
Chapter 3: Morbidity and Mortality in Patients With CKD

Mortality

- In 2013, adjusted mortality rates remained higher for Medicare patients with CKD (117.9/1,000) than those without (47.5/1,000), and these rates increase with CKD severity, although this gap has narrowed in the period 2001-2013.
- Male patients had slightly higher mortality rates (52.6/1,000) than females (43.4/1,000), more so among those with CKD (male: 128.7/1,000; female: 110.0/1,000).
- In contrast to previous estimations indicating racial disparity, in 2013, with adjustment for sex and age, no difference was exhibited in the rate of mortality between White and Black Medicare patients with CKD.

Hospitalization

- A notable decrease in hospitalization rates occurred from 2012 to 2013; even after adjustment, admission rates decreased by 11% for CKD patients, and by 10.1% for those without. However, rates of both overall and cause-specific admissions did increase with advancing stages of CKD.
- Older patients exhibited greater rates of hospitalization than did the younger age cohorts. In the CKD group, 769.9/1,000 for those over 85, 37.9% higher than the 558.4/1,000 rate for those 66 to 69 after adjustment.
- Racial differences in hospitalization were notable. In the CKD group, Black patients showed higher rates (719.7/1,000) than Whites (624.8/1,000) or those of other races (544.6/1,000) with adjustment, and this disparity increased with disease severity.

Rehospitalization

- Rates of rehospitalization for CKD patients were higher (22.3%) than those for patients without diagnosed CKD (15.8%).
- Male patients exhibited higher rehospitalization rates than did females in the no CKD group. (adjusted percentage were 16.7 for males and 15.3 for females).

Introduction

In this chapter we evaluate the morbidity and mortality of patients with chronic kidney disease (CKD). Each year's analysis sample was limited to patients aged 66 and older who were continuously enrolled in Medicare; employing a one-year entry period allowed us to identify CKD and other medical conditions using ICD-9-CM (International

Classification of Diseases, 9th revision, clinical modification) diagnosis codes from Medicare claims. Their hospitalizations, services, and deaths are then reported for the following calendar year. For example, the rates reported for 2013 are based on events in 2013 for patients with and without CKD in 2012. We initially present results on mortality, then focus on hospitalizations, and end with an examination of patient readmission to the hospital within 30 days

of discharge from their first hospitalization of the calendar year (referred to as the index hospitalization).

Adjusted mortality rates are higher for Medicare patients with CKD than for those without, and rates increase with advancing CKD stage, a finding consistent with studies using biochemical measures to define CKD (Matsushita et al., 2010). The co-occurrence of diabetes mellitus (DM) and cardiovascular disease (CVD) with CKD increase a patient's risk of death. This is clinically significant, as cardiovascular risk factors are relatively undertreated in CKD patients in the United States (U.S.); we illustrate this through data on disease awareness, treatment, and control of risk factors from the population-level National Health and Nutrition Examination Survey (NHANES) cohorts shown in Chapter 1, *CKD in the General Population*. Clearly, early detection and active treatment are important considerations in reducing morbidity and mortality in the CKD population.

As with mortality, hospitalization rates in the CKD population increase for both overall and cause-specific admissions with advancing stages of CKD. When data were adjusted for age, race, and sex, CKD patients were hospitalized at a rate of 0.63 admissions per patient year overall—0.54 for those in Stages 1-2, 0.61 for Stage 3, and 0.87 for Stages 4-5 (0.61 where stage was not specified; see Table A). It has been known for over a decade that rates of hospitalization for cardiovascular disease and infection also rise with CKD stage (Go et al., 2004). In general, and not surprisingly, hospitalizations among CKD patients also increase in the presence of underlying comorbidities, such as diabetes and CVD.

Hospital readmissions are a key quality indicator for the Medicare program. In an attempt to lower the rate of readmission, the Medicare Hospital Readmission Reduction Program was instituted as part of the Patient Protection and Affordable Care Act, (CMS, 2010) reducing Medicare payments to hospitals with excess readmissions. Rates of rehospitalization for CKD patients were higher than those for patients without diagnosed CKD. In 2013, 22.3% of patients with CKD were readmitted within 30 days, compared to only 15.8% of those without CKD. These rates have not changed significantly in the past decade, which is of major concern.

In Chapter 2, *Identification and Care of Patients with Chronic Kidney Disease*, we document the increasing

recognition of CKD through analysis of diagnosis codes from Medicare claims. The ascertainment of CKD cases through claims data has increased in recent years, likely resulting in decreased estimates of average disease severity, as influenced by the early disease stage of those identified most recently. Thus, changes in mortality and hospitalization rates over time should be viewed with some caution.

ANALYTICAL METHODS

See the CKD Analytical Methods chapter for an explanation of analytical methods used to generate the figures and tables in this chapter.

Mortality Rates

As with many chronic conditions, patient mortality is of paramount importance to consider as a major outcome in those with CKD. Table 3.1 presents the mortality rates for several demographic subgroups of patients, both unadjusted and adjusted for age, sex, and race. This year, we have modified the application of adjustment variables; in the 2014 ADR and in prior years, data were also adjusted for prior year hospitalization and disease comorbidities. These were removed as covariates starting this year, as it was felt that presenting highly adjusted rates would make mortality rates seem artificially much lower than they actually are. This modification should be kept in mind when comparing adjusted rates with those in prior ADRs, as differences are apparent.

For patients with CKD, the unadjusted mortality rate was 140.9 per 1,000 patient years; this decreased to 117.5 per 1,000 patient years after adjusting for age, sex and race. As expected, as age increased mortality rates also rose, particularly for the oldest cohort. In all cases, male patients had slightly higher mortality rates than did females, more so for those with CKD, and when adjusted.

The relationship of race and mortality is not as consistent, however. As was also reported in the 2014 ADR, White patients had higher unadjusted mortality rates than did Black/African American patients. In previous years, after taking adjustment factors into account, however, Black patients had a higher rate of mortality than Whites. In the 2013 data introduced for this report, for the first time we observe no difference in the rates of mortality for CKD patients between these race groups.

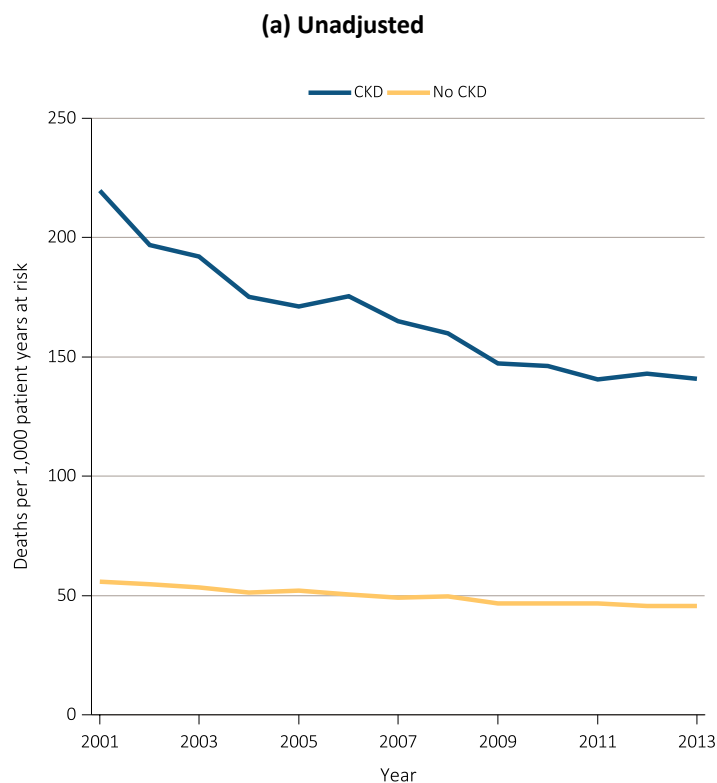
vol 1 Table 3.1 Unadjusted and adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status, 2013

	Unadjusted		Adjusted	
	No CKD	All CKD	No CKD	All CKD
All	45.7	140.9	47.2	117.5
Age				
66–69	15.5	67.7	15.2	66.5
70–74	21.1	76.9	20.9	74.7
75–84	44.5	123.2	44.5	121.0
85+	141.7	257.6	142.1	255.1
Sex				
Male	45.9	144.8	52.6	128.7
Female	45.6	137.5	43.4	110.0
Race				
White	46.5	144.3	47.6	118.8
Black/African American	44.7	128.5	50.0	118.7
Other	34.5	113.8	37.7	95.2

Data source: Medicare 5 percent sample. January 1, 2013 point prevalent patients aged 66 and older. Adj: age/sex/race. Ref: all patients, 2013. Abbreviation: CKD, chronic kidney disease.

