Chapter 6: Healthcare Expenditures for Persons with CKD

- In this 2017 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 CKD.
- Medicare spending for all beneficiaries who had chronic kidney disease (CKD; 11% of total) exceeded $64 billion in 2015 (Tables 6.1 and 6.3). When adding an extra $34 billion of end-stage renal disease (ESRD) costs (Volume 2, Chapter 9, *Healthcare Expenditures for Persons with ESRD*, Figure 9.2), total Medicare spending on both CKD and ESRD was over $98 billion.
- In 2015, Medicare spending for beneficiaries with CKD aged 65 and older exceeded $55 billion, representing 20% of all Medicare spending in this age group (Figure 6.1).
- Medicare spending for beneficiaries with CKD who were younger than age 65 (6% of total) exceeded $8 billion in 2015, representing 14% of total spending in this age group (Table 6.3).
- 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 2015 Medicare spending for beneficiaries aged 65 and older was for those who had diagnoses of CKD, diabetes mellitus (DM), or heart failure (HF; Figure 6.1).
- Over 70% of total Medicare spending for beneficiaries with CKD who were aged 65 and older was incurred by the 60% of these patients who also had DM, HF, or both (Table 6.1).
- Spending per patient-year for those with all three chronic conditions of CKD, DM, and HF was more than twice as high ($39,395) than for beneficiaries with only CKD ($15,930; Table 6.1).
- Per-person per-year spending for Medicare Advantage enrollees and those in the Optum Clinformatics™ managed care was slightly lower, at 93% and 99% of the expenditures for fee-for-service Medicare (Table 6.6).
- For beneficiaries under age 65 who qualified for Medicare based on a disability rather than age, spending was somewhat higher in the Medicare Advantage program, both when averaged across all beneficiaries (12% higher) and among all those with CKD (6% higher; Table 6.3).
- In the fee-for-service 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. However, Blacks with Medicare Advantage may have lower spending than do patients of other races.
- The analysis of expenses for beneficiaries with CKD indicates avenues for potential savings, and the effect of cost-containment efforts in this population. 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 CKD 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 DM and HF status.

In this 2017 ADR, we add comparable information from the Optum Clinformatics™ DataMart for persons enrolled in Medicare Advantage and through a large commercial managed care organization. Growth in the percent of Medicare beneficiaries enrolled in managed care increased from 13% in 2004 to 31% in 2015 (Kaiser, 2017); 16.8 million individuals were enrolled in an Medicare Advantage plan in March 2015. Addition of this data 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. Assuming that under-identification occurs most often in the earliest and least costly patient cases, spending estimates per patient-year (PPY) 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 PPY 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 2017 ADR, Volume 1, Chapters 1 (*CKD in the General Population*), 2 (*Identification and Care of Patients with CKD*), and *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. The 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.

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 1996-2015 and from 100% of the Optum Clinformatics™ dataset for calendar years 2006-2015. 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. See the Chapter 6 section of *CKD Analytical Methods*, in the *CKD Analytical Methods* chapter for an explanation of the analytical methods used to generate the study cohorts, figures, and tables in this chapter. Microsoft Excel and PowerPoint files containing the data and graphics for these figures and tables are available to download from 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 11% of the point prevalent aged Medicare population, yet accounted for 21% of total expenditures (Table 6.1).

We examined 2015 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 97% higher for patients with CKD only, versus those with no CKD, DM, or HF ($15,930 vs $8,074). 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 45% higher than for those with HF alone. For beneficiaries with CKD, HF, and DM, costs were 44% higher than for those with only HF and DM. Overall, people with diagnoses 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 6.1 Prevalent Medicare fee-for-service patient counts and spending for beneficiaries aged 65 and older, by diabetes, heart failure, and/or CKD, 2015

	U.S. Medicare Population	Total Spending (millions, U.S. $)	PPPY (U.S. $)	Population (%)	Spending (%)
All	24,449,480	$262,261	$11,127	100.00	100.00
With HF or CKD or DM	8,106,280	$133,562	$17,506	33.16	50.93
CKD only (- DM & HF)	1,070,980	$16,124	$15,930	4.38	6.15
DM only (- HF & CKD)	4,003,460	$48,143	$12,432	16.37	18.36
HF only (- DM & CKD)	872,680	$17,290	$21,707	3.57	6.59
CKD and DM only (- HF)	886,240	$15,993	$19,109	3.63	6.10
CKD and HF only (- DM)	347,500	$9,255	$31,401	1.42	3.53
DM and HF only (- CKD)	495,060	$12,343	$27,397	2.03	4.71
CKD and HF and DM	430,360	$14,413	$39,395	1.76	5.50
No CKD or DM or HF	16,343,200	$128,699	$8,074	66.85	49.07
All CKD (+/- DM & HF)	2,735,080	$55,785	$22,228	11.19	21.27
All DM (+/- CKD & HF)	5,815,120	$90,892	$16,448	23.78	34.66
All HF (+/- DM & CKD)	2,145,600	$53,302	$27,941	8.78	20.32
CKD and DM (+/- HF)	1,316,600	$30,406	$25,280	5.39	11.59
CKD and HF (+/- DM)	777,860	$23,668	$35,828	3.18	9.03
DM and HF (+/- CKD)	925,420	$26,756	$32,774	3.79	10.20

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

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 10% having CKD and those with CKD accounting for 18% of spending. The managed care population had a lower prevalence of CKD (6%), but those with CKD also accounted for an outsize (12%) proportion of spending.

Per-person per-year spending in these populations was somewhat lower than that for FFS Medicare. In this data set, Optum Clinformatics™ Medicare Advantage spending was 93% of those receiving FFS Medicare, with managed care beneficiaries at 99%. 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, so may be younger and healthier than the typical Medicare FFS beneficiary). Spending for those with CKD was only about 80.3% ($15,630 vs $8,670) and 90.1% ($17,615 vs $9,267) higher than for those with no CKD, DM, or HF in the Medicare Advantage and managed care populations.

vol 1 Table 6.2 Prevalent Medicare Advantage and managed care spending for beneficiaries aged 65 and older, by diabetes, heart failure, and/or CKD, 2015

	Medicare Advantage			Managed care		
	PPPY (U.S. $)	Population (%)	Spending (%)	PPPY (U.S. $)	Population (%)	Spending (%)
All	$11,191	100.00	100.00	$11,146	100.00	100.00
With HF or CKD or DM	$17,253	29.81	45.29	$17,100	24.19	36.80
CKD only (- DM & HF)	$15,630	4.14	5.71	$17,615	2.75	4.37
DM only (- HF & CKD)	$13,612	15.54	18.88	$13,675	14.76	17.99
HF only (- DM & CKD)	$20,916	2.69	4.84	$21,260	2.16	4.07
CKD and DM only (- HF)	$19,226	3.73	6.32	$21,008	2.32	4.32
CKD and HF only (- DM)	$27,505	1.02	2.34	$30,363	0.55	1.44
DM and HF only (- CKD)	$27,223	1.47	3.41	$27,612	1.00	2.43
CKD and HF and DM	$37,105	1.23	3.78	$38,928	0.65	2.18
No CKD or DM or HF	$8,670	70.19	54.71	$9,267	75.81	63.20
All CKD (+/- DM & HF)	$20,603	10.12	18.16	$22,092	6.27	12.32
All DM (+/- CKD & HF)	$16,673	21.96	32.39	$16,167	18.73	26.92
All HF (+/- DM & CKD)	$26,435	6.41	14.38	$26,431	4.37	10.12
CKD and DM (+/- HF)	$23,459	4.96	10.10	$24,841	2.97	6.50
CKD and HF (+/- DM)	$32,736	2.26	6.13	$35,002	1.20	3.62
DM and HF (+/- CKD)	$31,658	2.70	7.19	$32,012	1.65	4.61

