

Chapter 7:

Healthcare Expenditures for Persons with CKD

- In this 2018 Annual Data Report (ADR), we introduce information from the Optum Clinformatics™ DataMart for persons with Medicare Advantage and commercial managed care coverage. This will provide a more comprehensive examination of the financial costs necessary to provide care to beneficiaries with chronic kidney disease (CKD).
- Medicare spending for all beneficiaries who had CKD (12.5% of total) exceeded \$79 billion in 2016, an increase of 23% from 2015 (Tables 7.1 and 7.3). When adding an extra \$35 billion for end-stage renal disease (ESRD) costs (see Volume 2, Chapter 9: Healthcare Expenditures for Persons with ESRD, Figure 9.2), total Medicare spending on both CKD and ESRD was over \$114 billion, representing 23% of total Medicare fee-for-service (FFS) spending.
- In 2016, Medicare spending for beneficiaries with CKD aged 65 and older exceeded \$67 billion, representing 25% of all Medicare spending in this age group (Figure 7.1). Medicare expenditures for CKD were 20% higher in 2016 than in 2015 (\$55 billion). This was mostly due to an 18% increase in the ascertainment of CKD.
- Medicare spending for beneficiaries with CKD who were younger than age 65 (8% of total) exceeded \$12 billion in 2016, representing 18% of total spending in this age group (Table 7.3).
- Growth in total CKD spending has primarily been driven by an increase in the number of identified cases, particularly those in the earlier stages (CKD Stages 1-3).
- Over half of the 2016 Medicare spending for beneficiaries aged 65 and older was for those who had diagnoses of CKD, diabetes mellitus (DM), or heart failure (HF; Figure 7.1).
- Over 78% of total Medicare spending for beneficiaries with CKD who were aged 65 and older was incurred by the 71% of these patients who also had DM, HF, or both (Table 7.1).
- Spending per patient-year for those with all three chronic conditions of CKD, DM, and HF was more than twice as high (\$39,506) than for beneficiaries with only CKD (\$16,176; Table 7.1).
- Per-person per-year spending for Medicare Advantage enrollees over age 65 and those enrolled in Optum Clinformatics™ managed care over age 65 was slightly higher, at 79% and 123% of the expenditures for FFS Medicare (Table 7.2).
- For beneficiaries under age 65, spending was somewhat higher in the Medicare Advantage program than in FFS Medicare, both when averaged across all beneficiaries (12% higher) and among all those with CKD (6% higher; Table 7.3).
- In the FFS Medicare CKD population, Black/African American beneficiaries continued to exhibit higher spending in all disease categories as compared to Whites and those of other races (Table 7.5). However, Blacks with Medicare Advantage had lower spending than patients of other races (Table 7.6).
- The analysis of expenses for beneficiaries with CKD indicates the effect of cost-containment efforts in this population, and avenues for potential savings. Reduction in expenditures could be achieved through the prevention of disease progression to later stages of CKD, and prevention of the development of concurrent chronic conditions such as DM and HF.

Introduction

Persons with chronic kidney disease (CKD) but not end-stage renal disease (ESRD) often have extensive healthcare needs and frequently face co-existing illnesses. This chapter assesses the overarching financial cost of caring for persons with CKD through comparison of expenditures in three payment systems. As in previous Annual Data Reports (ADR), the Medicare 5% sample was used to determine spending for Medicare fee-for-service (FFS) beneficiaries. In this chapter, we present recent patterns and longer-term trends in both total claims-based spending and spending by CKD status, patient characteristics such as age, sex, and race, and diabetes mellitus (DM) and heart failure (HF) status.

In this 2018 ADR, we add comparable information from the Optum Clinformatics™ DataMart for persons enrolled in Medicare Advantage and through a large commercial managed care organization. The percent of Medicare beneficiaries enrolled in managed care grew from 13% in 2004 to 33% in 2017 (Kaiser, 2017); 19.0 million individuals were enrolled in an Medicare Advantage plan in March 2017. Addition of this dataset makes our assessment of CKD spending significantly more comprehensive, particularly for the CKD population aged 65 and older. Similarly, the addition of commercial insurance data allows more complete assessment of CKD spending, particularly for those younger than age 65, as commercial insurance was the largest source of payment for this group.

While our analyses provide a sound and valid estimate of the costs of CKD to healthcare systems, when interpreting spending levels and trends in these claims data, the impact of potential under-identification should be kept in mind. Unlike ESRD, where determination is straightforward due to the need for renal replacement services, CKD can be under-identified. There may be valid under-recognition that occurs when patients who have impaired renal function have not yet been tested. Claims-based under-identification can also occur

when patients who have been tested and identified clinically do not have a CKD diagnosis listed on an insurance claim. Such under-identification makes the determination of the full economic impact of CKD on a healthcare system challenging.

Under-recognition of CKD can affect estimates of CKD-related expenditures in several ways. Identification of persons with CKD using ICD-9-CM and ICD-10-CM (International Classification of Diseases, Ninth and Tenth Revision, Clinical Modification) diagnosis codes will result in an underestimate of total CKD expenditures, as early in the disease process formal diagnoses of CKD are not commonly documented or may not even have been identified clinically (Grams, 2011). Assuming that under-identification occurs most often in the earliest and least costly patient cases, spending estimates per patient per year (PPPY) calculated solely from the claims-based diagnoses of CKD are likely to be biased upwards. To the extent that under-identification is not constant over time, interpretation of trend data for both total and PPPY expenditures should be made in this context.

In addition, it is not possible to attribute healthcare expenditures solely to kidney disease with any accuracy; the costs of CKD are influenced by its interactive nature and associations with other chronic conditions such as DM and hypertension (HTN), and with cardiovascular diseases (CVD) such as coronary artery disease, cerebrovascular disease, peripheral arterial disease, and HF. In order to understand better the complexity of how these conditions contribute to costs, we often present and compare results for patients with varying combinations of CKD, DM, and HF.

Similar issues of CKD under-identification are also discussed in this 2018 ADR in the following chapters in Volume 1: Chapter 1: CKD in the General Population; Chapter 2: Identification and Care of Patients with CKD; and Chapter 3: Morbidity and Mortality in Patients with CKD.

Methods

This chapter uses data from three primary sources including beneficiaries of general Medicare, those enrolled in Medicare Advantage plans, and a cohort of individuals enrolled in a commercial managed care plan.

The Medicare 5% sample provides information on FFS beneficiaries aged 66 and older. Roughly 98% of Americans aged 65 and older qualify for Medicare, and as a result, analysis of Medicare data is representative of beneficiaries age 65 and older.

Medicare prescription drug coverage through Part D plans is also included in this chapter. Note that beneficiaries have many options to purchase prescription drugs, so the claims filled through the Part D plan may not represent all medications prescribed to Medicare beneficiaries.

In addition to reporting on the population aged 65 and older, beginning in 2014, we have added information on beneficiaries younger than 65 who generally were Medicare-eligible due to disability. Data from the Optum Clinformatics™ DataMart is presented for those both younger than 65, and 65 and older.

The Optum Clinformatics™ DataMart includes a cohort of individuals with commercial managed care plans. Optum Clinformatics™ data provides paid medical and prescription claims and enrollment information for national participants in the commercial managed care plans of a large U.S. health insurance company. The data was purchased from OptumInsight, and participants are enrolled in both a medical and a prescription plan. There was a complete refresh of data for all years for Optum this year in

comparison with last year. Optum also added new claims sources, which contributed to the increase in claim counts and the difference in this year's counts compared to the 2017 ADR.

The methodology we employed to calculate costs related to CKD (excluding ESRD) utilizes ICD-9-CM and ICD-10-CM diagnosis codes to define the point prevalent CKD cohort. We included only those beneficiaries classified as having CKD on January 1 of each given year, to avoid possible association with acute kidney injury (AKI). How to best integrate the costs of AKI patients into CKD calculations is a continuing area for research, due to the potential for transition from AKI to CKD.

In this chapter, we defined costs as insurance expenditures rather than true economic costs, using claims from Medicare Parts A, B, and D as based on the 5% Medicare sample for calendar years 1996-2016 and from 100% of the Optum Clinformatics™ dataset for calendar years 2006-2016. To account for differences in pricing across health plans and provider contracts, Optum Clinformatics™ applies standard pricing algorithms to claims data. These algorithms were designed to create standard prices that reflect allowed payments across all provider services.

Details of this data are described in the [Data Sources](#) section of the [CKD Analytical Methods](#) chapter. For an explanation of the analytical methods used to generate the study cohorts, figures, and tables in this chapter, see the section on [Chapter 7](#) within the [CKD Analytical Methods](#) chapter. Downloadable Microsoft Excel and PowerPoint files containing the data and graphics for these figures and tables are available on the [USRDS website](#).

Spending for CKD and Related Chronic Comorbidities

BENEFICIARIES AGED 65 AND OLDER

FEE-FOR-SERVICE MEDICARE

Examining FFS Medicare spending reinforces CKD’s reputation as a cost multiplier. Beneficiaries with recognized CKD represent 13% of the point prevalent aged Medicare population, yet accounted for 25% of total expenditures (Table 7.1).

We examined 2016 costs in relation to beneficiaries’ CKD stage, age, sex, race, and concurrent disease, focusing on DM and HF. These conditions, in addition to CKD, represent some of the costliest chronic disease populations for Medicare. For example, HF affects 9% of beneficiaries in the FFS Medicare

population, but accounts for 20% of expenditures. Thirty-five percent of overall expenditures were directed toward the 24% of beneficiaries with DM.