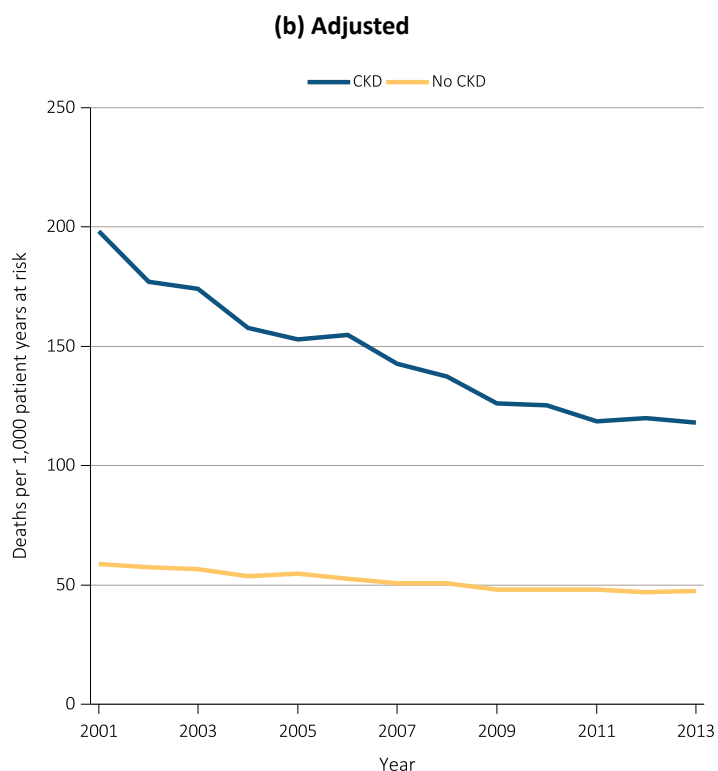
Trends in the mortality rates for Medicare patients aged 66 and older are shown in Figure 3.1. Unadjusted mortality in CKD patients has decreased by 35.9% since 2001, from 220 deaths per 1,000 patient years to 141 deaths in 2013. For those without CKD, the unadjusted rate decreased from 56 deaths per 1,000 patient years in 2001 to 46 deaths in 2013, a reduction of 18.1%.

When adjusted for age, race, and sex, the 2013 mortality rate for CKD patients reduced considerably, to 118 deaths per 1,000 patient years at risk. Among those without CKD, adjustment for these factors resulted in a slightly higher mortality rate of 48 deaths per 1,000 patient years, as compared to the unadjusted rate of 46. One major contributor to the discrepancy between adjusted and unadjusted death rates was the relative age difference between the CKD and non-CKD cohorts. In 2013, the mean age of patients with CKD was 79.1 years, compared to 75.9 years for those without, and 76.2 years for the sample as a whole.

vol 1 Figure 3.1 Unadjusted and adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and year, 2001-2013

Data source: Medicare 5 percent sample. January 1 of each reported year, point prevalent Medicare patients aged 66 and older. Adj: age/sex/race. Ref: 2012 patients. Abbreviation: CKD, chronic kidney disease.

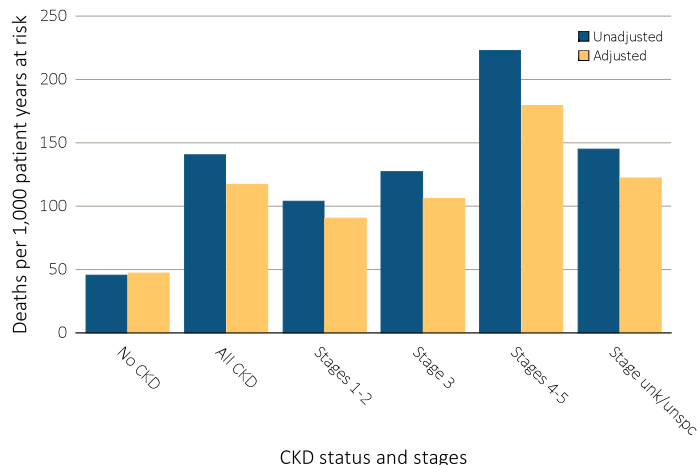
vol 1 Figure 3.1 Unadjusted and adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and year, 2001-2013 (continued)



Data source: Medicare 5 percent sample. January 1 of each reported year, point prevalent Medicare patients aged 66 and older. Adj: age/sex/race. Ref: 2012 patients. Abbreviation: CKD, chronic kidney disease.

As expected, unadjusted mortality rates increased with progressing stage of CKD, as shown in Figure 3.2. These rose progressively, from 104 deaths per 1,000 patient years for those in Stages 1 and 2, to 127 for Stage 3, and 223 for Stages 4 and 5 (without ESRD; stages identified by the ICD-9-CM codes, see Table A). Those without an identified CKD stage or with a diagnosis other than the 585 code series had an unadjusted mortality rate falling between that of Stage 3 and Stages 4-5, at 145 deaths per 1,000 patient years at risk. After adjustment, death rates for Stages 1-2 and Stage 3 were 54 and 65 deaths per 1,000 patient years, respectively. The adjusted rate for Stages 4-5 was slightly higher, at 107 deaths per 1,000 patient years at risk. Those with an unspecified CKD stage had death rates at 78 per 1,000 patient years.

vol 1 Figure 3.2 Unadjusted and adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older. Adj: age/sex/race. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

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

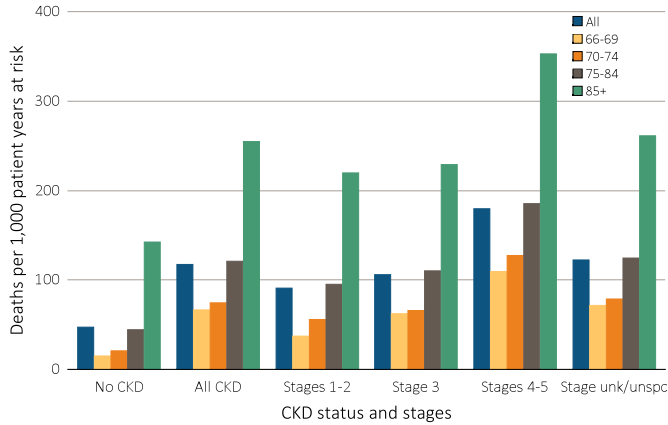
ICD-9-CM code ^a	Stage
585.1	CKD, Stage 1
585.2	CKD, Stage 2 (mild)
585.3	CKD, Stage 3 (moderate)
585.4	CKD, Stage 4 (severe)
585.5	CKD, Stage 5 (excludes 585.6: Stage 5, requiring chronic dialysis ^b)
CKD stage-unspecified	For these analyses, identified by multiple codes including 585.9, 250.4x, 403.9x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

^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 & with no ESRD 2728 form or other indication of end-stage renal disease (ESRD) are considered to have code 585.5.

