	98,567,500
Potassium chloride	22.1	Lenalidomide	90,704,140
Ciprofloxacin	20.2	Olanzapine	89,710,740
Azithromycin	18.6	Sitagliptin	80,352,180
Metoprolol tartrate	18.4	Tiotropium	78,010,940
Clopidogrel	15.7	Memantine	76,562,900
Carvedilol	15.4	Rosuvastatin	74,643,660
Prednisone	15.0	Valsartan	65,418,300
Warfarin	15.0	Aripiprazole	65,383,400

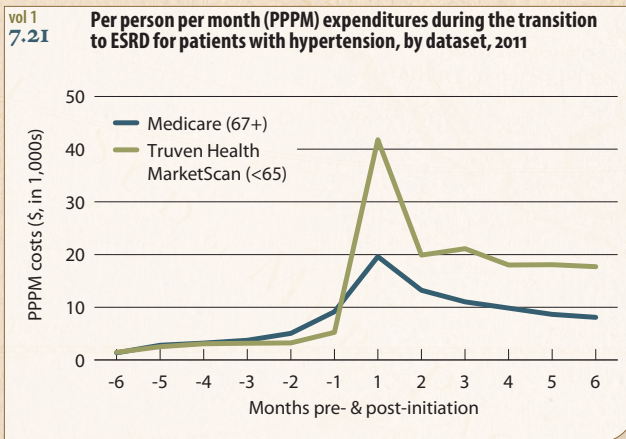
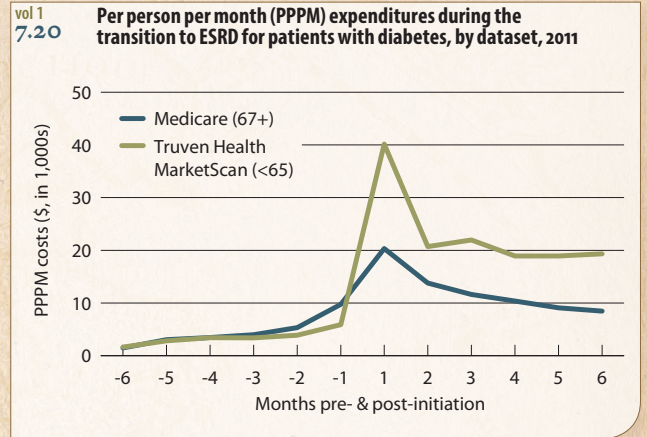
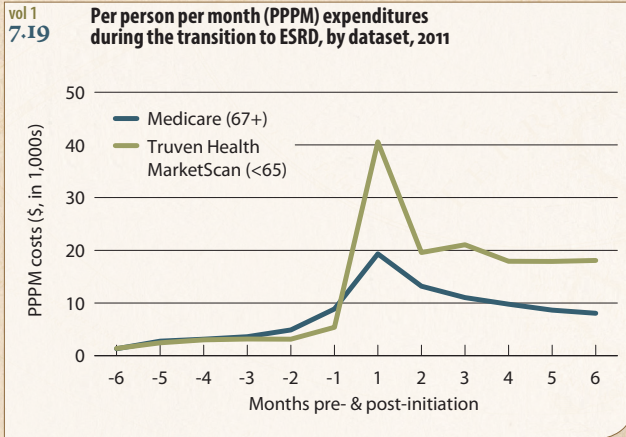
Diuretics, statins, and beta blockers are three classes of drugs used by 53–55 percent of Part D enrollees with CKD, while ACE inhibitors and opioid analgesics are used by 50 and 47 percent, respectively. More than a third of enrollees use a calcium channel blocker or a selective serotonin reuptake inhibitor. Fluoroquinolones, thyroid hormones, potassium, proton pump inhibitors, sympathomimetics, and anticonvulsants are used by 20–26 percent of enrollees with CKD, and 19 percent use insulin or glucocorticosteroids.