In those aged 65 and older, per-person per-year (PPPY) costs were 93% higher for patients with CKD only, versus those with no CKD, DM, or HF (\$16,176 vs \$8,400). Costs for those with CKD and DM were 54% higher than for those with DM only. Similarly, expenditures for those with CKD and HF were 46% higher than for those with HF alone. For beneficiaries with CKD, HF, and DM, costs were 49% higher than for those with only HF and DM. Overall, people with diagnoses of any condition of CKD, DM, and/or HF accounted for one-third of the Medicare aged 65 and older population, but over half of total programmatic costs.

vol 1 Table 7.1 Prevalent Medicare fee-for-service patient counts and spending for beneficiaries aged 65 and older, by diabetes, heart failure, and/or CKD, ESRD excluded, 2016

	U.S. Medicare Population	Total Spending (millions, U.S. \$)	PPPY (U.S. \$)	Population (%)	Spending (%)
All	24,247,520	\$271,334	\$11,534	100	100
With HF or CKD or DM	8,246,040	\$139,538	\$17,809	34.01	51.43
CKD only (- DM & HF)	1,176,200	\$18,139	\$16,176	4.85	6.69
DM only (- HF & CKD)	3,730,480	\$44,533	\$12,229	15.39	16.41
HF only (- DM & CKD)	860,780	\$17,372	\$21,808	3.55	6.40
CKD and DM only (- HF)	1,183,580	\$21,738	\$19,243	4.88	8.01
CKD and HF only (- DM)	367,500	\$10,124	\$31,887	1.52	3.73
DM and HF only (- CKD)	424,260	\$10,445	\$26,544	1.75	3.85
CKD and HF and DM	503,240	\$17,187	\$39,506	2.08	6.33
No CKD or DM or HF	16,001,480	\$131,796	\$8,400	65.99	48.57
All CKD (+/- DM & HF)	3,230,520	\$67,188	\$22,369	13.32	24.76
All DM (+/- CKD & HF)	5,841,560	\$93,904	\$16,769	24.09	34.61
All HF (+/- DM & CKD)	2,155,780	\$55,128	\$28,378	8.89	20.32
CKD and DM (+/- HF)	1,686,820	\$38,925	\$24,877	6.96	14.35
CKD and HF (+/- DM)	870,740	\$27,311	\$36,291	3.59	10.07
DM and HF (+/- CKD)	927,500	\$27,633	\$33,350	3.83	10.18

Data Source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; HF, heart failure; DM, diabetes mellitus; PPPY, per-person per-year.

MEDICARE ADVANTAGE AND COMMERCIAL MANAGED CARE COVERAGE

CKD was also a cost multiplier for individuals 65 and older who were beneficiaries of Medicare Advantage or commercial managed care plans. The Medicare Advantage population was similar to FFS Medicare, with 15% having CKD and those with CKD accounting for 24% of spending. The managed care population had a lower prevalence of CKD (8%), but those with CKD also accounted for an outsized (17%) proportion of spending.

Per-person per-year spending in these populations

was somewhat higher than that for FFS Medicare (Zuckerman, 2017). In this dataset, Optum Clinformatics™ Medicare Advantage spending was 79% of those receiving FFS Medicare, with managed care beneficiaries at 123%. Such differences can arise from plan effects (e.g., care management activities of Medicare Advantage plans) or patient selection (e.g., those over 65 with commercial coverage are often still employed). Spending for those with CKD only was 72% (\$13,418 vs \$7,813) and 132% (\$22,124 vs \$9,527) higher than for those with no CKD, DM, or HF in the Medicare Advantage and managed care populations.

vol 1 Table 7.2 Prevalent Medicare Advantage and managed care spending for beneficiaries aged 65 and older, by diabetes, heart failure, and/or CKD, ESRD excluded, 2016

	Medicare Advantage			Managed care		
	PPPY (U.S. \$)	Population (%)	Spending (%)	PPPY (U.S. \$)	Population (%)	Spending (%)
All	\$10,356	100	100	\$12,176	100	100
With HF or CKD or DM	\$15,362	34.15	49.97	\$20,562	24.15	40.53
CKD only (- DM & HF)	\$13,418	5.96	7.63	\$22,124	3.33	6.04
DM only (- HF & CKD)	\$11,942	15.48	17.92	\$15,627	13.74	17.63
HF only (- DM & CKD)	\$18,291	2.74	4.67	\$24,352	1.98	3.93
CKD and DM only (- HF)	\$16,051	5.31	8.15	\$25,132	2.68	5.51
CKD and HF only (- DM)	\$24,601	1.53	3.36	\$37,903	0.77	2.25
DM and HF only (- CKD)	\$23,949	1.38	3.08	\$32,561	0.87	2.28
CKD and HF and DM	\$33,143	1.75	5.17	\$48,110	0.78	2.90
No CKD or DM or HF	\$7,813	65.85	50.03	\$9,527	75.85	59.47
All CKD (+/- DM & HF)	\$17,757	14.54	24.30	\$27,289	7.56	16.70
All DM (+/- CKD & HF)	\$14,968	23.92	34.32	\$19,164	18.07	28.31
All HF (+/- DM & CKD)	\$24,063	7.40	16.28	\$32,359	4.40	11.35
CKD and DM (+/- HF)	\$20,066	7.06	13.32	\$30,085	3.46	8.41
CKD and HF (+/- DM)	\$29,158	3.28	8.52	\$43,047	1.55	5.15
DM and HF (+/- CKD)	\$28,988	3.13	8.25	\$39,754	1.65	5.18

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; HF, heart failure; DM, diabetes mellitus; PPPY, per-person per-year. Numbers of 'All' patients included in this table are 2,536,831 and 236,268 for Medicare Advantage and Commercial managed care respectively.

BENEFICIARIES YOUNGER THAN AGE 65**FEE-FOR-SERVICE MEDICARE**

For the FFS Medicare population under age 65 only 8% had CKD, but those individuals accounted for 18%

of spending. One-fourth had one or more of CKD, DM, and/or HF, accounting for almost 44% of spending for this group (Table 7.3). Much of these expenditures, however, were for those who had DM, at 22% of the population and 34% of spending.

vol 1 Table 7.3 Prevalent Medicare fee-for-service patient counts and spending for beneficiaries younger than age 65, by diabetes, heart failure, and/or CKD, ESRD excluded, 2016

	U.S. Medicare Population	Total Costs (millions, U.S. \$)	PPPY spending (U.S. \$)	Population (%)	Spending (%)
All	4,709,780	\$66,276	\$14,558	100	100
With HF or CKD or DM	1,269,900	\$28,917	\$23,851	26.96	43.63
CKD only (- DM & HF)	111,820	\$2,691	\$25,394	2.37	4.06
DM only (- HF & CKD)	714,800	\$12,248	\$17,705	15.18	18.48
HF only (- DM & CKD)	96,120	\$2,401	\$26,462	2.04	3.62
CKD and DM only (- HF)	190,680	\$5,429	\$30,002	4.05	8.19
CKD and HF only (- DM)	23,400	\$992	\$46,599	0.50	1.50
DM and HF only (- CKD)	67,100	\$2,078	\$33,051	1.43	3.14
CKD and HF and DM	65,980	\$3,079	\$52,335	1.40	4.65
No CKD or DM or HF	3,439,880	\$37,359	\$11,185	73.04	56.37
All CKD (+/- DM & HF)	391,880	\$12,190	\$33,214	8.32	18.39
All DM (+/- CKD & HF)	1,038,560	\$22,834	\$22,961	22.05	34.45
All HF (+/- DM & CKD)	252,600	\$8,549	\$36,580	5.36	12.90
CKD and DM (+/- HF)	256,660	\$8,508	\$35,482	5.45	12.84
CKD and HF (+/- DM)	89,380	\$4,071	\$50,812	1.90	6.14
DM and HF (+/- CKD)	133,080	\$5,157	\$42,374	2.83	7.78

Data Source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease; HF, heart failure; PPPY, per-person per-year.

MEDICARE ADVANTAGE AND COMMERCIAL MANAGED CARE COVERAGE

The Medicare Advantage population under age 65 was similar to the FFS Medicare population. Thirty-three percent of the Medicare Advantage beneficiaries had one or more of CKD, DM, and/or HF, accounting for 49% of spending for this group (Table 7.4). The managed care population under age 65 was much less likely to have CKD, DM, or HF (6%) than the Medicare Advantage population (33%).

For those under age 65, spending was somewhat higher for beneficiaries in the Medicare Advantage program, both when averaged across all beneficiaries (12% higher: \$16,358 vs \$14,558) and among all with CKD (1.9% lower: \$32,571 vs \$33,214; Tables 7.3 and 7.4). Consistent with our other findings, average spending for those with CKD was considerably lower (27% lower for those with CKD: \$24,214 vs \$33,214) in the managed care population than in the Medicare FFS and Medicare Advantage populations.

vol 1 Table 7.4 Prevalent Medicare Advantage and managed care fee-for-service spending for beneficiaries younger than age 65, by diabetes, heart failure, and/or CKD, ESRD excluded, 2016

	Medicare Advantage			Managed care		
	PPPY (U.S. \$)	Population (%)	Spending (%)	PPPY (U.S. \$)	Population (%)	Spending (%)
All	\$16,358	100	100	\$5,317	100	100
With HF or CKD or DM	\$24,317	33.34	49.24	\$15,313	6.43	18.54
CKD only (- DM & HF)	\$25,398	3.24	5.00	\$18,996	0.77	2.74
DM only (- HF & CKD)	\$18,863	19.32	22.30	\$12,161	4.77	10.96
HF only (- DM & CKD)	\$27,505	2.06	3.41	\$23,139	0.29	1.25
CKD and DM only (- HF)	\$28,616	4.62	8.03	\$25,423	0.40	1.91
CKD and HF only (- DM)	\$45,866	0.67	1.78	\$52,704	0.05	0.42
DM and HF only (- CKD)	\$33,680	1.83	3.70	\$32,309	0.10	0.59
CKD and HF and DM	\$54,296	1.60	5.01	\$71,480	0.05	0.66
No CKD or DM or HF	\$12,416	66.66	50.76	\$4,629	93.57	81.46
All CKD (+/- DM & HF)	\$32,571	10.13	19.83	\$24,214	1.27	5.73
All DM (+/- CKD & HF)	\$23,449	27.37	39.04	\$14,066	5.32	14.13
All HF (+/- DM & CKD)	\$38,093	6.15	13.91	\$32,647	0.49	2.92
CKD and DM (+/- HF)	\$34,971	6.22	13.05	\$30,457	0.45	2.57
CKD and HF (+/- DM)	\$51,798	2.26	6.80	\$62,768	0.10	1.08
DM and HF (+/- CKD)	\$43,101	3.42	8.71	\$45,383	0.15	1.25

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; HF, heart failure; DM, diabetes mellitus; ESRD, end-stage renal disease; PPPY, per-person per-year. Number of 'All' patients included in this table are 279,972 and 5,011,031 for Medicare Advantage and Managed care respectively.