Adjusted mortality rates for 2013 are shown by CKD and age groups in Figure 3.3. As expected, the mortality rates for older patients groups were higher. In the CKD group, those aged 66-69 years had a mortality rate of 66 deaths per 1,000 patient years at risk, while those aged 75-84 had nearly double that, at 121 deaths. As might be expected, patients aged 85 and older experienced the highest rates of mortality, with 255 deaths per 1,000 patient years.

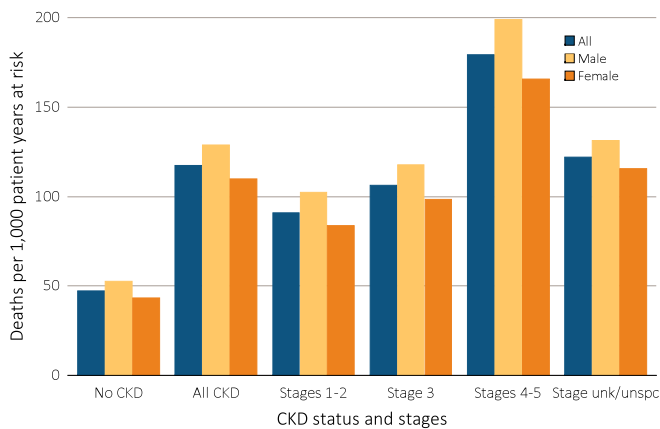
vol 1 Figure 3.3 Adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by age, CKD status, and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent patients aged 66 and older. Adj: age/sex/race. Ref: all patients, 2013. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

A comparison of adjusted mortality rates in 2013 by CKD groups and sex is shown in Figure 3.4. The rates for males and females were similar for the earlier Stages 1-2 and 3, and the unknown group. A disparity between males and females becomes notable at Stages 4-5, with adjusted mortality rates of 124.6 and 94.7 per 1,000 patient years at risk for males and females, respectively.

vol 1 Figure 3.4 Adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by sex, CKD status, and stage, 2013

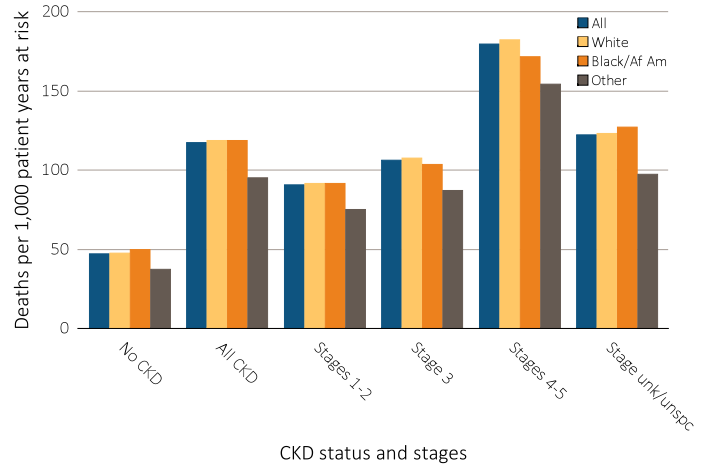


Data source: Medicare 5 percent sample. January 1, 2013 point prevalent patients aged 66 and older. Adj: age/sex/race. Ref: all patients, 2013. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

Figure 3.5 illustrates the adjusted mortality rates by race, CKD status, and stage. The rates for the CKD group were more than twice that of the non-CKD group for patients of all races. For those with CKD, the mortality rates for Whites were higher than Blacks in Stages 1-2, 3, and 4-5. For Whites in

Stages 1-2 the adjusted rates were 55 per 1,000 patient years at risk, 66/1,000 and 110/1,000 for Stages 3 and 4-5, respectively. The Black patient groups showed adjusted rates of 50 deaths per 1,000 patient years at risk, 57/1,000 and 85/1,000 in Stages 1-2, 3 and 4-5, respectively. Only in the group of patients with no CKD stage specified did Black patients exhibit greater rates of mortality.

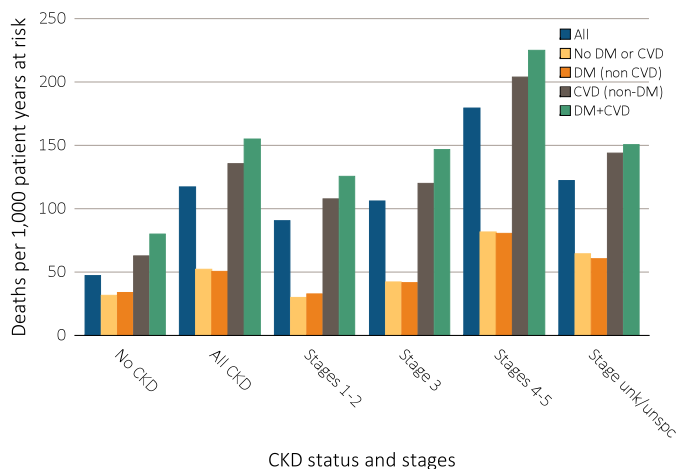
vol 1 Figure 3.5 Adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by race, CKD status, and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent patients aged 66 and older. Adj: age/sex/race. Ref: all patients, 2013. Abbreviations: Af Am, African American; CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

Adjusted rates of mortality were observed to be higher with greater patient health complexity. Figure 3.6 presents mortality rates by the presence of two common comorbidities of CKD—diabetes and CVD. These comorbid conditions dramatically influence the health outcomes of these patients; in 2013, those with CKD but without DM or CVD had an adjusted mortality rate of 52 deaths per 1,000 patient years at risk, while those with both DM and CVD experienced triple that rate, at 155 deaths per 1,000 patient years.

vol 1 Figure 3.6 Adjusted all-cause mortality rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by cardiovascular disease and diabetes mellitus, CKD status, and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent patients aged 66 and older. Adj: age/sex/race. Ref: all patients, 2013. Abbreviations: CKD, chronic kidney disease; CVD, cardiovascular disease; DM, diabetes mellitus.

Hospitalization Rates

Table 3.2 shows all-cause hospitalization rates in 2013 for older Medicare patients, by whether they had recognized CKD during 2012. The unadjusted rate for those with CKD was 656 hospitalizations per 1,000 patient years at risk, compared to a much lower rate of 244 for patients without CKD. Encouragingly, 2013 admission rates for CKD patients showed a reduction from 2011 levels (unadjusted CKD: 757/1,000; unadjusted no CKD: 285/1,000). Across all demographic characteristics, the unadjusted hospitalization rate for patients with CKD was two to three times the corresponding rate for patients without CKD. Once adjustment was made for age, race, and sex, the hospitalization rate for patients with CKD (627 per 1,000 patient years at risk) was 152.8% greater than for those without CKD (248 per 1,000). As with mortality, the adjusted hospitalization rate increased with age for all patients. In contrast to the mortality findings, however, women with CKD had higher adjusted hospitalization rates (636.3/1,000) than did men (620.2/1,000); whereas women without CKD (246.7/1,000) had lower adjusted hospitalization rates than did men (250.2/1,000).