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; HF, heart failure; DM, diabetes mellitus; PPPY, per-person per-year costs. Numbers of 'All' patients included in this table are 2,167,627 and 223,395 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 6% had CKD, but those individuals accounted for 14% of spending. One-fourth had one or more of CKD, DM, and/or HF, accounting for 43% of spending for this group (Table 6.3). Much of these expenditures, however, were for those who had DM, at 21% of the population and 35% of spending.

vol 1 Table 6.3 Prevalent Medicare fee-for-service patient counts and spending for beneficiaries younger than age 65, by diabetes, heart failure, and/or CKD, 2015

	U.S. Medicare Population	Total Costs (millions, U.S. $)	PPPY spending (U.S. $)	Population (%)	Spending (%)
All	4,967,060	$62,093	$13,025	100.00	100.00
With HF or CKD or DM	1,278,300	$26,984	$22,311	25.74	43.46
CKD only (- DM & HF)	99,680	$2,236	$23,803	2.01	3.60
DM only (- HF & CKD)	808,920	$13,605	$17,551	16.29	21.91
HF only (- DM & CKD)	99,140	$2,295	$24,701	2.00	3.70
CKD and DM only (- HF)	113,500	$3,078	$29,119	2.29	4.96
CKD and HF only (- DM)	21,600	$775	$40,786	0.44	1.25
DM and HF only (- CKD)	83,280	$2,673	$34,484	1.68	4.30
CKD and HF and DM	52,180	$2,322	$51,377	1.05	3.74
No CKD or DM or HF	3,688,760	$35,109	$9,868	74.26	56.54
All CKD (+/- DM & HF)	286,960	$8,411	$31,879	5.78	13.55
All DM (+/- CKD & HF)	1,057,880	$21,677	$21,600	21.30	34.91
All HF (+/- DM & CKD)	256,200	$8,065	$34,373	5.16	12.99
CKD and DM (+/- HF)	165,680	$5,399	$35,785	3.34	8.70
CKD and HF (+/- DM)	73,780	$3,097	$48,241	1.49	4.99
DM and HF (+/- CKD)	135,460	$4,995	$40,705	2.73	8.04

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

Medicare Advantage and commercial Managed Care coverage

The under age 65 Medicare Advantage population was similar to the FFS Medicare population. Thirty percent of the Medicare Advantage beneficiaries had one or more of CKD, DM, and/or HF, accounting for 44% of spending for this group (Table 6.4). At only 6%, the managed care population under age 65 was much less likely to have CKD, DM, or HF (Table 6.4).

For those under age 65 who qualified for Medicare based on a disability rather than age, spending was somewhat higher for beneficiaries in the Medicare Advantage program, both when averaged across all beneficiaries (42% higher) and among all with CKD (24% higher; Tables 6.3 and 6.4). Consistent with our other findings, average spending for those with CKD was considerably lower in the managed care population than in the Medicare FFS and Medicare Advantage populations.

vol 1 Table 6.4 Prevalent Medicare Advantage and managed care fee-for-service spending for beneficiaries younger than age 65, by diabetes, heart failure, and/or CKD, 2015

	Medicare Advantage			Managed care		
	PPPY (U.S. $)	Population (%)	Spending (%)	PPPY (U.S. $)	Population (%)	Spending (%)
All	$18,503	100.00	100.00	$5,279	100.00	100.00
With HF or CKD or DM	$27,572	29.77	43.92	$13,208	6.37	15.62
CKD only (- DM & HF)	$29,476	2.04	3.23	$16,206	0.55	1.66
DM only (- HF & CKD)	$22,035	19.20	22.77	$11,029	5.02	10.30
HF only (- DM & CKD)	$32,499	2.09	3.59	$20,752	0.30	1.14
CKD and DM only (- HF)	$34,673	2.99	5.54	$22,361	0.32	1.33
CKD and HF only (- DM)	$53,785	0.44	1.23	$40,815	0.03	0.21
DM and HF only (- CKD)	$39,620	1.91	3.97	$28,588	0.11	0.56
CKD and HF and DM	$63,266	1.12	3.59	$59,704	0.04	0.41
No CKD or DM or HF	$14,713	70.23	56.08	$4,751	93.63	84.38
All CKD (+/- DM & HF)	$38,954	6.58	13.60	$20,782	0.94	3.62
All DM (+/- CKD & HF)	$26,570	25.21	35.88	$12,359	5.49	12.60
All HF (+/- DM & CKD)	$42,663	5.55	12.38	$26,831	0.48	2.33
CKD and DM (+/- HF)	$42,169	4.10	9.14	$26,253	0.36	1.75
CKD and HF (+/- DM)	$60,539	1.56	4.83	$51,605	0.07	0.63
DM and HF (+/- CKD)	$48,183	3.02	7.56	$36,721	0.15	0.97

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; HF, heart failure; DM, diabetes mellitus; PPPY, per-person per-year spending. Number of 'All' patients included in this table are 277,724 and 4,868,546 for Medicare Advantage and Managed care respectively.

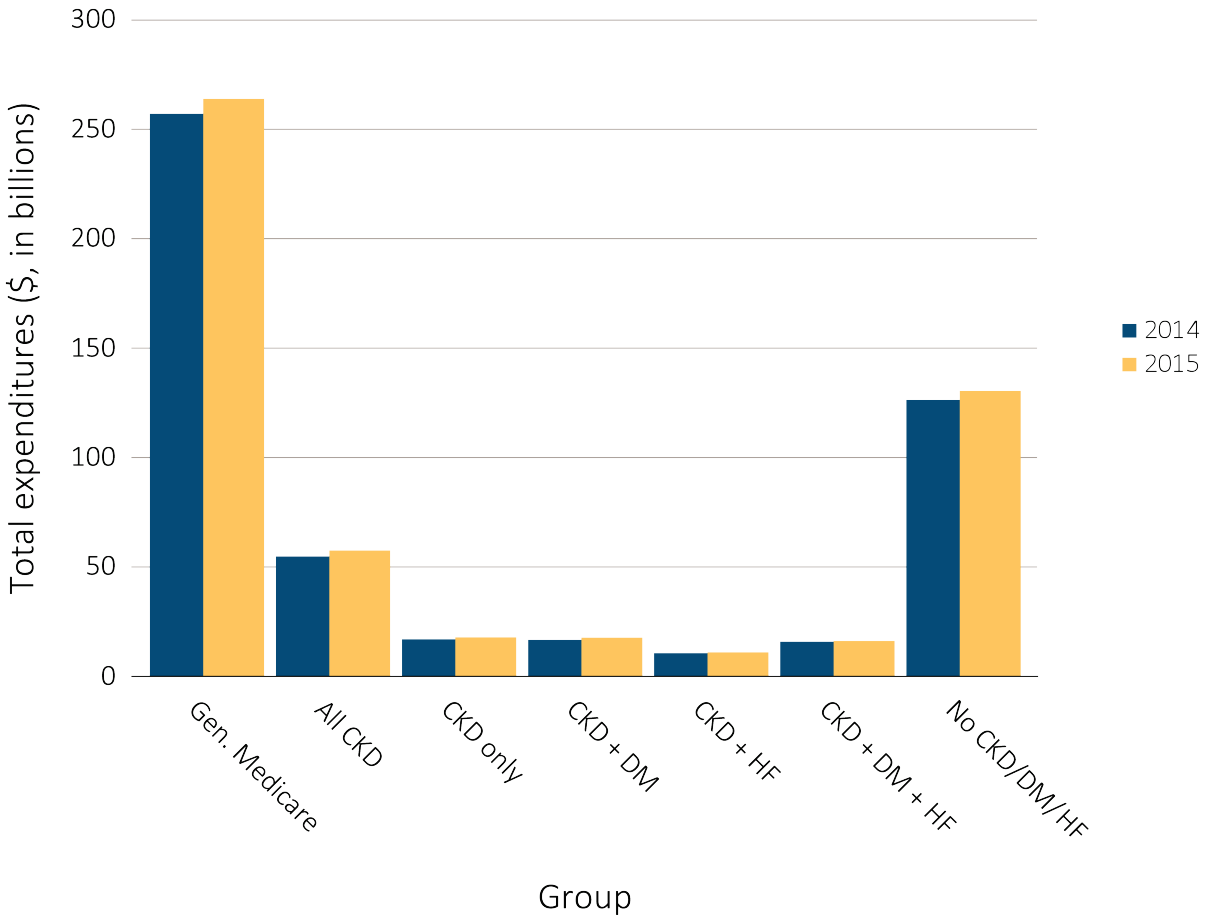
Spending for CKD by Stage and Patient Characteristics