Spending for CKD by Stage and Patient Characteristics

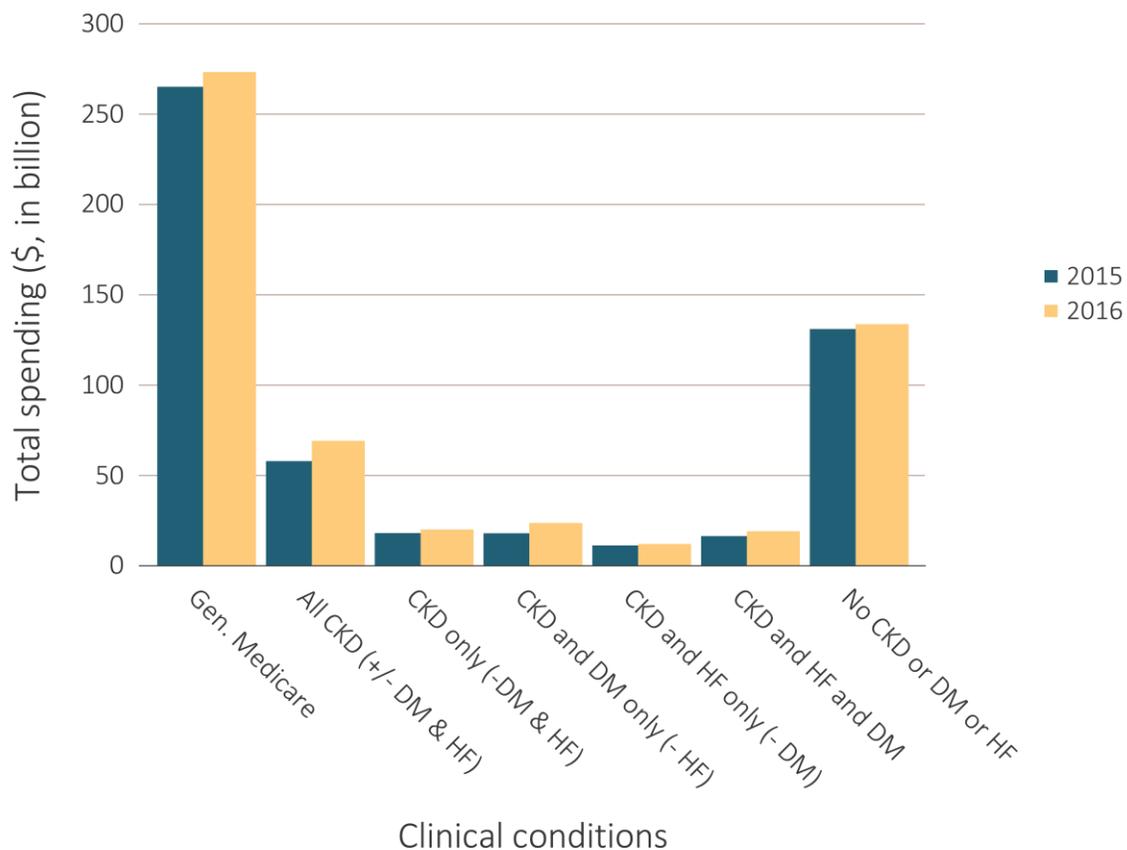
Among the FFS Medicare population aged 65 and older, between 2015 and 2016 total spending for Parts A, B, and D rose by \$8 billion, to \$271 billion. Total spending for CKD patients rose by \$11.2 billion, to \$67.2 billion (Figure 7.1).

Further, total Medicare expenditures were higher for beneficiaries with CKD than for beneficiaries with ESRD (\$67.2 billion vs. \$35.4 billion; see Volume 2, Chapter 9: Healthcare Expenditures for Persons with

ESRD). Expenditures for beneficiaries with CKD now represent 24.8% of all Medicare Parts A, B, and D non-ESRD spending.

Expenditures increased for all covered groups, but the highest growth rates occurred in those with CKD and DM, followed by all CKD, and then CKD and HF and DM. The spending increase appears to be driven by a rise in the proportion of beneficiaries with recognized CKD (see Table 7.7 and Volume 1, Chapter 2: Identification and Care of Patients with CKD, Figure 2.2).

vol 1 Figure 7.1 Overall Medicare Parts A, B, and D fee-for-service spending for beneficiaries aged 65 and older, by CKD, diabetes, and heart failure, ESRD excluded, 2015 & 2016



Data source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease; HF, heart failure.

All CKD patients 65 and older required increased care as they progressed to later stages of disease (Figures 7.2.a-c; see Table A for CKD definitions). In the FFS Medicare population, PPPY expenditures in 2016 ranged from \$19,074 for those in Stages 1-2, to \$29,151 for those in Stages 4-5. In the Medicare Advantage population, expenditures increased from \$17,756 in Stages 1-2 to \$26,314 in Stages 4-5. The managed care population was similar, with expenditures of \$27,289 in Stages 1-2 to \$35,886 in Stages 4-5.

Group trends in PPPY spending from 2013-2016 were mixed (Figures 7.2.a-c). FFS Medicare saw PPPY

expenditures increase 1.7% overall for individuals with any CKD, but the increase was most dramatic for those in Stages 4-5, rising by 6.3%. However, PPPY spending dropped 15% over this period for Medicare Advantage beneficiaries with CKD. Spending for managed care beneficiaries moved without clear patterns, but it should be noted that in 2016 the Optum Clinformatics™ population of managed care enrollees with CKD was relatively small (N=17,864). Overall PPPY spending was slightly higher in 2016 than in 2013, but spending on beneficiaries in Stages 1-2 decreased by 2%, while expenditures on beneficiaries in Stages 4-5 decreased by 15%.

vol 1 Figure 7.2 Overall per-person per-year spending for beneficiaries aged 65 and older, by CKD stage, and year, ESRD excluded, 2013-2016

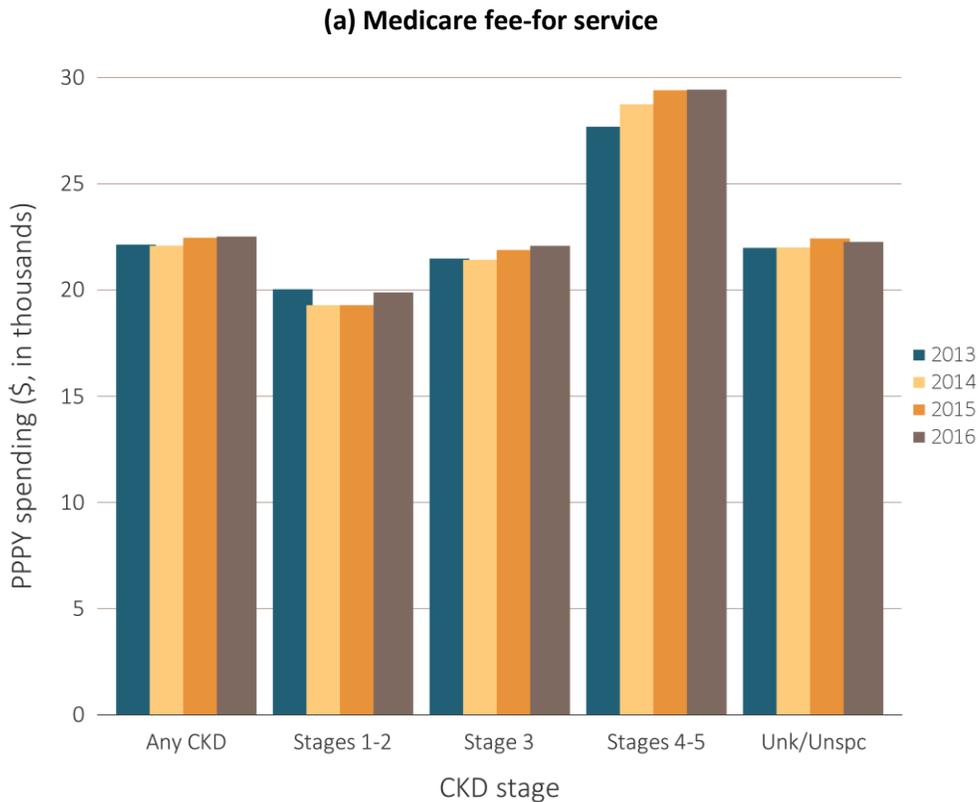
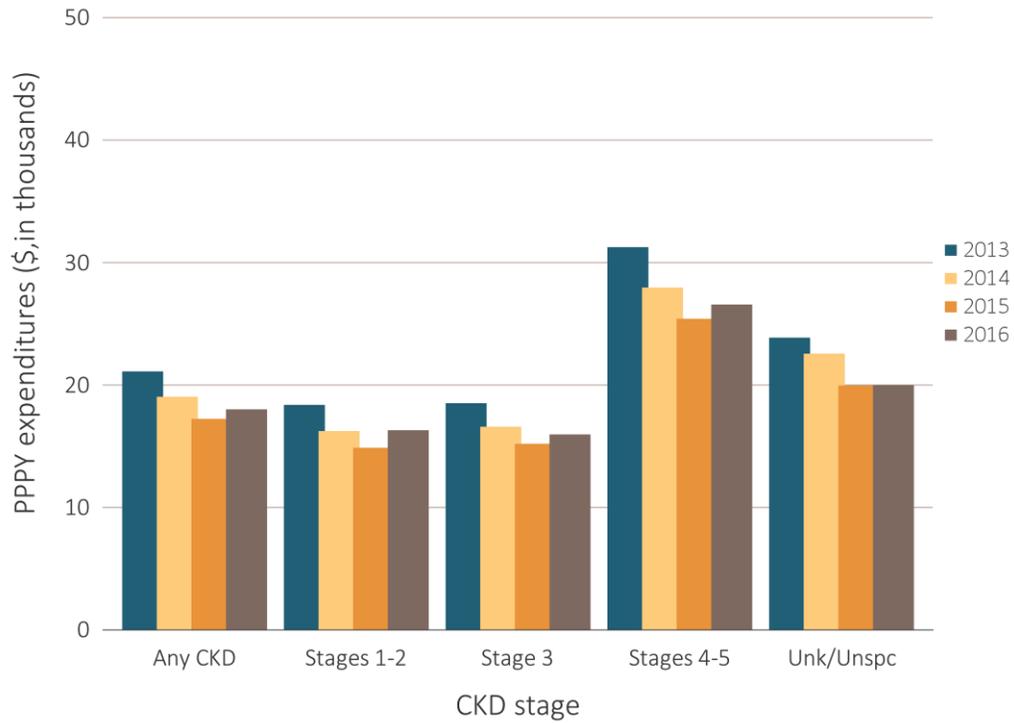