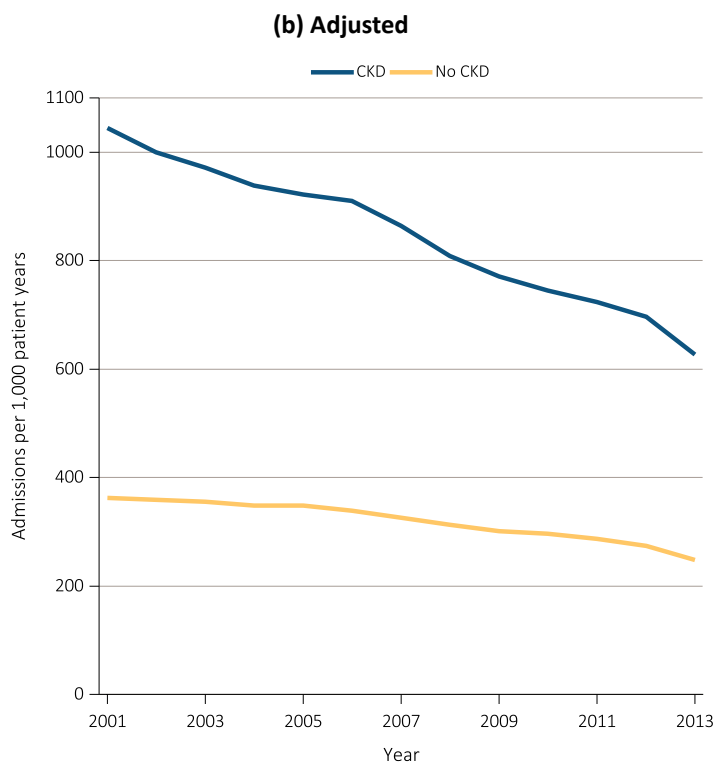
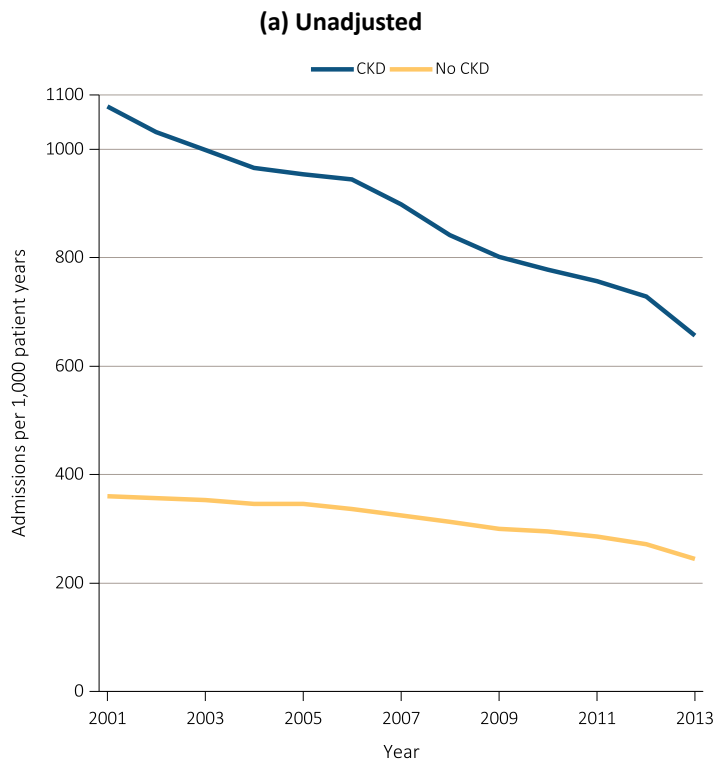
vol 1 Table 3.2 Unadjusted and adjusted all-cause hospitalization rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status, 2013

	Unadjusted		Adjusted	
	No CKD	All CKD	No CKD	All CKD
All	244.3	655.9	247.8	626.8
Age				
66–69	154.8	558.8	154.8	558.4
70–74	191.6	568.2	191.5	567.5
75–84	273.1	660.5	273.1	658.2
85+	419.6	767.9	423.1	769.9
Sex				
Male	235.8	643.7	250.2	620.2
Female	250.5	666.7	246.7	636.3
Race				
White	246.0	651.5	248.4	624.8
Black/African American	261.2	734.9	273.0	719.7
Other	196.8	572.4	205.7	544.6

Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients, aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. Abbreviations: CKD, chronic kidney disease.

Figure 3.7 presents the trends for unadjusted and adjusted hospitalization rates for Medicare patients over the past 13 years. The overall trends between adjusted and unadjusted rates, CKD and non CKD, were consistent with data presented thus far. After adjustment, the pattern of hospitalization rates across this time frame showed a gradual decline and was less variable. A notable decrease in hospitalization rates occurred from 2012 to 2013; even after adjustment the CKD group decreased by 11.1%, from 696 to 627 per 1,000 patient years at risk for the CKD group, and 10.5%, from 274 to 248 per 1,000 patient years at risk for non-CKD group.

vol 1 Figure 3.7 Unadjusted and adjusted all-cause hospitalization rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and year, 2001-2013

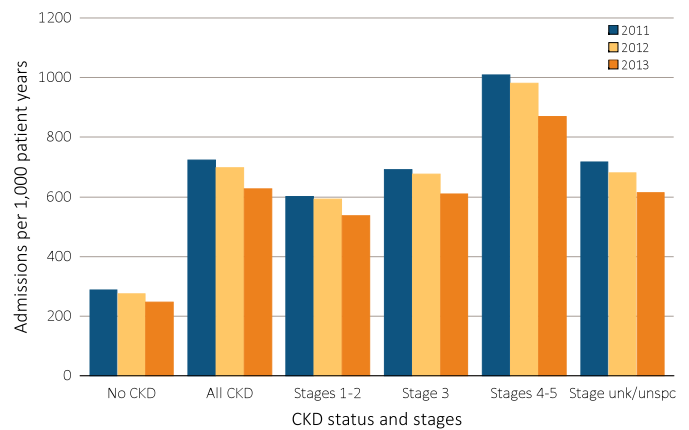


Data source: Medicare 5 percent sample. January 1 of each reported year point prevalent Medicare patients aged 66 and older. Adj: age/sex/race. Ref: 2013 patients. Abbreviations: CKD, chronic kidney disease.

For patients with CKD, differences can be observed in the rates of hospitalizations necessary to treat different comorbid conditions. Figure 3.8 shows the adjusted hospitalization rates for all causes; in Figures 3.9 through 3.11, we present hospitalization rates resulting from CVD (23.3% of all-cause admissions), infection (20.2%), and all other cause categories (56.5%), respectively. As the covariates in the adjusted model no longer include comorbidities and prior year hospitalizations, the adjusted rates do vary noticeably from results presented in the 2014 ADR.

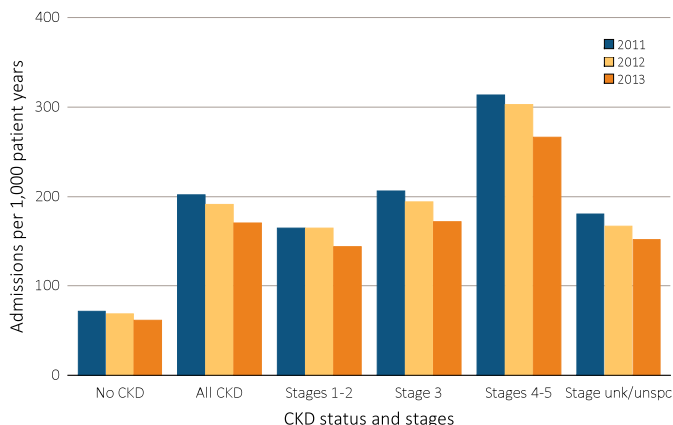
Rates of all-cause hospitalizations in 2013 increased with disease severity, from 536 admissions per 1,000 patient years for those in Stages 1 and 2, to 609 for Stage 3, and 869 for Stages 4 and 5; these are uniformly lower than those occurring in 2011 and 2012 (see Figure 3.8). The pattern of increase for hospitalizations resulting from a primary diagnosis of CVD was similar, with rates increasing from 144 admissions per 1,000 patient years for CKD Stages 1 and 2, to 172 for Stage 3, and 266 for Stages 4 and 5 (see Figure 3.9).

vol 1 Figure 3.8 Adjusted all-cause hospitalization rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and stage, 2011-2013



Data source: Medicare 5 percent sample. January 1 of each reported year, point prevalent Medicare patients aged 66 and older. Adj: age/sex/race. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