Insulin and antiplatelet drugs are the two most costly classes of drugs used by Part D enrollees with CKD, at \$394 and \$302 million, respectively, and account for nearly 15 percent of total net costs, while statins and dibenzapine antipsychotics account for \$264 and \$232 million, nearly 11 percent of total costs. Erythropoiesis stimulating agents round out the top fifteen drug classes, and with costs of \$92 million account for just under 2 percent of total Part D CKD drug costs.

Furosemide, a loop diuretic, is the most frequently used drug in CKD patients, at 39 percent. Simvastatin, a drug used to control hypercholesterolemia, and hydrocodone, an opioid analgesic, are used by nearly 30 percent of patients with CKD, while amlodipine and lisinopril — medications used to treat high blood pressure — are used by 28 and 25 percent, respectively. Insulin is the most costly drug used by CKD patients, alone accounting for over 8 percent of total Part D CKD drug costs. ♦ Figures 7.17–18 & Table 7.b; see page 147 for analytical methods. Medicare patients with CKD; costs scaled up by a factor of 20 to estimate totals.

CKD populations exclude patients receiving dialysis.

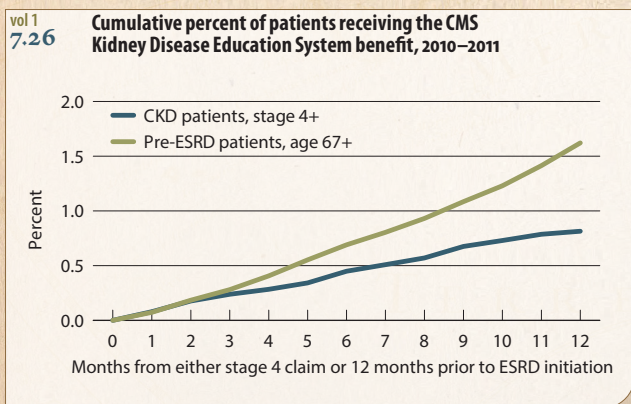
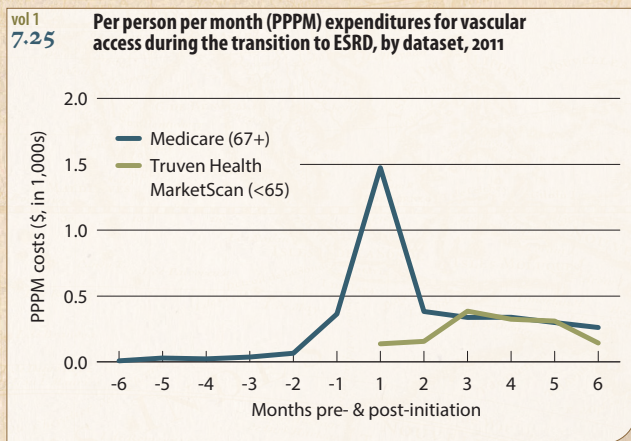
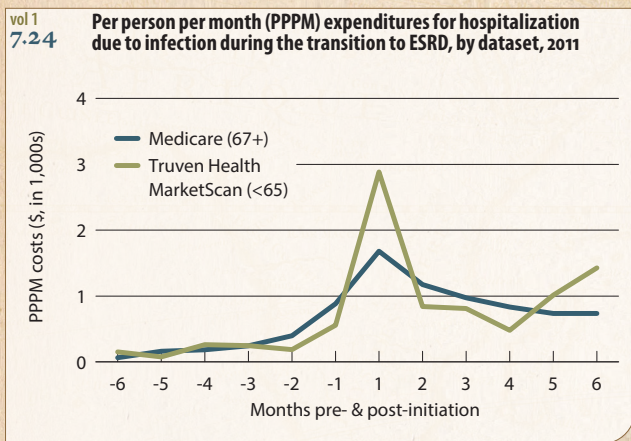
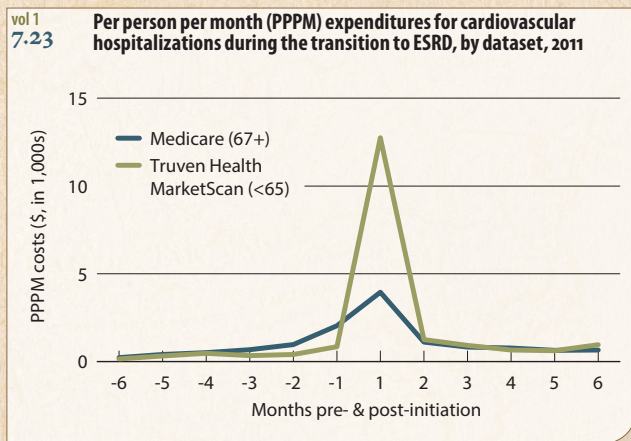
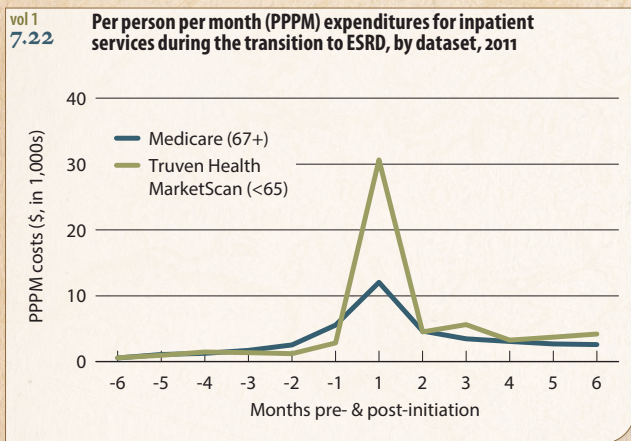