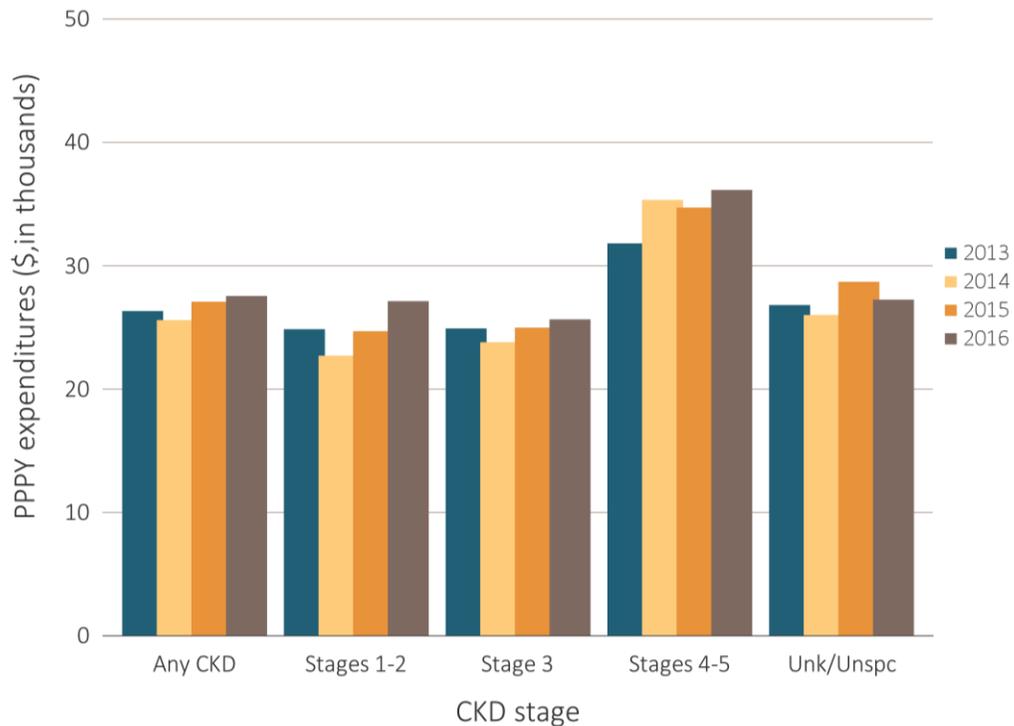
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vol 1 Figure 7.2 Overall per-person per-year spending for beneficiaries aged 65 and older, by CKD stage, and year, ESRD excluded, 2013-2016 (continued)

(b) Medicare Advantage



(c) Managed care



Data Source: Medicare 5% sample and Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; PPPY, per-person per-year; Unk/Unspc, CKD stage unknown or unspecified.

Table A. ICD-9-CM and ICD-10-CM codes for Chronic Kidney Disease (CKD) stages

ICD-9-CM code ^a	ICD-10-CM code ^a	Stage
585.1	N18.1	CKD, Stage 1
585.2	N18.2	CKD, Stage 2 (mild)
585.3	N18.3	CKD, Stage 3 (moderate)
585.4	N18.4	CKD, Stage 4 (severe)
585.5	N18.5	CKD, Stage 5 (excludes 585.6: Stage 5, requiring chronic dialysis ^b)
CKD Stage-unspecified	CKD Stage-unspecified	For these analyses, identified by multiple codes including 585.9, 250.4x, 403.9x & others for ICD-9-CM and A18.xx, E08.xx, E11.xx and others for ICD-10-CM.

^a For analyses in this chapter, CKD stage estimates require at least one occurrence of a stage-specific code, and the last available CKD stage in a given year is used. ^b In USRDS analyses, patients with ICD-9-CM code 585.6 or ICD-10-CM code N18.6 & with no ESRD 2728 form or other indication of end-stage renal disease (ESRD) are considered to have code 585.5 or N18.5.

Table 7.5 presents PPPY Medicare FFS spending for Parts A, B, and D services, for beneficiaries with CKD (but not ESRD), by stage of CKD. In 2016, PPPY costs reached \$22,369 for FFS Medicare CKD patients aged 65 and older, a slight increase from 2015 (\$22,314). The spending was increased slightly across all the CKD stages. During this period, the distribution of identified patient years also shifted towards the less severe and less costly stages. In 2016, costs for beneficiaries with Stages 4-5 CKD (\$29,285) were 48% greater than for beneficiaries with Stages 1-2 CKD

(\$19,737). Although the number of beneficiaries with unknown/unspecified CKD stage increased, this still accounted for one-third of all cases of CKD. The PPPY costs for those unknown/unspecified were similar to the overall CKD population.

Spending for Black beneficiaries with CKD exceeded that for Whites by 9.6%, a slightly increase over the 9.1% disparity observed in 2015. Per capita spending for Whites increased slightly while per capita spending for Blacks stayed the same.

vol 1 Table 7.5 Per-person-per year Medicare Parts A, B, and D fee-for-service spending for all CKD beneficiaries aged 65 and older, by CKD stage, age, sex, and race, ESRD excluded, 2015 & 2016

	2015					2016				
	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc
Patient years at risk	2,509,508	266,835	1,231,417	228,519	782,737	3,003,561	307,714	1,411,160	244,364	1,040,323
All patients	\$22,314	\$19,137	\$21,734	\$29,256	\$22,282	\$22,369	\$19,737	\$21,932	\$29,285	\$22,117
Age										
65-69	\$21,234	\$17,945	\$20,897	\$31,636	\$20,597	\$21,266	\$18,456	\$21,820	\$31,291	\$20,150
70-74	\$20,461	\$16,844	\$20,053	\$28,638	\$20,518	\$21,237	\$17,800	\$21,018	\$28,904	\$21,184
75-79	\$21,587	\$18,772	\$20,921	\$28,608	\$21,818	\$22,082	\$19,493	\$21,517	\$29,940	\$21,951
80-84	\$22,818	\$19,844	\$22,266	\$28,770	\$22,862	\$22,683	\$20,711	\$21,724	\$29,032	\$23,051
85+	\$24,674	\$22,812	\$23,725	\$29,305	\$24,972	\$24,178	\$22,713	\$23,180	\$28,460	\$24,776
Sex										
Male	\$22,031	\$18,577	\$21,685	\$29,345	\$21,770	\$22,134	\$19,636	\$21,974	\$29,488	\$21,485
Female	\$22,573	\$19,681	\$21,780	\$29,184	\$22,754	\$22,585	\$19,835	\$21,894	\$29,118	\$22,699
Race										
White	\$22,074	\$18,880	\$21,643	\$28,387	\$22,051	\$22,189	\$19,695	\$21,809	\$28,440	\$22,013
Black/African American	\$24,086	\$19,907	\$22,549	\$34,080	\$24,264	\$24,086	\$20,229	\$23,104	\$34,126	\$23,600
Other	\$22,577	\$20,928	\$21,654	\$30,097	\$22,261	\$21,970	\$19,373	\$21,727	\$29,794	\$21,312

Data source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; Unk/Unspc, CKD stage unknown or unspecified.