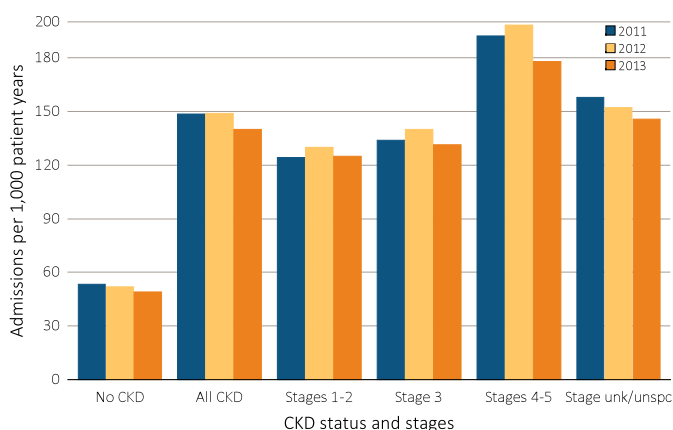
vol 1 Figure 3.9 Adjusted rates of hospitalization for cardiovascular disease (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and stage, 2011-2013



Data source: Medicare 5 percent sample. January 1 of each reported year, point prevalent Medicare patients aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

Adjusted hospitalization rates for infection by CKD status and stages are shown in Figure 3.10. Although the rates increased slightly from 2011 to 2012, they returned to lower or almost equal levels in 2013.

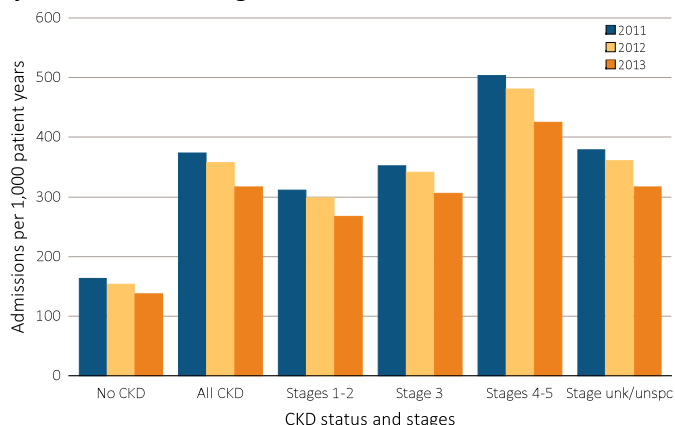
vol 1 Figure 3.10 Adjusted rates of hospitalization for infection (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and stage, 2011-2013



Data source: Medicare 5 percent sample. January 1 of each reported year, point prevalent Medicare patients aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

Figure 3.11 presents the adjusted rates of hospitalization resulting from all other health causes. The pattern was similar to that seen in Figure 3.8, with rates steadily decreasing from 2011 to 2013.

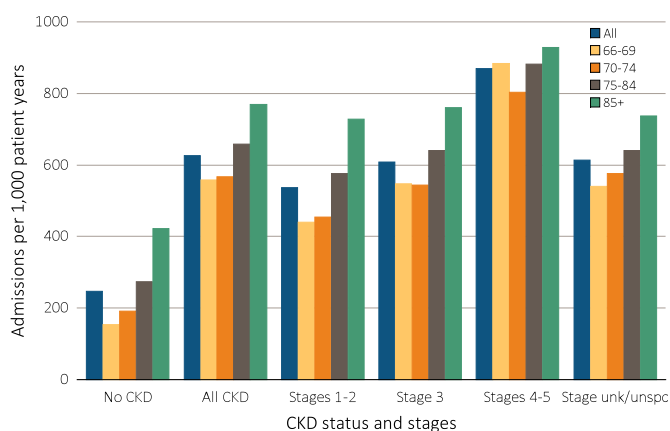
vol 1 Figure 3.11 Adjusted rates of hospitalization for causes other than cardiovascular disease and infection (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by CKD status and stage, 2011-2013



Data source: Medicare 5 percent sample. January 1 of each reported year, point prevalent Medicare patients aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

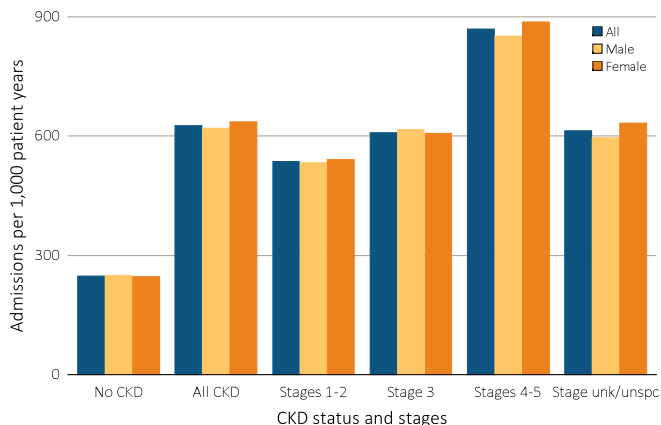
Demographic comparisons also highlight differences in all-cause hospitalization rates for CKD, as shown in Figures 3.12-3.14. In general, and consistent with mortality patterns, older patients exhibit higher rates of hospitalization than do the younger age cohorts. An interaction between age and disease severity is observed in later stages of CKD. As seen in Figure 3.12, rates for younger patients were lower in Stages 1-2 and 3, but in Stages 4-5 the rate for patients aged 70-74 was lower than for all other groups.

vol 1 Figure 3.12 Adjusted all-cause hospitalization rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by age, CKD status, and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

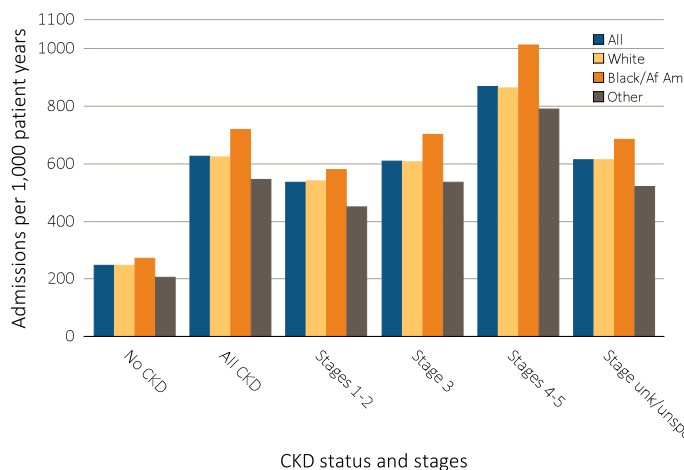
vol 1 Figure 3.13 Adjusted all-cause hospitalization rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by sex, CKD status, and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

Racial differences in hospitalization were notable. In both non CKD and CKD populations, black persons are hospitalized more frequently than other races. In 2013, Black patients in the CKD group showed higher rates than Whites or those of other races (720 per 1,000 patient years vs 625 and 545, respectively; Figure 3.15). This disparity increases with disease severity, with rates for Black patients 7.2% higher than Whites in Stages 1-2 (580 vs 540), 15.8% in Stage 3 (701 vs 606) and 17.4% higher in Stage 4 or 5 (1,013 vs 864). Patients of other races experience the lowest rates of hospitalization in all disease stages.

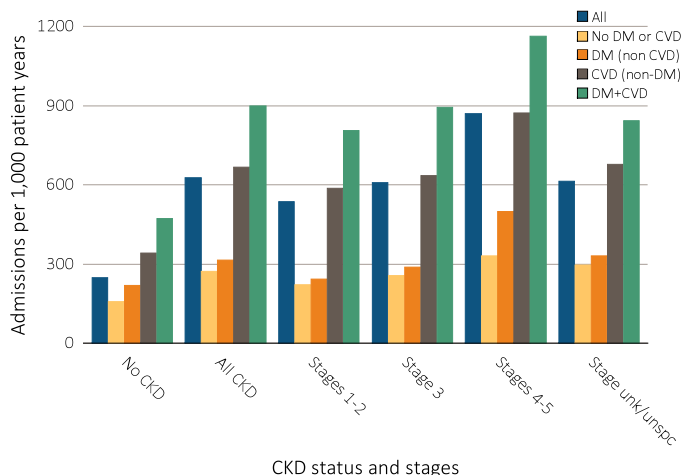
vol 1 Figure 3.14 Adjusted all-cause hospitalization rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by race, CKD status, and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: Af Am, African American; CKD, chronic kidney disease; unk/unspc, CKD stage unidentified.