Among patients incident in 2011, total per person per month (PPPM) costs in the month following ESRD initiation reached \$19,343 for Medicare patients age 67 and older, compared to \$40,578 for those younger than 65 in the Truven Health MarketScan (THMS) program — 2.1 times greater. Costs during this month for patients with diabetes were two times higher for THMS patients, at \$40,151 compared to \$20,340. Among patients with hypertension, Medicare costs in the first month of ESRD were \$19,635 compared to THMS costs of \$41,816 — a 2.1-fold difference. + Figures 7.19–21; see page 148 for analytical methods. Medicare (age 67 & older) & Truven Health MarketScan (younger than 65) ESRD patients, initiating in 2008.



For 2011 incident patients, inpatient costs during the first month of ESRD were 2.5 times higher for Truven Health MarketScan (THMS) patients younger than 65 than for their Medicare counterparts age 67 and older, at \$30,621 compared to \$12,044. PPPM costs for cardiovascular hospitalizations in the month following initiation reached \$12,751 and \$3,954, respectively, for THMS and Medicare patients, while costs related to infection reached \$2,884 and \$1,678. Vascular access costs in the month following ESRD initiation, in contrast, were 11-fold higher for Medicare patients compared to THMS patients, at \$1,475 and \$137.25, respectively, but were generally comparable in months 2–6 following initiation. • **Figures 7.22–25**; see page 148 for analytical methods. *Incident Medicare (age 67 & older) & Truven Health MarketScan (younger than 65) ESRD patients, 2011.*



On January 1, 2010, CMS added Kidney Disease Patient Education System services as a benefit to Medicare beneficiaries diagnosed with Stage 4 CKD. The service provides patients with information on comorbidity, treatment in the prevention of uremia, and choices for renal replacement therapy should the need arise. The education benefit can be individualized giving each patient the opportunity to actively participate in their treatment choices. Pre-ESRD patients (those who initiate renal replacement therapy) are more likely to utilize the education benefit than those with Stage 4 CKD, but overall, the benefit is used by less than 2 percent of patients. • **Figure 7.26**; see page 148 for analytical methods. *General Medicare patients with CKD age 65 & older, & pre-ESRD patients age 67 or older at initiation of ESRD.*

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## costs of chronic kidney disease

PER PERSON PER YEAR COSTS IN MEDICARE CKD PATIENTS WITH DIABETES, 2011 (FIGURE 7.3)

white: \$24,932; black/African American: \$27,651

PER PERSON PER YEAR COSTS IN MEDICARE CKD PATIENTS WITH CONGESTIVE HEART FAILURE, 2011 (FIGURE 7.4)

white: \$33,735; black/African American: \$40,377

OVERALL MEDICARE EXPENDITURES FOR CKD, 2011 (FIGURE 7.5)