Among the FFS Medicare population aged 65 and older, between 2014 and 2015 total spending for Parts A, B, and D rose by $7 billion, to $262 billion. Total spending for CKD patients rose by $2.8 billion, to $55.8 billion (Figure 6.1). Therefore, spending growth among CKD patients accounted for over one third of the increase in Medicare expenditures during this year.

Further, Medicare expenditures were higher for beneficiaries with CKD than for beneficiaries with ESRD ($55.8 billion vs. $33.9 billion; see Volume 2, Chapter 9, *Healthcare Expenditures for Persons with ESRD*). Expenditures for beneficiaries with CKD now represent 21.3% 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 only CKD and CKD with comorbid DM. The spending increase appears to be driven by a rise in the proportion of beneficiaries with recognized CKD (see Table 6.7 and Volume 1, Chapter 2, *Identification and Care of Patients with CKD*, Figure 2.2).

vol 1 Figure 6.1 Overall Medicare Parts A, B, and D fee-for-service spending for beneficiaries aged 65 and older, by CKD, diabetes, and heart failure, 2014 & 2015



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

All CKD patients 65 and older required increased care as they progressed to later stages of disease (Figures 6.2.a-c; see Table A for CKD definitions). In the FFS Medicare population, PPPY expenditures in 2015 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 $16,691 in Stages 1-2 to $31,277 in Stages 4-5. The managed care population was similar, with expenditures of $18,026 in Stages 1-2 to $32,585 in Stages 4-5.

Group trends in PPPY spending from 2012-2015 were mixed (Figures 6.2.a-c). FFS Medicare saw PPPY expenditures increase 1.8% overall for individuals with any CKD, but the increase was most dramatic for those in Stages 4-5, rising by 6.2%. However, PPPY spending dropped 13% over this period for Medicare Advantage beneficiaries with CKD. Spending for managed care beneficiaries moved without clear patterns, but it should be noted that the Optum Clinformatics™ population of managed care enrollees with CKD was relatively small (N=14,011 in 2015). Overall PPPY spending was slightly higher in 2015 than in 2012, but spending on beneficiaries in Stages 1-2 decreased by 6% while expenditures on beneficiaries in Stages 4-5 increased by 10%.

vol 1 Figure 6.2 Overall per-person per-year spending for beneficiaries aged 65 and older, by CKD stage, and year, 2012-2015