Adjusted rates of all-cause hospitalization increased in the presence of diabetes and CVD for patients both with and without CKD (see Figure 3.15). In the non CKD population, the adjusted hospitalization rates were 157.1/1,000 for no DM or CVD, 219.5/1,000 for DM only, 340.9 for CVD only and 473.0/1,000 for CM with CVD. In 2013, admissions per 1,000 patient years increased from 273 for CKD patients without DM or CVD, to 316 for CKD patients with only DM and 667 for those with only cardiovascular disease, to a high of 898 for CKD patients with both comorbidities. This additional disease burden was most striking for patients with Stage 4 or 5 CKD; patients with both DM and CVD in addition to late-stage CKD had an all-cause hospitalization rate of 1,162 admissions per 1,000 patient years, compared to only 331 for late-stage CKD patients without DM or CVD.

vol 1 Figure 3.15 Adjusted all-cause hospitalization rates (per 1,000 patient years at risk) for Medicare patients aged 66 and older, by cardiovascular disease and diabetes mellitus, CKD status, and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older. Adj: age/sex/race; rates by one factor are adjusted for the others. Ref: all patients, 2013. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease; CVD, cardiovascular disease; DM, diabetes mellitus; unk/unspc, CKD stage unidentified.

Rehospitalization

Reducing the rate of readmission to a hospital within 30 days of discharge from the original hospitalization is a quality assurance goal for many healthcare systems, including the Medicare program. Table 3.3 shows the distribution of unadjusted percentages of rehospitalization among those with and without recognized CKD, by CKD stage, stratified by age groups, sex and race, in the Medicare population in 2013. The unadjusted proportion of Medicare patients aged 66 and older who were readmitted to the hospital within 30 days of discharge from a first, all-cause hospitalization was 15.8% for those without CKD and 22.3% for those with CKD (see Table 3.3). These rates represent a slight decrease from 2012 levels. Rehospitalization rates increased slightly with stage of CKD, from 21.0 percent in stages 1-2 to 24.1 percent in stages 4-5.

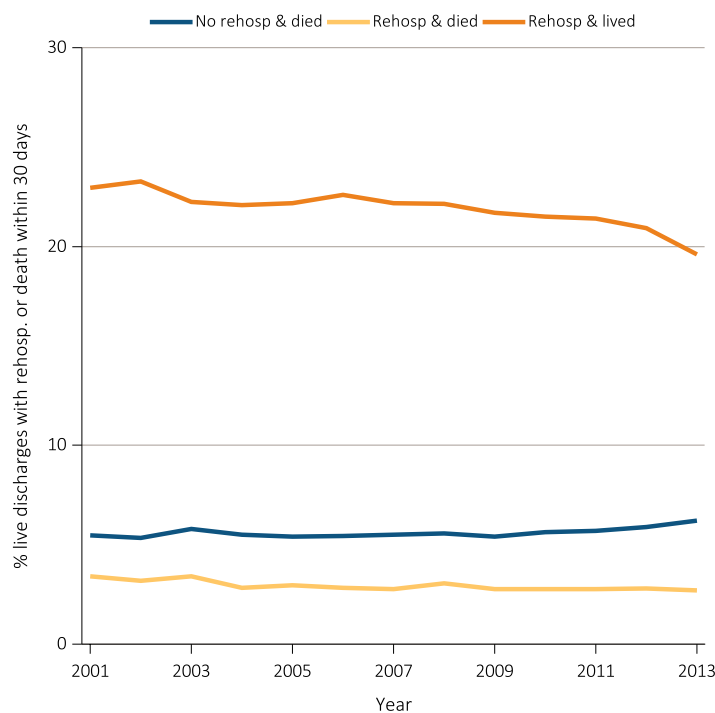
vol 1 Table 3.3 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from an all-cause index hospitalization between January 1 and December 1, by CKD status and stage, 2013

	No CKD	All CKD	Stages 1-2	Stage 3	Stages 4-5	Stage Unknown / unspecified
All	15.8	22.3	21.0	22.2	24.1	22.0
Age						
66-69	15.3	24.4	23.9	23.6	25.1	25.2
70-74	15.5	23.1	21.5	22.4	24.4	23.9
75-84	16.1	22.8	20.7	22.6	25.7	22.4
85+	15.9	20.3	19.9	20.9	21.7	19.1
Sex						
Male	16.6	22.8	22.0	22.4	25.3	22.5
Female	15.3	21.8	20.1	22.0	23.3	21.6
Race						
White	15.6	21.9	20.7	21.8	23.5	21.7
Black/African American	17.5	25.3	22.7	25.2	27.8	24.8
Other	17.3	21.5	22.3	21.6	22.2	20.7
No rehospitalization & died	4.5	6.2	5.6	5.9	8.0	6.2
Rehospitalization & died	1.7	2.7	2.1	2.8	3.3	2.6
Rehospitalization & lived	14.1	19.6	19.0	19.4	20.9	19.4

Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013; unadjusted. See Table A for CKD stage definitions. Abbreviations: CKD, chronic kidney disease.

The adjusted trend for readmissions from 2001-2013 is shown in Figure 3.16. Results may differ from those presented in previous ADRs, in part because the adjustment variables of disease comorbidity and prior year hospitalization are no longer applied in the model. Specifically, the percentage of patients who were rehospitalized and lived within 30 days of the initial discharge declined from 22.9% in 2006 to 19.6% in 2013, amounting to a decrease of 3.3% over the 13-year period. While any reductions are encouraging, the proportion of patients who were rehospitalized and subsequently died within 30 days of the initial discharge has not changed significantly—reducing by only 0.7% from 2012 levels. Of note, the rate of patients who were not rehospitalized but died within 30 days of the initial discharge has increased somewhat, by 0.8% since 2009.

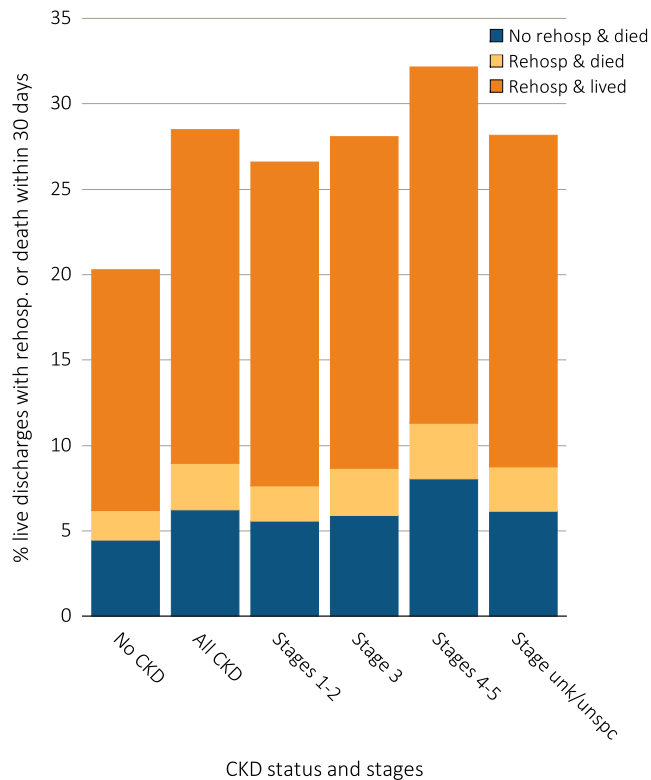
vol 1 Figure 3.16. Adjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare CKD patients aged 66 and older who were discharged alive from an all-cause index hospitalization between January 1 and December 1, by year, 2001-2013



Data source: Medicare 5 percent sample. January 1 of each reported year, point prevalent Medicare patients aged 66 and older with CKD (defined during the prior year), discharged alive from an all-cause index hospitalization between January 1 and December 1 of the reported year. Adj: age/sex/race. Ref: 2013. Abbreviations: CKD, chronic kidney disease; Rehossp, rehospitalized.