Table 7.6 presents overall PPPY spending for Medicare Advantage and managed care beneficiaries with CKD (but not ESRD) by stage of CKD (see Table A for definitions). In contrast to the FFS Medicare population, for these patients spending generally decreased with age and was

substantially lower for Blacks than Whites, by 24% for those covered by Medicare Advantage and 28% in the managed care population. This is an area for further research.

vol 1 Table 7.6 Per-person per-year Medicare Advantage and managed care spending for all CKD beneficiaries aged 65 and older, by CKD stage, age, sex, and race, ESRD excluded, 2016

	Medicare Advantage					Managed care				
	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc
Patient years at risk	350,359	70,836	169,180	37,853	72,490	16,032	2,945	6,534	1,752	4,802
All patients	\$17,757	\$16,051	\$15,708	\$26,314	\$19,737	\$27,289	\$26,869	\$25,394	\$35,886	\$26,989
Age										
65-69	\$20,238	\$16,993	\$18,456	\$33,200	\$21,153	\$27,172	\$27,963	\$45,841	\$29,063	\$27,172
70-74	\$18,399	\$14,977	\$16,476	\$31,252	\$20,080	\$28,435	\$27,221	\$41,549	\$28,127	\$28,435
75-79	\$18,411	\$16,221	\$16,645	\$27,323	\$20,342	\$23,993	\$24,890	\$33,114	\$26,535	\$23,993
80-84	\$17,602	\$16,536	\$15,505	\$26,061	\$19,339	\$29,480	\$23,935	\$29,858	\$24,574	\$29,480
85+	\$15,161	\$15,931	\$13,307	\$19,254	\$17,391	\$24,092	\$20,803	\$23,593	\$19,529	\$24,092
Sex										
Male	\$18,745	\$17,096	\$16,836	\$27,768	\$19,949	\$27,717	\$26,428	\$38,560	\$27,726	\$27,717
Female	\$16,936	\$15,071	\$14,841	\$25,094	\$19,550	\$25,316	\$23,820	\$31,944	\$25,683	\$25,316
Race										
White	\$18,655	\$18,145	\$16,437	\$25,779	\$20,591	\$27,390	\$27,099	\$25,287	\$35,284	\$27,487
Black/African American	\$13,489	\$10,069	\$12,821	\$21,514	\$14,478	\$19,682	\$13,956	\$17,829	\$24,685	\$26,569
Other	\$16,545	\$13,617	\$14,579	\$27,751	\$18,631	\$27,686	\$27,816	\$26,475	\$38,685	\$25,260

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; Unk/Unspc, CKD stage unknown or unspecified.

Tables 7.7 and 7.8 present PPPY spending for beneficiaries with both CKD and DM. These tables show similar results as in the overall CKD population. Among the 2016 FFS Medicare beneficiaries with these two conditions, PPPY spending for Blacks was \$26,168—5.6% greater than the

\$24,788 incurred for Whites. Yet, spending by Medicare Advantage was 27% lower for Blacks than Whites and 33% lower for the managed care population.

vol 1 Table 7.7 Per-person per-year Medicare Parts A, B, and D fee-for-service spending for CKD patients with diabetes, aged 65 and older, by CKD stage, age, sex, and race, ESRD excluded, 2015 & 2016

	2015					2016				
	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/ Unspc	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/ Unspc
Patient years at risk	1,202,549	128,812	594,206	120,943	358,589	1,564,729	153,255	682,630	129,606	599,238
All patients	\$25,386	\$21,872	\$24,986	\$33,107	\$24,708	\$24,877	\$22,575	\$25,140	\$32,671	\$23,480
Age										
65-69	\$24,704	\$20,387	\$24,908	\$35,736	\$23,152	\$23,643	\$21,975	\$25,439	\$34,027	\$21,248
70-74	\$23,604	\$19,389	\$23,191	\$32,814	\$23,305	\$23,728	\$20,446	\$24,415	\$31,653	\$22,549
75-79	\$24,944	\$22,135	\$24,224	\$32,342	\$24,790	\$24,873	\$21,861	\$24,822	\$33,501	\$23,834
80-84	\$26,131	\$22,499	\$25,907	\$32,660	\$25,275	\$25,641	\$24,027	\$25,134	\$31,797	\$25,020
85+	\$27,935	\$27,447	\$27,135	\$32,671	\$27,413	\$27,029	\$26,592	\$26,089	\$32,614	\$26,632
Sex										
Male	\$24,598	\$21,033	\$24,355	\$33,343	\$23,660	\$24,178	\$22,149	\$24,529	\$32,248	\$22,652
Female	\$26,174	\$22,778	\$25,627	\$32,910	\$25,766	\$25,556	\$23,036	\$25,761	\$33,031	\$24,244
Race										
White	\$25,145	\$21,348	\$25,039	\$32,129	\$24,396	\$24,788	\$22,586	\$25,118	\$31,979	\$23,478
Black/African American	\$27,126	\$23,396	\$25,293	\$37,237	\$27,145	\$26,168	\$22,530	\$25,623	\$36,148	\$24,927
Other	\$24,968	\$24,044	\$23,808	\$34,054	\$24,066	\$23,769	\$22,539	\$24,583	\$32,358	\$21,599

Data source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; Unk/Unspc, CKD stage unknown or unspecified.

vol 1 Table 7.8 Per-person per-year Medicare Advantage and managed care spending for CKD patients with diabetes, aged 65 and older, by CKD stage, age, sex, and race, ESRD excluded, 2016

	Medicare Advantage					Managed care				
	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc
Patient years at risk	169,933	36,448	78,671	19,927	34,887	7,323	1,436	3,026	899	1,963
All patients	\$20,066	\$18,014	\$18,305	\$30,438	\$20,256	\$30,085	\$29,580	\$28,857	\$40,934	\$27,382
Age										
65-69	\$22,819	\$18,630	\$21,982	\$37,769	\$22,060	\$32,165	\$29,730	\$32,715	\$51,024	\$27,152
70-74	\$20,443	\$17,046	\$18,762	\$34,665	\$20,469	\$30,947	\$28,247	\$29,552	\$42,224	\$30,225
75-79	\$20,287	\$18,195	\$18,954	\$30,031	\$20,082	\$30,153	\$29,062	\$28,802	\$37,813	\$28,707
80-84	\$19,474	\$18,477	\$17,322	\$29,088	\$19,658	\$27,405	\$35,741	\$23,699	\$32,824	\$25,213
85+	\$17,150	\$18,149	\$15,238	\$22,104	\$17,973	\$23,650	\$26,235	\$22,955	\$25,248	\$22,205
Sex										
Male	\$20,438	\$18,826	\$18,805	\$30,954	\$19,950	\$30,792	\$31,236	\$29,317	\$45,524	\$25,997
Female	\$19,725	\$17,185	\$17,867	\$29,985	\$20,544	\$28,729	\$26,324	\$28,036	\$33,388	\$29,361
Race										
White	\$21,777	\$21,466	\$19,700	\$30,212	\$21,888	\$30,043	\$30,565	\$28,207	\$39,625	\$27,941
Black/African American	\$14,619	\$10,894	\$14,592	\$24,679	\$13,445	\$20,035	\$17,429	\$18,962	\$24,341	\$22,318
Other	\$18,148	\$14,814	\$16,533	\$31,354	\$18,496	\$31,290	\$28,702	\$31,656	\$46,461	\$26,432

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; Unk/Unspc, CKD stage unknown or unspecified.

Tables 7.9 and 7.10 present PPPY spending for beneficiaries with CKD and concurrent HF. The presence of HF greatly increased the costs of care for persons with CKD. Persons with both CKD and HF cost 62% more (\$36,291) than the average CKD patient (\$22,369). These results were consistent with those seen in the previous tables. In 2016, FFS

Medicare PPPY expenditures for Black beneficiaries with both conditions reached \$39,825—12.0% higher than the \$35,690 PPPY for their White counterparts. In contrast to FFS Medicare, Black Medicare Advantage beneficiaries required 14% less spending than did their White counterparts, and Black managed care beneficiaries 21% less.

vol 1 Table 7.9 Per-person per-year Medicare Parts A, B, and D fee-for-service spending for CKD patients with heart failure, aged 65 and older, by CKD stage, age, sex, race, and year, ESRD excluded, 2015 & 2016

	2015					2016				
	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc
Patient years at risk	660,426	57,097	330,474	83,233	189,622	752,556	64,737	379,373	88,744	219,701
All patients	\$35,986	\$33,929	\$35,666	\$41,519	\$34,735	\$36,291	\$34,604	\$35,526	\$41,496	\$36,008
Age										
65-69	\$39,993	\$36,445	\$39,285	\$50,581	\$38,097	\$40,114	\$38,820	\$40,323	\$47,286	\$38,072
70-74	\$37,006	\$31,130	\$37,176	\$42,916	\$36,281	\$39,302	\$34,516	\$39,155	\$42,003	\$40,068
75-79	\$36,622	\$35,836	\$36,073	\$41,927	\$35,632	\$37,129	\$35,314	\$36,343	\$44,253	\$36,424
80-84	\$35,532	\$33,653	\$35,623	\$39,917	\$33,932	\$35,066	\$32,929	\$33,951	\$42,310	\$34,702
85+	\$34,014	\$33,384	\$33,527	\$38,856	\$32,748	\$33,571	\$33,400	\$32,648	\$37,845	\$33,267
Sex										
Male	\$35,131	\$32,898	\$34,802	\$41,353	\$33,834	\$35,546	\$33,684	\$34,895	\$41,333	\$35,060
Female	\$36,800	\$34,948	\$36,518	\$41,658	\$35,576	\$37,000	\$35,574	\$36,153	\$41,633	\$36,856
Race										
White	\$35,352	\$33,103	\$35,207	\$40,043	\$34,293	\$35,690	\$34,129	\$34,948	\$40,120	\$35,732
Black/African American	\$39,567	\$34,923	\$38,751	\$48,514	\$37,464	\$39,825	\$35,848	\$39,255	\$46,995	\$38,235
Other	\$38,735	\$43,312	\$37,110	\$45,230	\$36,570	\$38,715	\$39,151	\$37,912	\$47,167	\$36,165

Data source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; Unk/Unspc, CKD stage unknown or unspecified.