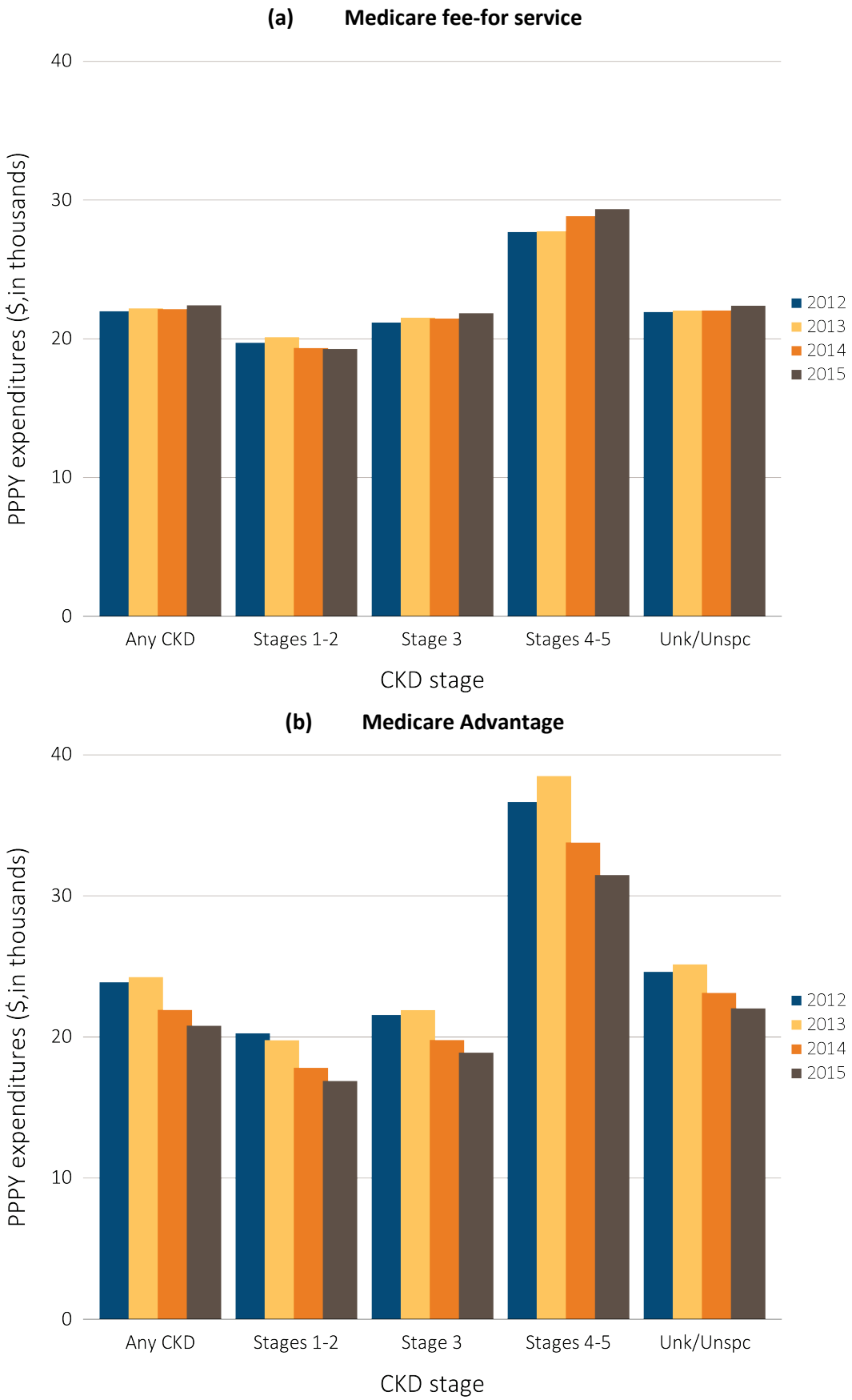
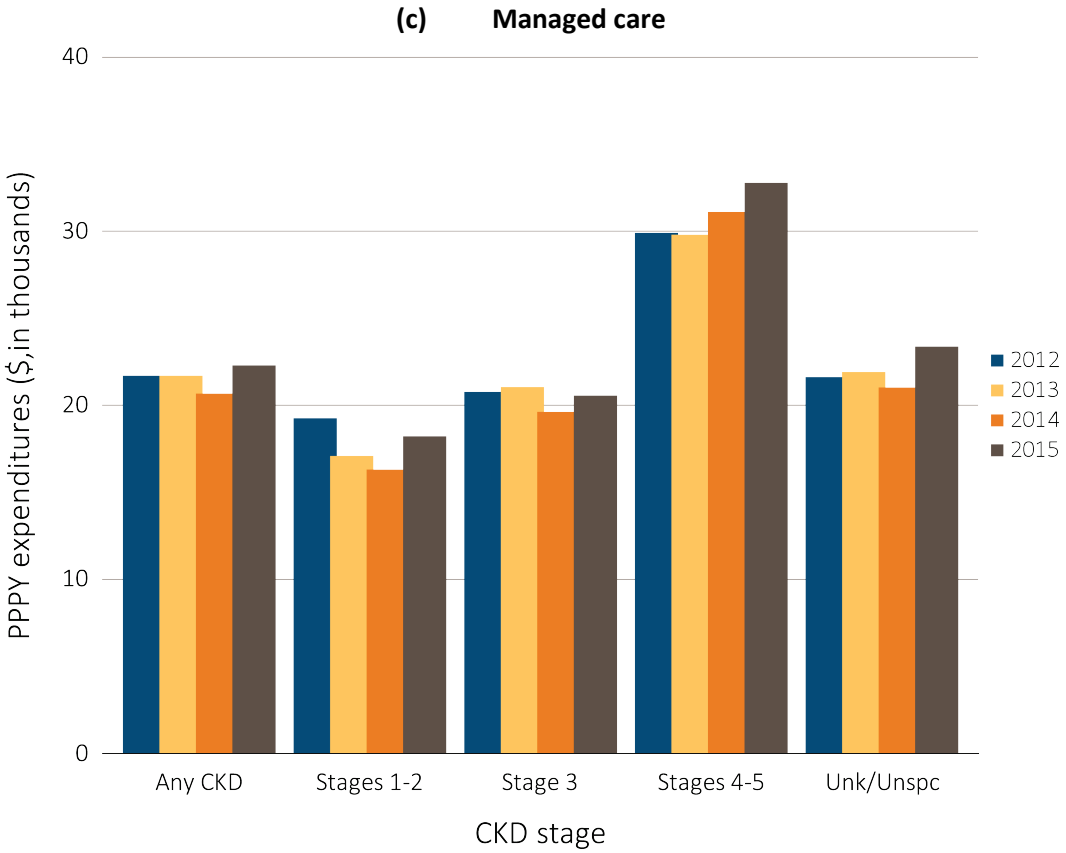


Figure 6.2 continued on next page.

vol 1 Figure 6.2 Overall per-person per-year spending for beneficiaries aged 65 and older, by CKD stage, and year, 2012-2015 *(continued)*



Data Source: Medicare 5% sample and Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; PPPY, per-person per-year.

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 6.5 presents PPPY Medicare FFS spending for Parts A, B, and D services, for beneficiaries with CKD (but not ESRD), by stage of CKD. In 2015, PPPY costs reached $22,228 for FFS Medicare CKD patients aged 65 and older, a slight increase from 2014 ($21,942). This increased spending was observed in CKD Stages 3 and 4-5, while the costs in Stages 1-2 decreased slightly from 2014 to 2015. During this period, the distribution of identified patient years also shifted towards the less severe and less costly stages. In 2015, costs for beneficiaries with Stages 4-5 CKD ($29,151) were 52.8% greater than for beneficiaries with Stages 1-2 CKD ($19,074). Although the number of beneficiaries with unknown/unspecified CKD stage decreased slightly, 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 9.1%, a decrease over the 14.9% disparity observed in 2014. Per capita spending for Whites increased slightly while per capita spending for Blacks decreased slightly.

vol 1 Table 6.5 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, 2014 & 2015

	2014					2015				
	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	2,416,562	248,272	1,125,995	227,538	814,757	2,509,731	266,837	1,231,392	228,778	782,724
All patients	$21,942	$19,139	$21,271	$28,637	$21,854	$22,228	$19,074	$21,649	$29,151	$22,190
Age										
65-69	$20,751	$17,380	$20,541	$30,039	$20,137	$21,115	$17,869	$20,801	$31,518	$20,431
70-74	$20,437	$17,460	$20,036	$28,398	$20,247	$20,363	$16,778	$19,940	$28,408	$20,459
75-79	$21,512	$17,472	$20,924	$28,916	$21,740	$21,516	$18,711	$20,820	$28,681	$21,746
80-84	$22,217	$20,511	$21,253	$27,794	$22,417	$22,737	$19,779	$22,190	$28,657	$22,776
85+	$23,957	$23,214	$22,907	$28,587	$23,967	$24,600	$22,760	$23,673	$29,170	$24,882
Sex										
Male	$21,542	$18,916	$21,099	$28,166	$21,221	$21,928	$18,499	$21,589	$29,200	$21,661
Female	$22,303	$19,348	$21,429	$29,022	$22,424	$22,501	$19,631	$21,704	$29,111	$22,677
Race										
White	$21,551	$18,921	$20,939	$27,871	$21,476	$21,990	$18,809	$21,563	$28,272	$21,962
Black/African American	$24,746	$21,099	$23,787	$32,269	$24,566	$23,983	$19,880	$22,439	$33,943	$24,139
Other	$22,457	$18,470	$21,625	$30,737	$22,811	$22,492	$20,878	$21,520	$30,138	$22,185

Data source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; Unk/unspc, CKD stage unknown or unspecified.