Figure 3.17 presents the percentages of Medicare patients who were rehospitalized and/or died with or without rehospitalization within 30 days of discharge following an index hospitalization. Compared to those without a diagnosis of CKD, those with CKD had a higher proportion of live discharges linked to a rehospitalization or death.

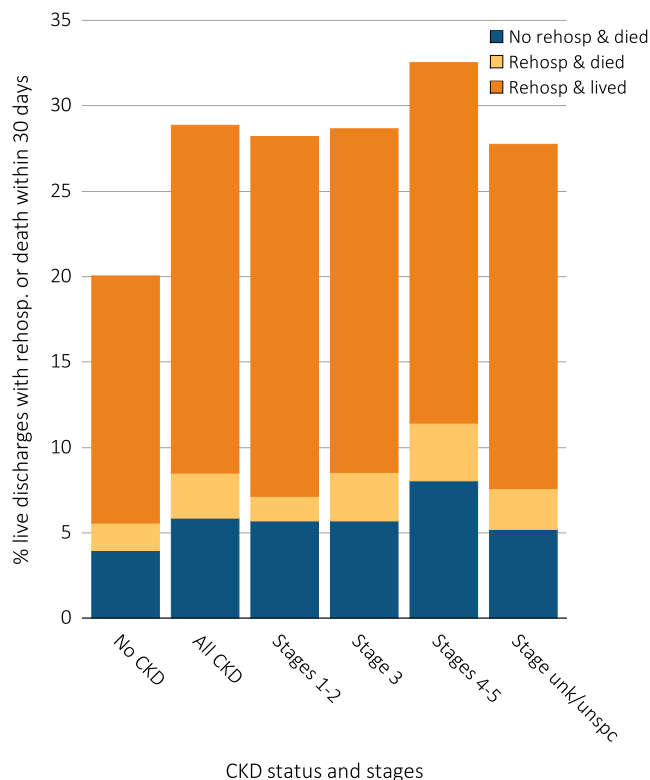
vol 1 Figure 3.17 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from an all-cause index hospitalization between January 1 and December 1, by CKD status and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013, unadjusted. Abbreviations: CKD, chronic kidney disease; Rehosp, rehospitalized; unk/unspc, CKD stage unidentified.

Figure 3.18 shows the death and rehospitalization percentages for older Medicare patients who were discharged alive from a cardiovascular index hospitalization; 23.0% of patients with CKD and 16.1% of those without required rehospitalization within 30 days. Otherwise, the magnitude and pattern of these readmission rates were similar to those for all-cause index hospitalizations.

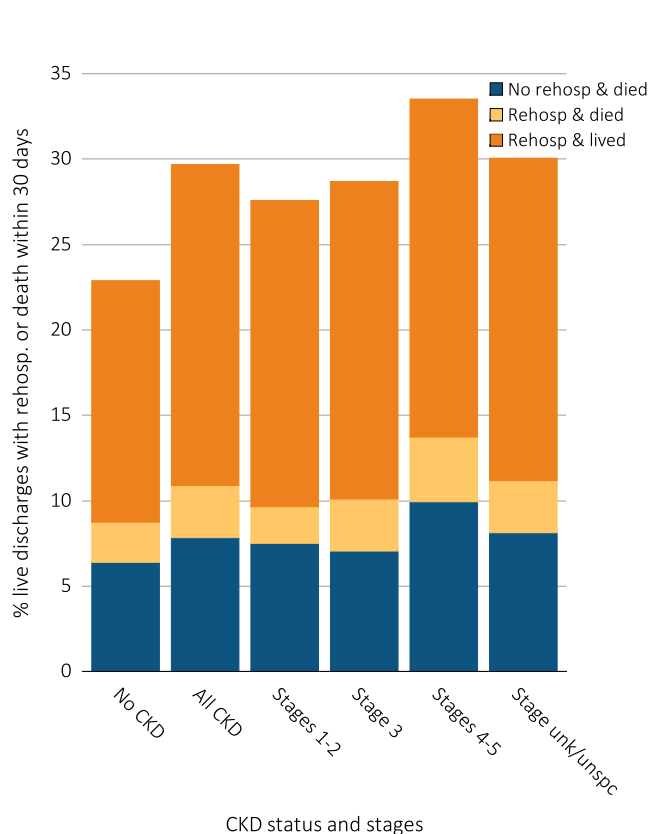
vol 1 Figure 3.18 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from a cardiovascular-related index hospitalization between January 1 and December 1, by CKD status and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013; unadjusted. Abbreviations: CKD, chronic kidney disease; Rehosp, rehospitalized; unk/unspc, CKD stage unidentified.

Of all patients who experienced an infection-related admission, 17.9% required rehospitalization (see Figure 3.19). In the CKD group, 18.8% of patients were subsequently rehospitalized and lived within 30 days of the initial discharge, and an additional 3.1% died following rehospitalization; 7.8% of patients were not rehospitalized and died. For those without CKD, these three percentages were 14.2%, 2.4%, and 6.4% respectively.

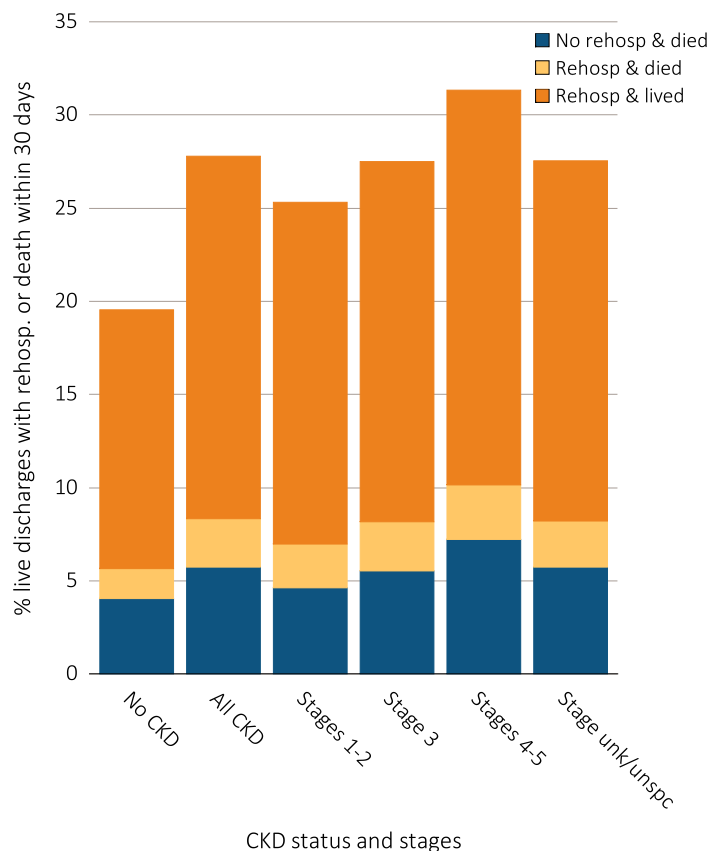
vol 1 Figure 3.19 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from an infection-related index hospitalization between January 1 and December 1, by CKD status and stage, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013, unadjusted. Abbreviations: CKD, chronic kidney disease; Re hosp, rehospitalized; unk/unspc, CKD stage unidentified.