vol 1 Table 7.10 Per-person per-year Medicare Advantage and managed care spending for CKD patients with heart failure, aged 65 and older, by CKD stage, age, sex, and race, ESRD excluded, 2016

	Medicare Advantage					Managed care				
	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc	Any CKD	Stages 1-2	Stage 3	Stages 4-5	Unk/Unspc
Patient years at risk	74,824	14,160	35,035	10,933	14,697	3,132	616	1,307	426	783
All patients	\$29,158	\$30,079	\$26,155	\$37,063	\$29,550	\$43,047	\$45,986	\$43,565	\$47,448	\$37,476
Age										
65-69	\$39,570	\$39,471	\$37,984	\$48,091	\$37,586	\$60,018	\$64,900	\$68,670	\$63,410	\$46,224
70-74	\$34,879	\$33,139	\$31,908	\$48,930	\$33,058	\$51,973	\$49,037	\$52,791	\$61,756	\$47,758
75-79	\$32,857	\$33,107	\$30,207	\$42,309	\$32,079	\$37,381	\$32,973	\$40,399	\$42,768	\$32,597
80-84	\$27,510	\$28,022	\$24,745	\$36,553	\$27,075	\$38,351	\$45,237	\$39,906	\$35,767	\$31,106
85+	\$21,381	\$23,538	\$19,169	\$25,115	\$22,496	\$26,505	\$29,758	\$25,309	\$33,010	\$22,180
Sex										
Male	\$29,982	\$30,449	\$27,358	\$37,716	\$29,941	\$43,976	\$43,990	\$45,970	\$51,554	\$36,552
Female	\$28,406	\$29,670	\$25,105	\$36,485	\$29,212	\$41,479	\$49,337	\$39,623	\$41,231	\$38,960
Race										
White	\$29,348	\$31,528	\$26,268	\$35,957	\$29,994	\$41,251	\$42,145	\$41,520	\$48,100	\$36,261
Black/African American	\$24,994	\$20,677	\$25,183	\$32,092	\$22,611	\$33,798	\$38,872	\$15,882	\$13,468	\$55,978
Other	\$29,041	\$28,039	\$25,968	\$39,652	\$29,064	\$50,436	\$59,821	\$53,558	\$45,521	\$40,594

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; Unk/Unspc, CKD stage unknown or unspecified.

Over time FFS Medicare beneficiaries aged 65 and older with recognized CKD have accounted for an increasing share of Medicare expenditures, expanding from 5.8% in 2000 to 14.1% in 2008, and 24.8% in 2016. Much of this growth was due to the increased ascertainment of CKD as shown in Volume 1, Chapter 2: Identification and Care of Patients with CKD, Figure 2.2. Persons aged 65 and older with CKD accounted for 2.1%, 8.8%, and 11.2% of the FFS Medicare population in 2000, 2008, and 2016.

Figure 7.3 presents total expenditures on Parts A, B, and D services for Medicare FFS beneficiaries with CKD, DM, and HF. In 2016, expenditures for CKD

patients reached \$67.2 billion, accounting for 24.8% of the total spending for all FFS Medicare beneficiaries. Care of beneficiaries with CKD and concurrent DM required \$38.9 billion in 2016, or 41.5% of the total FFS Medicare spending on DM. Spending on HF in the FFS Medicare population was \$55.1 billion in 2016. Of this, \$27.3 billion (49.5%) was spent on the CKD patient population with HF. Medicare expenditures for CKD were 20% higher in 2016 (\$67 billion) than in 2015 (\$55 billion). This was mostly due to an 18% increase in the ascertainment of CKD. Although 2016 represented a change in coding (ICD-9 to ICD-10), the reason for this increase is not known.

vol 1 Figure 7.3 Overall Medicare Parts A, B, and D fee-for-service spending for general Medicare population aged 65 and older and for those with CKD, ESRD excluded, 1996-2016

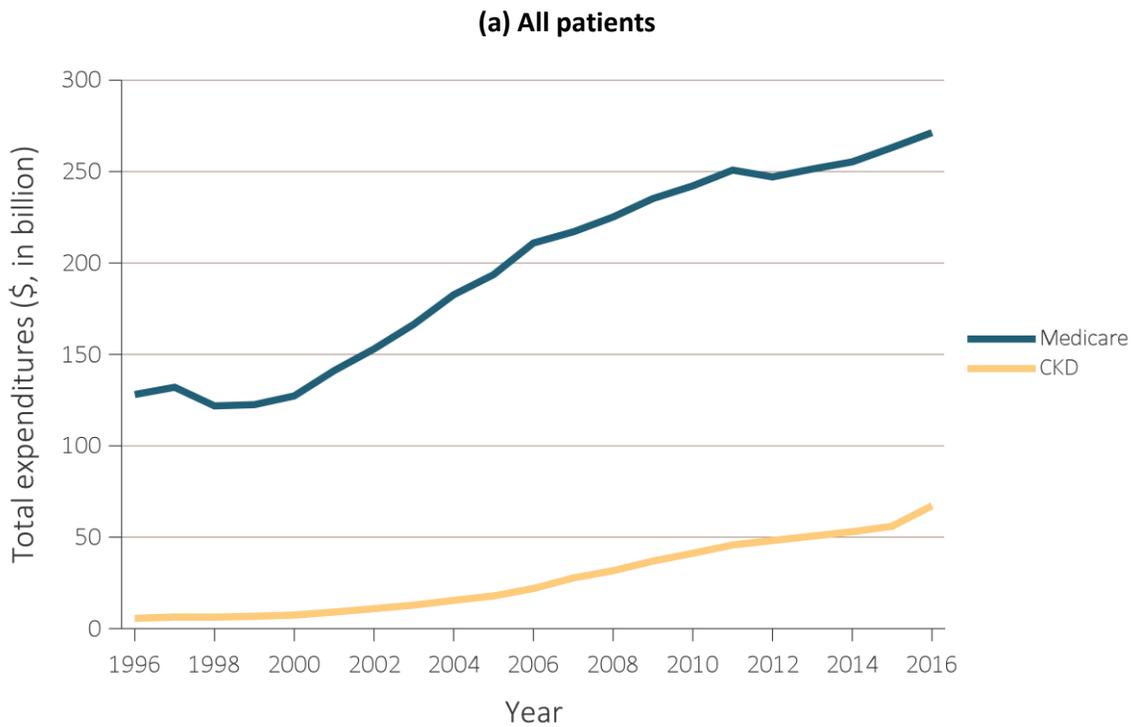
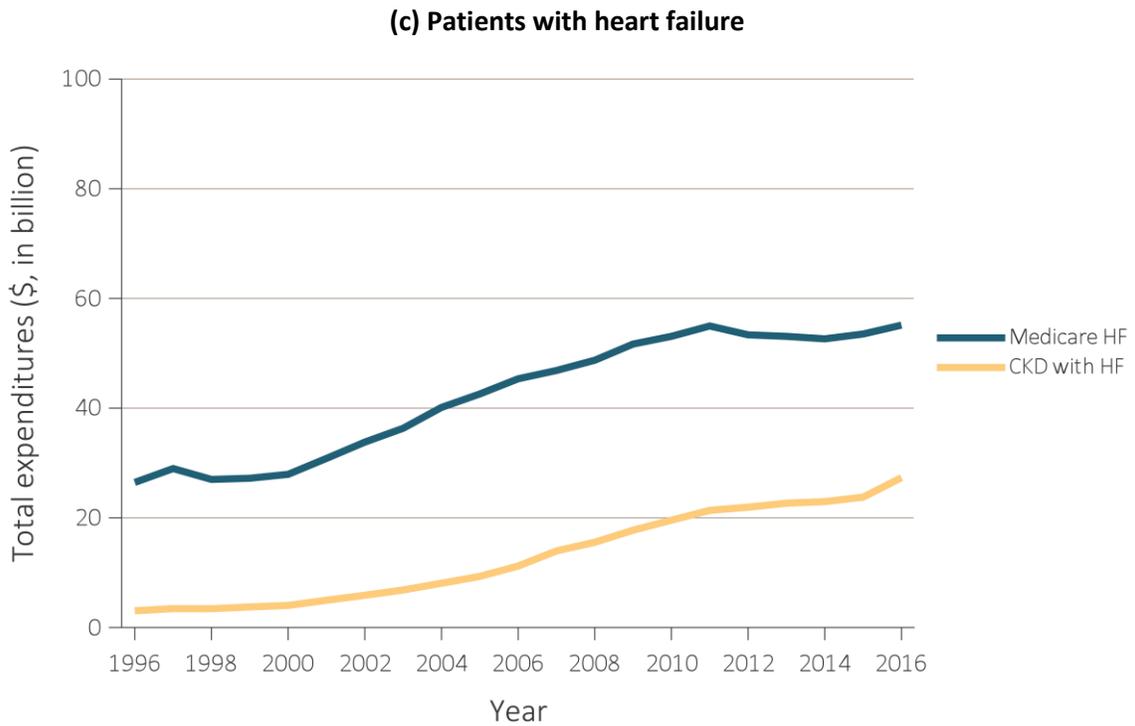
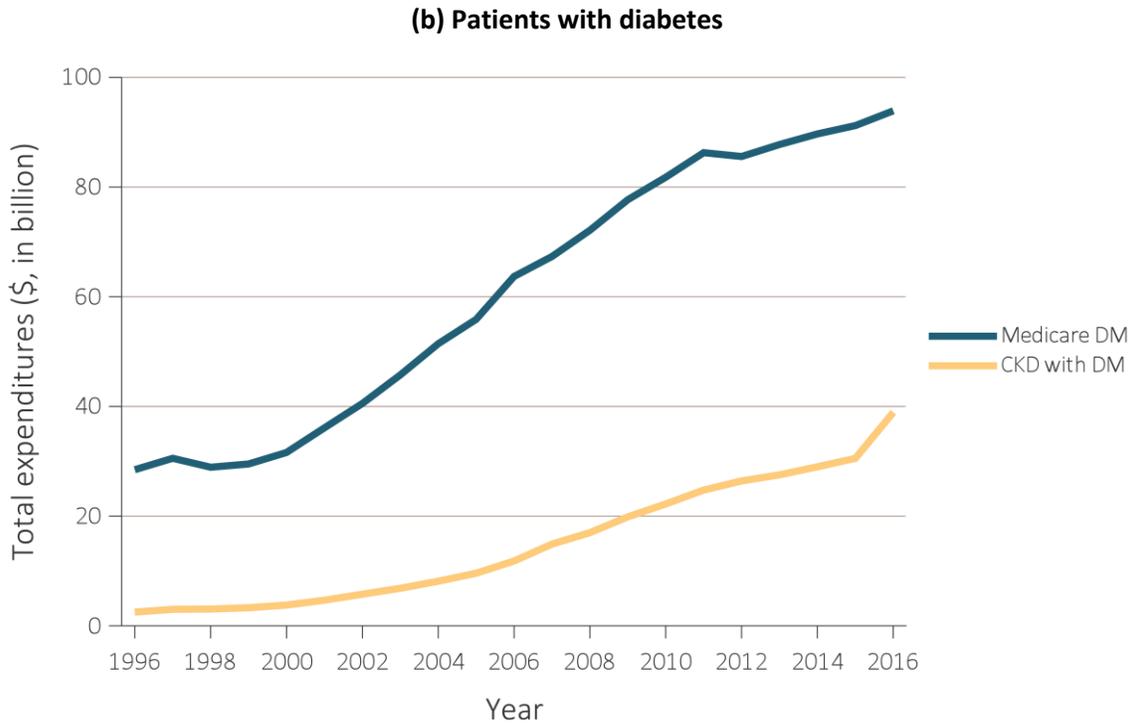