Table 6.6 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 lower for Blacks than Whites, by 26% for those covered by Medicare Advantage and 35% in the managed care population.

vol 1 Table 6.6 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, 2015

	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	219,259	20,495	95,087	14,940	88,737	14,011	1,362	5,689	885	6,075
All patients	$20,603	$16,691	$18,693	$31,277	$21,829	$22,092	$18,026	$20,361	$32,585	$23,181
Age										
65-69	$23,527	$17,190	$21,886	$44,084	$24,137	$24,336	$17,469	$22,059	$46,513	$25,893
70-74	$21,985	$17,372	$19,741	$39,711	$23,206	$22,982	$17,434	$21,171	$36,387	$24,639
75-79	$21,877	$16,864	$20,030	$36,906	$22,773	$21,245	$18,328	$19,516	$32,263	$21,899
80-84	$19,893	$16,195	$18,033	$28,614	$21,269	$21,046	$22,427	$19,681	$28,361	$21,024
85+	$16,823	$15,424	$15,522	$19,491	$18,104	$17,723	$15,833	$17,728	$20,386	$17,265
Sex										
Male	$21,368	$16,838	$19,439	$33,226	$22,607	$22,401	$18,668	$20,884	$33,259	$23,275
Female	$19,958	$16,563	$18,082	$29,777	$21,143	$21,520	$17,010	$19,634	$30,595	$22,941
Race										
White	$20,675	$17,205	$18,746	$28,785	$22,259	$22,051	$18,662	$20,563	$31,447	$22,840
Black/African American	$15,316	$9,883	$13,756	$30,632	$15,671	$14,326	$9,709	$13,809	$16,624	$15,869
Other	$21,058	$16,534	$19,134	$36,471	$21,648	$22,955	$17,167	$20,220	$37,534	$25,162

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; Unk/unspc, CKD stage unknown or unspecified.

Tables 6.7 and 6.8 present PPPY spending for beneficiaries with both CKD and DM. These tables show similar results as in the overall CKC population. Among the 2015 FFS Medicare beneficiaries with these two conditions, PPPY spending for Blacks was $27,016—7.9% greater than the $25,033 incurred for Whites. Yet, spending by Medicare Advantage was 29% lower for Blacks than Whites and 39% lower for the managed care population.

vol 1 Table 6.7 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, 2014 & 2015

	2014					2015				
	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	1,162,063	120,091	549,920	119,516	372,537	1,202,782	128,814	594,220	121,161	358,588
All patients	$24,967	$21,570	$24,500	$32,440	$24,354	$25,280	$21,797	$24,884	$32,981	$24,585
Age										
65-69	$24,083	$19,437	$24,709	$32,609	$22,750	$24,540	$20,290	$24,791	$35,626	$22,878
70-74	$23,657	$20,235	$23,321	$32,854	$22,836	$23,494	$19,302	$23,080	$32,525	$23,234
75-79	$24,488	$19,732	$24,237	$31,863	$24,205	$24,861	$22,062	$24,094	$32,501	$24,692
80-84	$25,378	$24,944	$24,261	$31,261	$25,138	$26,032	$22,450	$25,815	$32,439	$25,194
85+	$27,438	$26,046	$26,286	$33,507	$27,039	$27,854	$27,396	$27,078	$32,502	$27,318
Sex										
Male	$24,023	$21,210	$23,884	$31,141	$23,101	$24,469	$20,952	$24,242	$33,138	$23,506
Female	$25,892	$21,945	$25,119	$33,493	$25,586	$26,091	$22,709	$25,536	$32,850	$25,676
Race										
White	$24,447	$21,301	$23,990	$31,348	$23,983	$25,033	$21,259	$24,937	$31,991	$24,264
Black/African American	$28,184	$23,038	$27,392	$37,347	$27,386	$27,016	$23,370	$25,170	$37,048	$27,042
Other	$24,914	$21,601	$25,129	$32,986	$23,376	$24,927	$24,014	$23,732	$34,155	$24,011

Data source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; Unk/unspc, CKD stage unknown or unspecified.

vol 1 Table 6.8 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, 2015

	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	107,428	9,995	43,494	7,767	46,172	6,635	639	2,654	463	2,879
All patients	$23,459	$19,036	$22,041	$37,182	$23,520	$24,841	$20,492	$22,766	$40,557	$25,317
Age										
65-69	$26,544	$19,241	$25,468	$47,871	$26,425	$26,569	$20,232	$24,953	$57,489	$25,754
70-74	$24,704	$20,200	$23,189	$46,334	$24,195	$26,149	$20,599	$23,648	$34,882	$28,886
75-79	$24,210	$19,675	$23,096	$40,660	$23,647	$25,107	$21,032	$21,791	$43,039	$26,212
80-84	$21,876	$17,292	$20,196	$31,204	$22,715	$21,687	$20,809	$19,994	$32,716	$21,318
85+	$19,103	$17,144	$18,085	$22,900	$19,679	$18,985	$20,578	$19,382	$18,487	$18,494
Sex										
Male	$23,726	$18,819	$22,148	$39,575	$23,959	$24,446	$20,642	$23,026	$37,771	$24,757
Female	$23,213	$19,248	$21,942	$35,321	$23,111	$25,342	$20,305	$22,399	$42,098	$26,236
Race										
White	$23,863	$20,115	$22,348	$34,321	$24,408	$25,208	$21,737	$23,826	$37,791	$25,244
Black/African American	$16,837	$10,561	$16,427	$34,072	$15,804	$15,377	$9,056	$13,847	$29,197	$16,665
Other	$23,558	$18,545	$22,138	$42,299	$22,931	$24,750	$18,664	$20,564	$48,899	$26,600

Data Source: Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; Unk/unspc, CKD stage unknown or unspecified.

Tables 6.9 and 6.10 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 61% more ($35,826) than the average CKD patient ($22,228). These results were consistent with those seen in the previous tables. In 2015, FFS Medicare PPPY expenditures for Black beneficiaries with both conditions reached $39,417—12.0% higher than the $35,188 PPPY for their White counterparts. In contrast to FFS Medicare, Black Medicare Advantage beneficiaries required 21% less spending than did their White counterparts, and Black managed care beneficiaries 27% less.

vol 1 Table 6.9 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, 2014 & 2015

	2014					2015				
	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	654,204	55,380	307,873	83,501	207,451	660,606	57,097	330,479	83,409	189,622
All patients	$35,089	$32,559	$34,707	$41,078	$33,920	$35,828	$33,808	$35,519	$41,364	$34,540
Age										
65-69	$38,964	$35,468	$38,564	$48,415	$37,139	$39,623	$36,226	$39,094	$50,216	$37,389
70-74	$35,963	$29,170	$35,946	$43,186	$35,479	$36,739	$31,040	$36,867	$42,396	$36,129
75-79	$36,424	$31,296	$36,130	$43,382	$35,605	$36,501	$35,705	$35,884	$42,059	$35,505
80-84	$34,257	$34,638	$33,533	$39,513	$33,075	$35,416	$33,497	$35,522	$39,841	$33,786
85+	$33,136	$32,880	$32,752	$37,922	$31,686	$33,936	$33,324	$33,469	$38,722	$32,654
Sex										
Male	$34,250	$32,001	$34,025	$40,137	$32,947	$34,930	$32,710	$34,640	$41,134	$33,565
Female	$35,846	$33,096	$35,360	$41,834	$34,747	$36,682	$34,895	$36,387	$41,556	$35,451
Race										
White	$34,139	$31,708	$33,906	$39,922	$32,868	$35,188	$32,972	$35,058	$39,893	$34,087
Black/African American	$40,636	$36,146	$40,085	$46,446	$39,937	$39,417	$34,856	$38,612	$48,199	$37,335
Other	$38,247	$36,062	$36,300	$44,948	$39,040	$38,654	$43,218	$36,990	$45,342	$36,434

Data source: Medicare 5% sample. Abbreviations: CKD, chronic kidney disease; Unk/unspc, CKD stage unknown or unspecified.