45.5 billion (includes Part D)

MEDICARE EXPENDITURES FOR PATIENTS WITH CKD & DIABETES, 2011 (FIGURE 7.6)

\$24.6 billion (includes Part D)

MEDICARE EXPENDITURES FOR PATIENTS WITH CKD & CONGESTIVE HEART FAILURE, 2011 (FIGURE 7.7)

\$21.2 billion (includes Part D)

PER PERSON PER YEAR COSTS FOR CKD IN THE MEDICARE POPULATION, 2011 (FIGURE 7.8)

all CKD: \$22,348 (includes Part D)

no DM or CHF: \$15,759; CKD + DM: \$18,611; CKD + CHF: \$30,619; CKD + DM + CHF: \$38,202

## part d costs

OVERALL MEDICARE PART D & NON-PART D COSTS, BY AT-RISK GROUP, 2011 (IN BILLIONS; FIGURE 7.9)

	general Medicare	all CKD	CKD only	CKD DM	CKD + CHF	CKD + DM+ CHF	no CKD/DM/CHF
non Part D	\$226	\$41.6	\$11.5	\$10.4	\$7.9	\$11.8	\$11.3
Part D	\$23.6	\$3.9	\$0.99	\$1.3	\$0.49	\$1.1	\$10.9

PART D COSTS AS A PROPORTION OF TOTAL MEDICARE COSTS FOR EACH AT-RISK GROUP (IN BILLIONS; FIGURE 7.10)

	general Medicare	all CKD	CKD only	CKD DM	CKD + CHF	CKD + DM+ CHF	no CKD/DM/CHF
2007	9.0%	7.9%	7.6%	9.9%	6.3%	7.7%	8.5%
2011	9.5%	8.5%	7.9%	11.4%	8.3%	8.3%	8.8%

TOTAL ESTIMATED PART D COSTS, BY LOW INCOME SUBSIDY (LIS) STATUS, 2011 (IN BILLIONS; FIGURE 7.12)

	general Medicare	no CKD	all CKD	Stages 1-2	Stage 3	Stages 4-5
LIS	\$14.3	\$11.6	\$2.7	\$0.23	\$0.97	\$0.34
no LIS	\$9.3	\$8.1	\$1.2	\$0.10	\$0.48	\$0.13

TOTAL PER PERSON PER YEAR (PPPY) PART D COSTS, BY AT-RISK GROUP, 2011 (FIGURE 7.13)

general Medicare: \$2001; all CKD: \$3,367; CKD only: \$2,333; CKD + DM: \$3,766;

CKD + CHF: \$3,045; CKD + DM + CHF: \$5,012; no CKD/DM/CHF: \$1,434

## expenditures during the transition to esrd

PER PERSON PER MONTH (PPPM) EXPENDITURES DURING THE TRANSITION TO ESRD, 2011 (FIGURE 7.19)

	one month pre-initiation	one month post-initiation	six months post-initiation
Medicare (age 67+)	\$8,901	\$19,343	\$8,058
Truven Health MarketScan (age <65)	\$5,406	\$40,578	\$18,120

PER PERSON PER MONTH COSTS DURING THE TRANSITION TO ESRD FOR PATIENTS WITH DIABETES, 2011 (FIGURE 7.20)

	one month pre-initiation	one month post-initiation	six months post-initiation
Medicare (age 67+)	\$9,748	\$20,340	\$8,476
Truven Health MarketScan (age <65)	\$5,911	\$40,151	\$19,348

PER PERSON PER MONTH COSTS FOR INPATIENT SERVICES DURING THE TRANSITION TO ESRD, 2011 (FIGURE 7.22)

	one month pre-initiation	one month post-initiation	six months post-initiation
Medicare (age 67+)	\$5,562	\$12,044	\$2,603
Truven Health MarketScan (age <65)	\$2,848	\$30,621	\$4,191