Figure 7.3 continued on next page.

vol 1 Figure 7.3 Overall Medicare Parts A, B, and D fee-for-service spending for general Medicare population aged 65 and older and for those with CKD, ESRD excluded, 1996-2016 (continued)

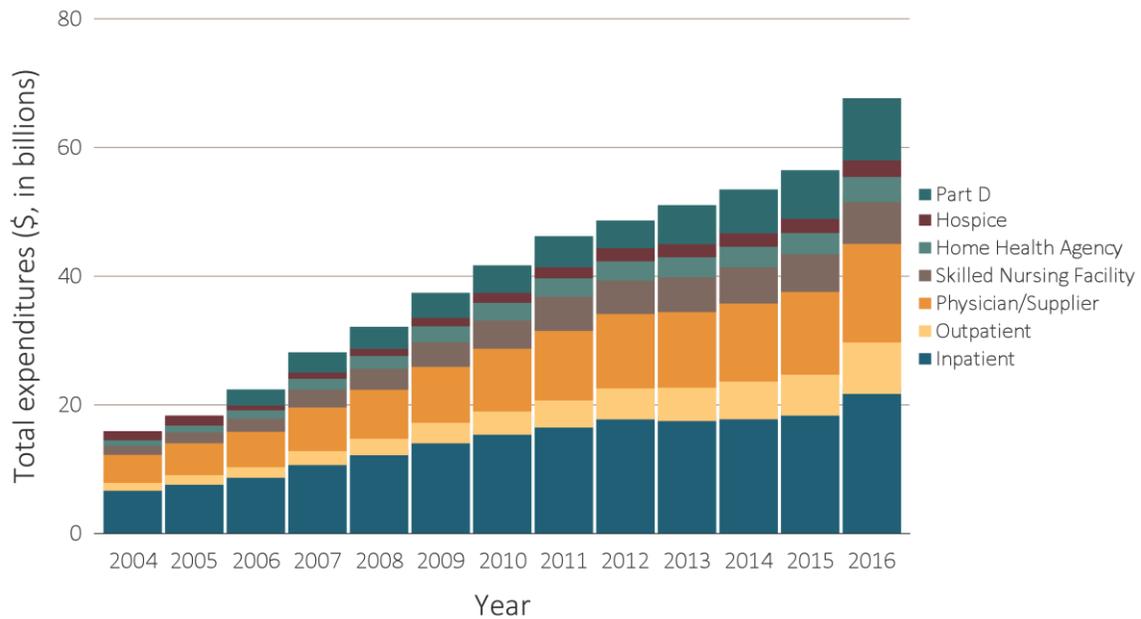


Data Source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease; HF, heart failure.

Most spending for CKD patients was incurred for inpatient and outpatient care, physician/supplier services, and care in skilled nursing facilities. Spending for Part D increased a great deal in recent years. The proportion of total FFS Medicare expenditures required to provide inpatient care was 33% in 2016, while outpatient costs were predictably lower at 12%. Physician/supplier service costs

amounted to 23%, spending for skilled nursing facilities was 10%, while spending for Part D reached 13% (Figure 7.4). In the Medicare non-CKD population, these expenditure percentages were 29% to provide inpatient care, 15% for outpatient, 28% for physician/supplier services, and 7% for skilled nursing facility care (not shown).

vol 1 Figure 7.4 Trends in total Medicare Parts A, B, and D fee-for-service spending for CKD patients aged 65 and older, by claim type, ESRD excluded, 2004-2016

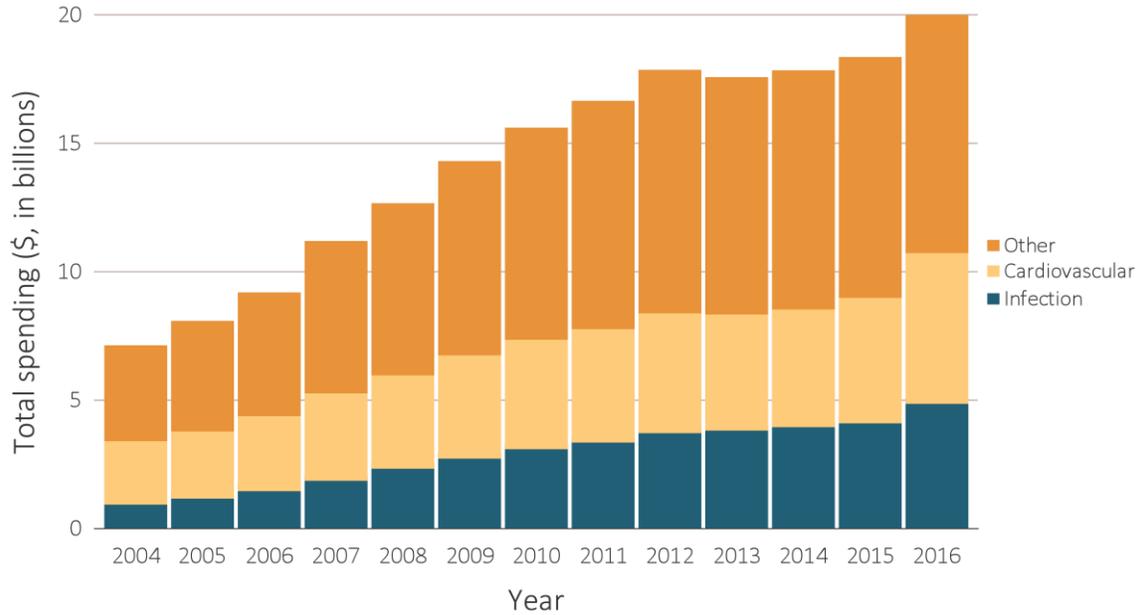


Data source: Medicare 5% sample. Part D data occurring since 2006. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease.

Hospitalization expenditures accounted for a large proportion of spending for CKD. Of the 2016 inpatient hospitalization spending for those with CKD, 23%

resulted from admissions to treat infections, and 27% from cardiovascular conditions, with the remaining 50% resulting from all other causes (Figure 7.5).

vol 1 Figure 7.5 Total Medicare fee-for-service inpatient spending for CKD patients aged 65 and older, by cause of hospitalization, ESRD excluded, 2004-2016



Data source: Medicare 5% sample. Part D data occurring since 2006. Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease.

Figure 7.6 illustrates PPPY costs for CKD patients aged 65 and older by the presence of DM and HF. In 2016, PPPY costs for CKD patients varied greatly by the presence of these comorbidities. CKD patients without DM and HF required \$18,525 PPPY from FFS Medicare. Those with DM in addition to CKD

averaged \$22,751 PPPY, and beneficiaries with both CKD and HF cost \$29,664. Expenditures for those with all three conditions reached \$40,075 PPPY in 2016 for FFS Medicare. Spending was also higher as comorbidities increased in the managed care populations.

vol 1 Figure 7.6 Per-person per-year Medicare, Medicare advantage, and managed care spending for CKD patients aged 65 and older, by diabetes and heart failure, ESRD excluded, 2006-2016