vol 1 Table 6.10 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, 2015

	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	48,871	3,174	19,734	4,511	21,452	2,690	163	1,136	258	1,133
All patients	$32,736	$29,232	$30,743	$43,293	$32,942	$35,002	$38,649	$31,856	$44,486	$35,500
Age										
65-69	$44,743	$37,331	$42,551	$63,593	$44,291	$49,769	$44,473	$49,095	$88,857	$45,340
70-74	$39,263	$34,410	$36,482	$53,006	$40,104	$39,502	$35,685	$33,810	$45,028	$45,420
75-79	$36,693	$30,348	$34,727	$55,871	$35,681	$34,234	$56,697	$27,289	$48,370	$34,927
80-84	$31,036	$26,279	$29,781	$42,645	$30,439	$30,377	$35,981	$27,208	$37,293	$30,957
85+	$22,865	$21,992	$21,782	$25,391	$23,468	$21,646	$21,051	$22,002	$21,908	$21,248
Sex										
Male	$33,430	$29,907	$31,443	$44,242	$33,698	$34,497	$41,971	$31,942	$48,441	$33,205
Female	$32,103	$28,621	$30,082	$42,488	$32,264	$35,950	$32,429	$31,858	$39,303	$39,650
Race										
White	$31,967	$29,231	$29,922	$39,984	$32,672	$33,237	$36,180	$29,610	$41,622	$34,534
Black/African American	$25,266	$13,455	$26,010	n/a	$23,104	$24,231	$31,264	$29,097	n/a	$19,525
Other	$35,124	$30,102	$33,213	$51,387	$34,282	$42,126	$46,988	$40,216	$55,446	$40,197

Data Source: Optum Clinformatics™. n/a: data not shown due to limited number of patients. Abbreviations: CKD, chronic kidney 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 21.3% in 2015. 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 12.3% of the FFS Medicare population in 2000, 2008, and 2015.

Figure 6.3 presents total expenditures on Parts A, B, and D services for Medicare FFS beneficiaries with CKD, DM, and HF. In 2015, expenditures for CKD patients reached $55.8 billion, accounting for 21.2% of the total spending for all FFS Medicare beneficiaries. Care of beneficiaries with CKD and concurrent DM required $30.4 billion in 2015, or 33.4% of the total FFS Medicare spending on DM. Spending on HF in the FFS Medicare population was $53.3 billion in 2015. Of this, $23.7 billion (44.4%) was spent on the CKD patient population with HF.

vol 1 Figure 6.3 Overall Medicare Parts A, B, and D fee-for-service spending for general Medicare population aged 65 and older and for those with CKD, 1996-2015

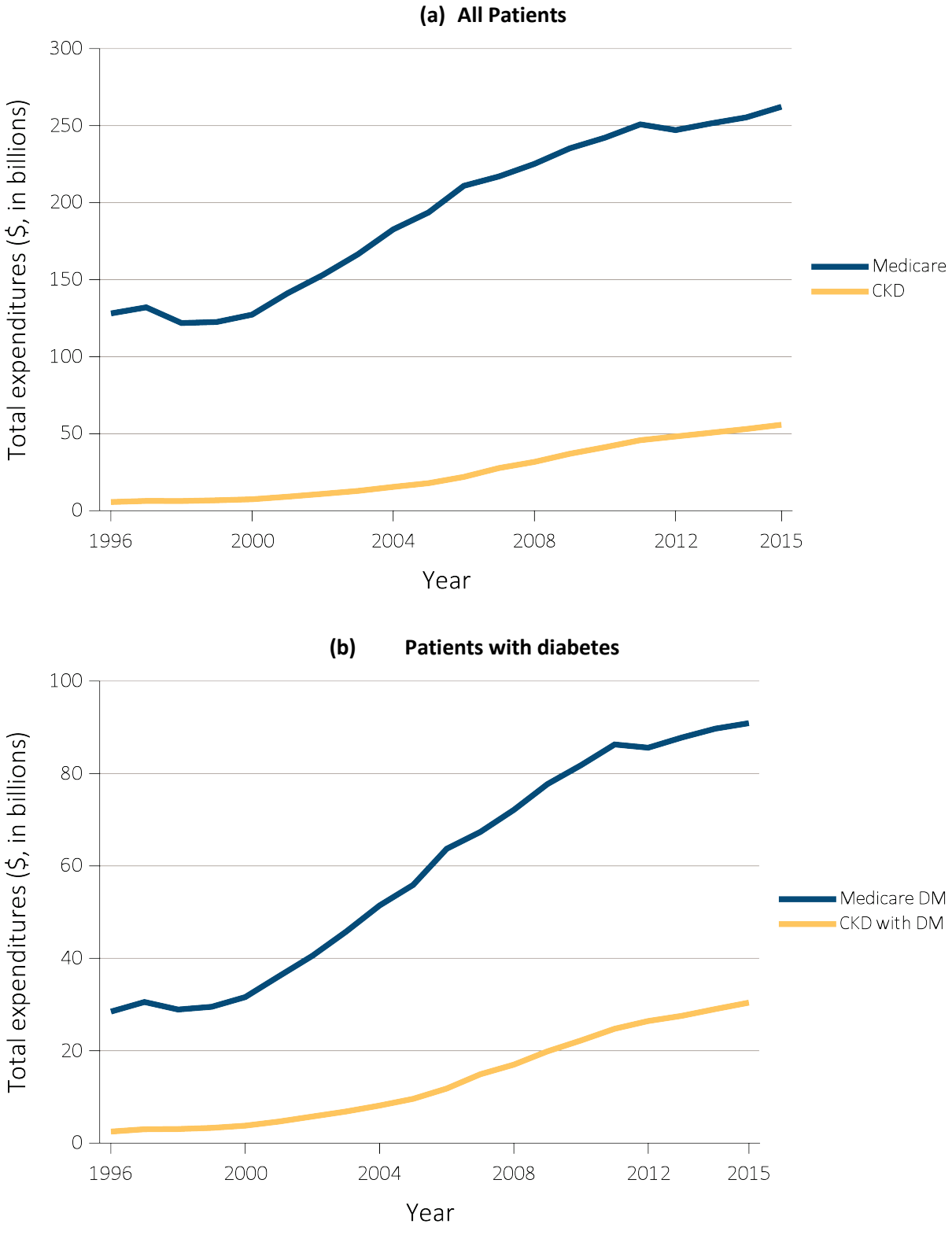
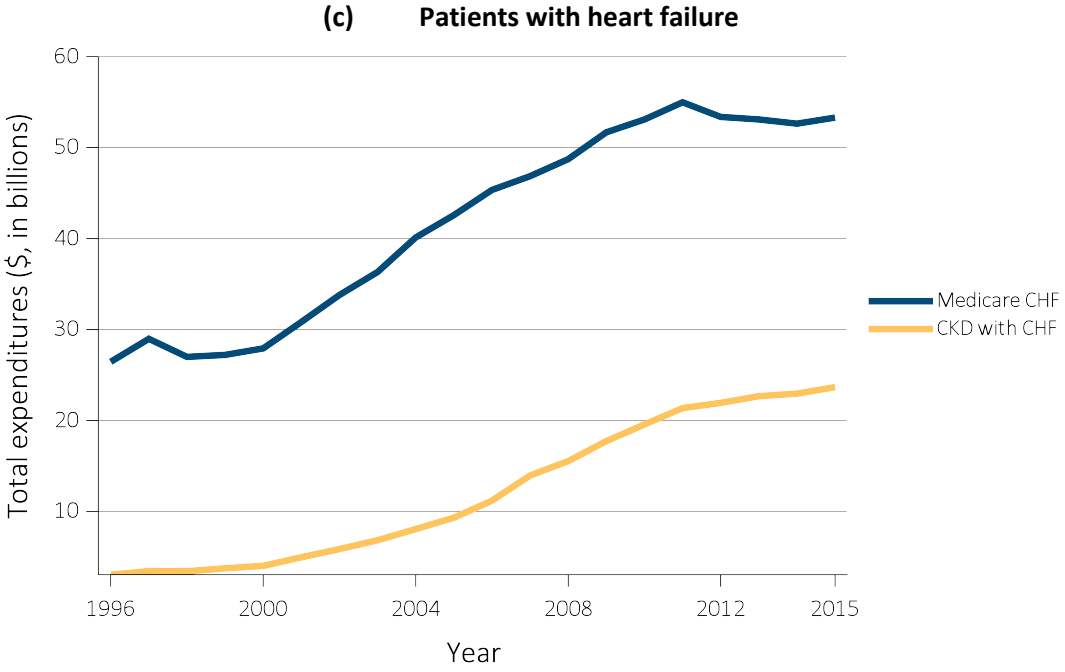