Figure 3.20 shows the death and rehospitalization percentages for Medicare patients aged 66 and older who were discharged alive from index hospitalization of all causes other than CVD and infection. The patterns of these percentages were similar to those for all-cause index hospitalizations. For the CKD group, patients who were not rehospitalized but died, rehospitalized and died, or rehospitalized and lived were 5.7%, 2.6% and 19.5%, respectively. In the no-CKD group, these percentages were somewhat lower: 4.1%, 1.6% and 13.9% respectively.

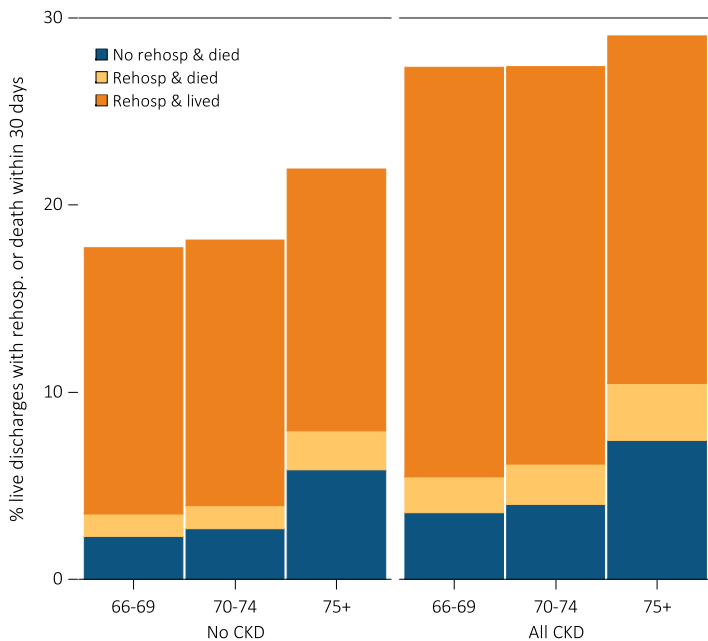
vol 1 Figure 3.20 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from a non-cardiovascular and non-infection related index hospitalization between January 1 and December 1, by CKD status and stage, 2013



Data Source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013; unadjusted. Abbreviations: CKD, chronic kidney disease; Re hosp, rehospitalized; unk/unspc, CKD stage unidentified.

Figure 3.21 illustrates a comparison by age group of the percentages of Medicare patients that were rehospitalized or died within 30 days of discharge from an all-cause, index hospitalization, among those with CKD and those without. Rates of rehospitalization with survival in patients with CKD decreased with age across all stages of CKD in the Medicare population. These findings are likely due to the competing risk of death in older age groups. For both patients with and without CKD, the proportion returning to the hospital and dying within 30 days of discharge or dying without rehospitalization, increased with older age.

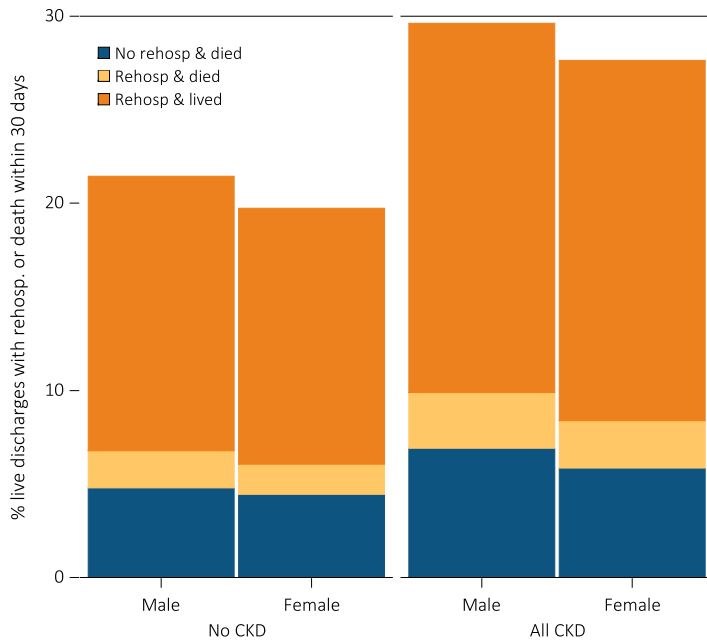
vol 1 Figure 3.21 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from an all-cause index hospitalization between January 1 and December 1, by age and CKD status, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013; unadjusted. Abbreviations: CKD, chronic kidney disease; Re hosp, rehospitalized.

Figure 3.22 compares the rates of all-cause hospitalization rates by sex. Male patients exhibited higher rates than did females in all outcome categories. Also, CKD patients in all categories showed higher rates than did those without. Specifically, 6.9% of males do not require rehospitalization, 3.0% were rehospitalized and later died within 30 days of the initial discharge, and 19.7% were rehospitalized and lived.

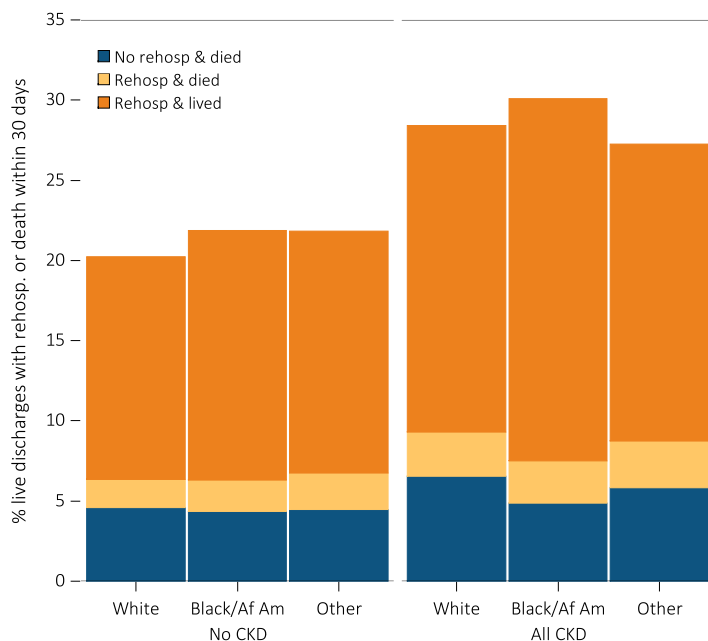
vol 1 Figure 3.22 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from an all-cause index hospitalization between January 1 and December 1, by sex and CKD status, 2013



Data source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013; unadjusted. Abbreviations: CKD, chronic kidney disease; Re hosp, rehospitalized.

Racial trends in post-discharge outcomes were mixed. As shown in Figure 3.23, for both patients with and without CKD, Blacks who were rehospitalized subsequently survive at greater rates (17.5%) than both Whites (15.6%) and patients of other races (17.4%). Whites experienced the highest rates of death without rehospitalization (4.6%), and more patients of other races were observed to have died following their rehospitalization (4.5%).

vol 1 Figure 3.23 Unadjusted percentage of patients readmitted to the hospital within 30 days of discharge, among Medicare patients aged 66 and older who were discharged alive from an all-cause index hospitalization between January 1 and December 1, by race and CKD status, 2013



Data Source: Medicare 5 percent sample. January 1, 2013 point prevalent Medicare patients aged 66 and older, discharged alive from an all-cause index hospitalization between January 1, 2013, and December 1, 2013; unadjusted. Abbreviations: Af Am, African American; CKD, chronic kidney disease; Rehosp, rehospitalized.

This chapter focused on mortality and morbidity in the Medicare population with and without CKD. While hospitalization rates have been decreasing over time, the underlying causes for this decline and lessons learnt requires further research as well as enhanced quality improvement efforts. In future iterations of the ADR, we will examine data on morbidity and mortality in the CKD population from non-Medicare data sources.

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