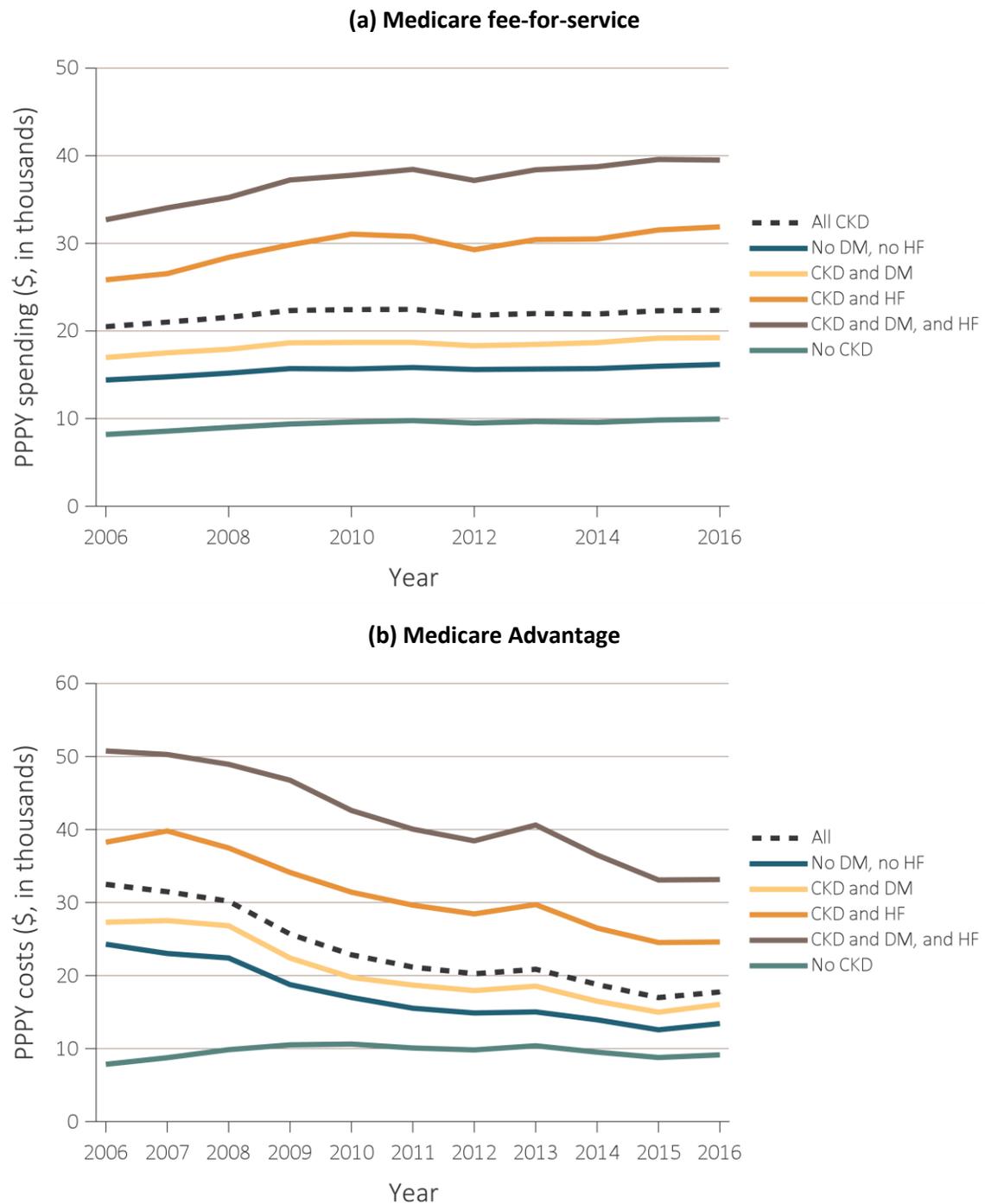
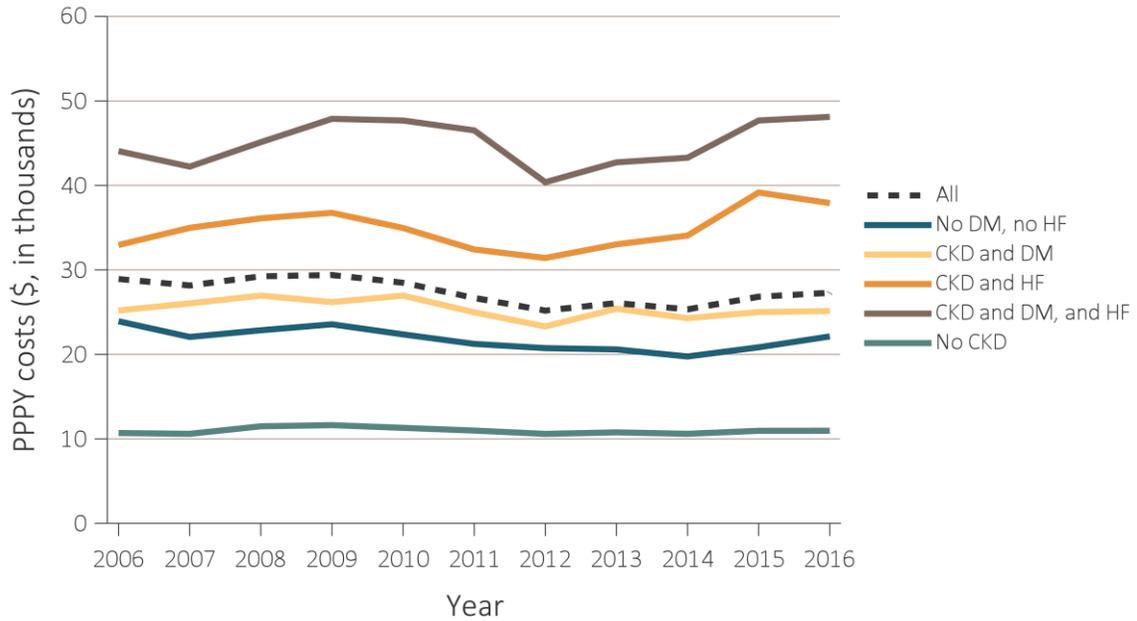


Figure 7.6 continued on next page.

vol 1 Figure 7.6 Per-person per-year Medicare, Medicare advantage and managed care spending for CKD patients aged 65 and older, by diabetes and heart failure, ESRD excluded, 2006-2016 (continued)

(c) Managed care



Data Source: Medicare 5% sample and Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease; HF, heart failure; PPPY, per person per year.

Table 7.11 shows the distribution of CKD stages by payer. For all payer types, reporting has become more specific since stage specific reporting began in 2007, with the percentage of CKD cases of unknown stage declining over time. Nonetheless, over 20% of cases for each payer type were still of unknown stage in 2016. The distribution of cases with reported stage

became somewhat less severe over time. The percentage of cases in the Stages 1 & 2 and Stage 3 categories grew between 2007 and 2016. Conversely, despite the increase in stage-specific reporting overall, the percentage of cases in Stages 4 & 5 actually declined.

vol 1 Table 7.11 Overall CKD percentage for Medicare, Medicare advantage, and managed care beneficiaries aged 65 and older, by CKD stage, and year, ESRD excluded, 2006-2016

Year	Insurance Plan	CKD Stages 1 & 2 (%)	CKD Stage 3 (%)	CKD Stages 4 & 5 (%)	CKD Stage Unknown (%)
2006	Medicare FFS	0.0	0.0	0.0	100.0
	Managed care	0.0	0.0	0.0	100.0
	Medicare Advantage	0.0	0.0	0.0	100.0
2007	Medicare FFS	8.6	22.2	12.5	56.7
	Managed care	17.4	23.7	13.3	45.5
	Medicare Advantage	19.1	23.8	12.6	44.5
2008	Medicare FFS	8.5	27.7	12.6	51.2
	Managed care	18.0	28.3	15.5	38.2
	Medicare Advantage	19.8	28.1	14.8	37.2
2009	Medicare FFS	8.3	31.5	12.3	47.9
	Managed care	17.4	31.1	14.0	37.5
	Medicare Advantage	18.7	34.9	13.3	33.1
2010	Medicare FFS	8.5	35.4	11.9	44.2
	Managed care	16.9	34.6	13.2	35.4
	Medicare Advantage	18.9	41.0	11.9	28.1
2011	Medicare FFS	8.7	38.6	11.4	41.3
	Managed care	17.1	36.6	12.7	33.6
	Medicare Advantage	18.2	44.8	11.4	25.6
2012	Medicare FFS	9.3	41.8	11.0	37.9
	Managed care	17.0	38.0	12.5	32.4
	Medicare Advantage	18.4	46.4	11.2	23.9
2013	Medicare FFS	9.7	44.0	10.8	35.6
	Managed care	17.1	38.9	12.1	31.9
	Medicare Advantage	19.4	45.9	11.0	23.7
2014	Medicare FFS	10.0	46.1	10.2	33.7
	Managed care	17.0	40.3	11.4	31.2
	Medicare Advantage	19.7	47.2	10.9	22.2
2015	Medicare FFS	10.4	48.5	9.9	31.2
	Managed care	17.0	42.1	11.3	29.6
	Medicare Advantage	18.7	48.7	10.7	21.9
2016	Medicare FFS	10.0	46.7	8.8	34.4
	Managed care	18.5	40.1	11.2	30.2
	Medicare Advantage	20.1	48.0	11.0	20.8

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; FFS, fee-for-service; ESRD, end-stage renal disease.

References

- Centers for Medicare & Medicaid Services (CMS). Medicare & Medicaid Statistical Supplement: 2013 Edition. <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/MedicareMedicaidStatSupp/2013.html>. Accessed July 12, 2017.
- The Henry J. Kaiser Family Foundation. Medicare Advantage. <http://kff.org/medicare/fact-sheet/medicare-advantage>. Accessed July 12, 2017.
- Morgan G., Laura P., Elizabeth H., Rajiv S., Gary M., Desmond W., and Neil P. Validation of CKD and related conditions in existing datasets: a systematic review. *Am J Kidney Dis* 2011 January; 57(1): 44-54. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2978782/pdf/nihms219374.pdf>
- S. Zuckerman, L. Skopec, and S. Guterman. “Do Medicare Advantage Plans Minimize Costs? Investigating the Relationship Between Benchmarks, Costs, and Rebates.” The Commonwealth Fund, December 2017. <https://www.commonwealthfund.org/publications/issue-briefs/2017/dec/do-medicare-advantage-plans-minimize-costs-investigating>

Notes