Figure 6.3 continued on next page.

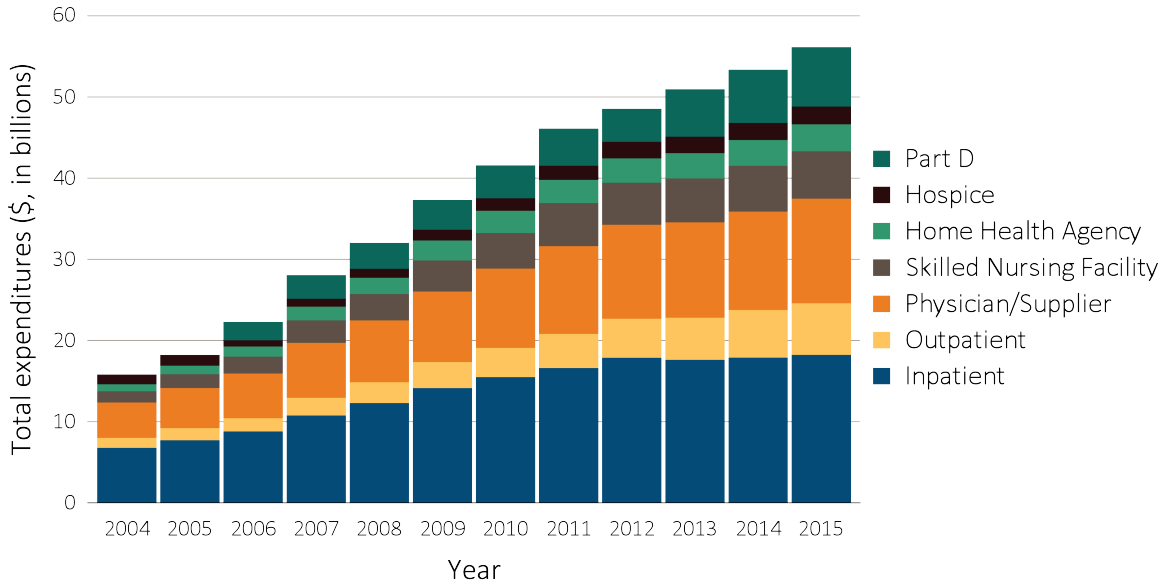
vol 1 Figure 6.3 Overall Medicare Parts A, B, and D fee-for-service spending for general Medicare population aged 65 and older and for those with CKD, 1996-2015 *(continued)*



Data Source: Medicare 5% sample. Abbreviation: CKD, chronic kidney disease.

Most spending for CKD patients was incurred for inpatient and outpatient care, physician/supplier services, and care in skilled nursing facilities. The proportion of total FFS Medicare expenditures required to provide inpatient care was 33% in 2015, while outpatient costs were predictably lower at 11%. Physician/supplier service costs amounted to 23% in 2015, while those for skilled nursing facility care reached 10% (Figure 6.4). In the Medicare non-CKD population, these expenditure percentages were 29% to provide inpatient care, 15% for outpatient, 28% for physician/supplier services, and 8% those for skilled nursing facility care (not shown).

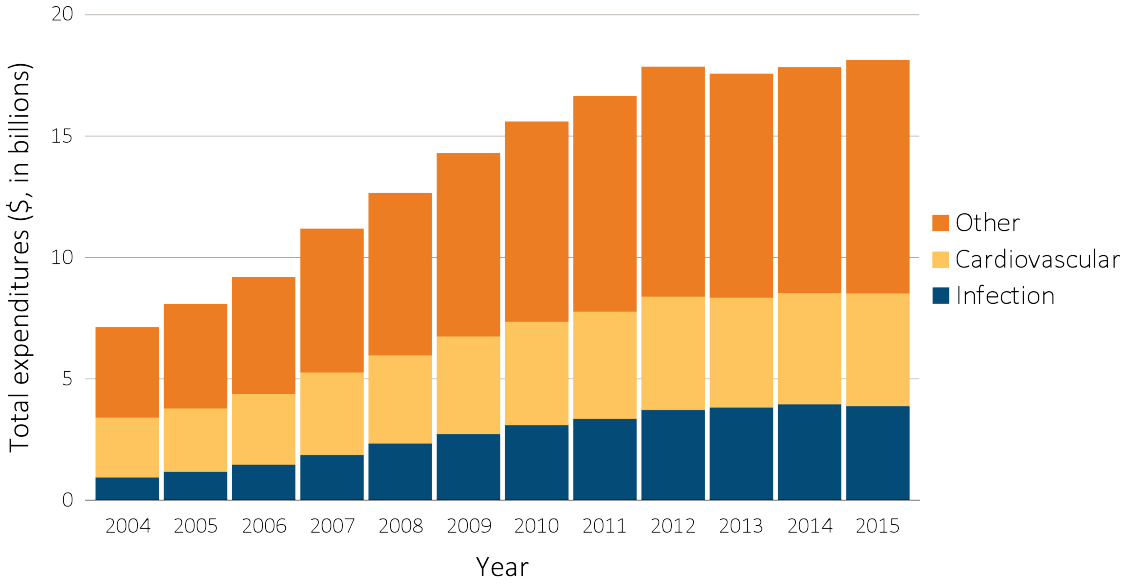
vol 1 Figure 6.4 Trends in total Medicare Parts A, B, and D fee-for-service spending for CKD patients aged 65 and older, by claim type, 2004-2015



Data source: Medicare 5% sample. Part D data occurring since 2006.

Hospitalization costs accounted for a large proportion of spending for CKD. Of the 2015 inpatient hospitalization spending for those with CKD, 22% resulted from admissions to treat infections, and 26% from cardiovascular conditions, with the remaining 52% resulting from all other causes (Figure 6.5).

vol 1 Figure 6.5 Total Medicare fee-for-service inpatient spending for CKD patients aged 65 and older, by cause of hospitalization, 2004-2015



Data source: Medicare 5% sample. Part D data occurring since 2006.

Figure 6.6 illustrates PPPY costs for CKD patients aged 65 and older by the presence of DM and HF. In 2015, PPPY costs for CKD patients varied greatly by the presence of these comorbidities. CKD patients without DM and HF required $15,930 PPPY from FFS Medicare. Those with DM in addition to CKD averaged $19,109 PPPY, and beneficiaries with both CKD and HF cost $31,401. Expenditures for those with all three conditions reached $39,395 PPPY in 2015 for FFS Medicare. Spending was also higher as comorbidities increased in the Medicare Advantage and managed care populations.

vol 1 Figure 6.6 Per-person per-year Medicare, Medicare advantage, and managed care spending for CKD patients aged 65 and older, by diabetes and heart failure, 2006-2015

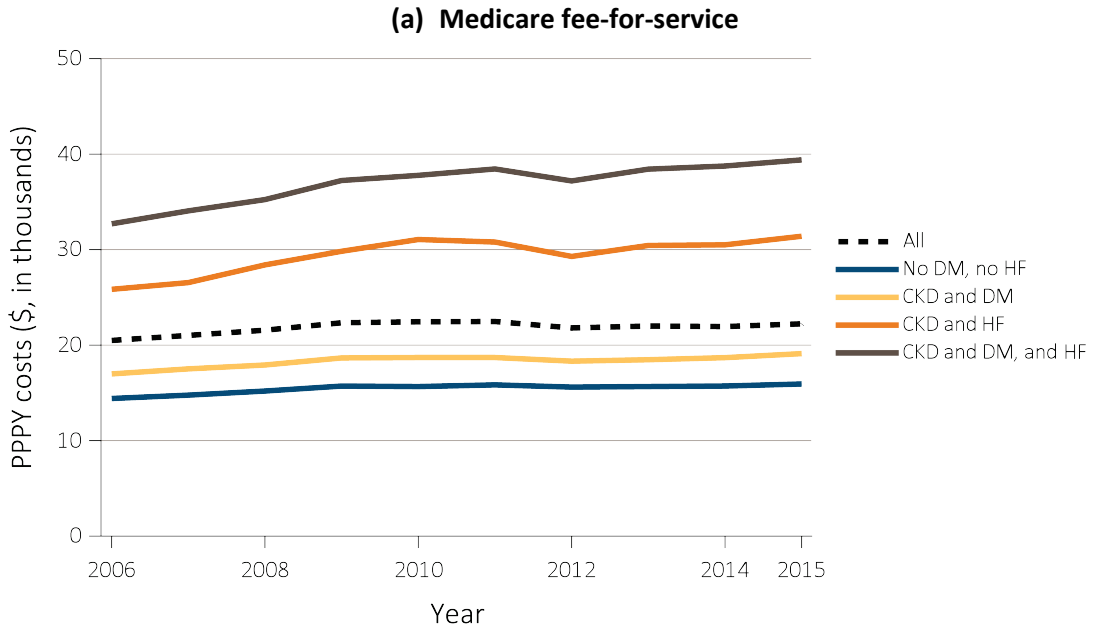
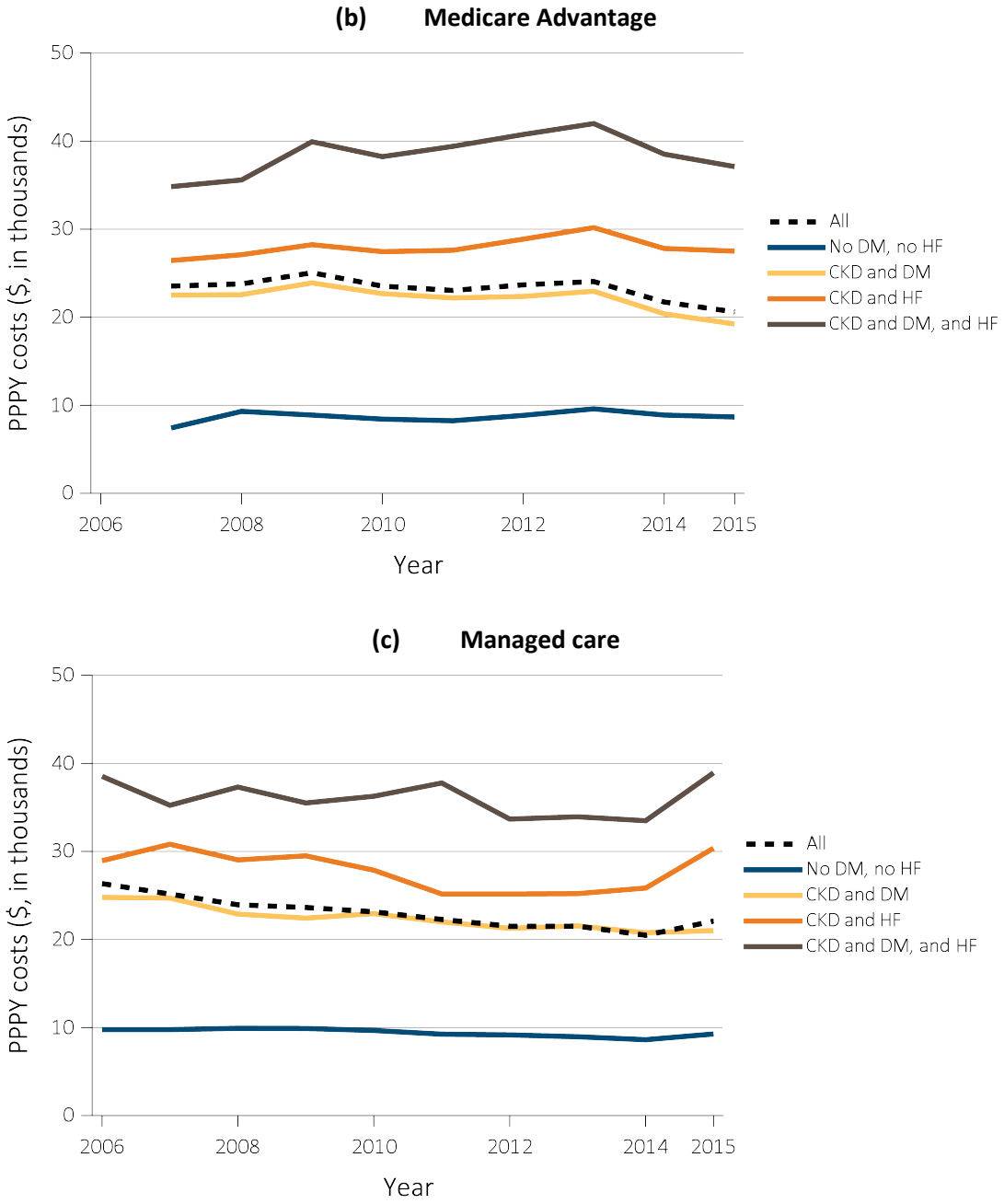


Figure 6.6 continued on next page.

vol 1 Figure 6.6 Per-person per-year Medicare, Medicare advantage, and managed care spending for CKD patients aged 65 and older, by diabetes and heart failure, 2006-2015 *(continued)*



Data Source: Medicare 5% sample and Optum Clinformatics™. Abbreviations: CKD, chronic kidney disease; DM, diabetes mellitus; HF, heart failure; PPPY, per person per year. Due to the inconsistent data, PPPY costs for Medicare Advantage in 2006 are suppressed.

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