Chapter 5: Acute Kidney Injury

- In 2013, the percent of Medicare fee-for-service beneficiaries experiencing an AKI hospitalization was 3.9%, slightly lower than the 4.1% in 2012. This decrease in rates was also observed across all age and race groups.
- For Medicare patients aged 66 years and older with an AKI hospitalization in 2011, the cumulative probability of a recurrent AKI hospitalization within two years was 48%.
- Overall, less than 20% of patients had a nephrology visit within one year of live discharge from an AKI hospitalization. Among patients without pre-existing CKD or diabetes, less than 5% had nephrology follow-up within one year.
- Among Medicare patients aged 66 years and older with a first AKI hospitalization, the in-hospital mortality rate in 2013 was 9.5% (or 14.4% when including discharge to hospice) and less than half of all patients were discharged to their home.

Introduction

Acute kidney injury (AKI) has gained increasing recognition as a major risk factor for the development of chronic kidney disease (CKD). The clearest example of this relationship is seen in cases of severe dialysis-requiring AKI where patients fail to recover renal function. Indeed, acute tubular necrosis without recovery is the primary diagnosis for 2 to 3% of incident end-stage renal disease (ESRD) cases annually. Yet this represents a small fraction of the renal disease burden resulting from AKI, as studies have demonstrated significantly increased long-term risk of CKD and ESRD following AKI, even after initial recovery of renal function. Furthermore, this relationship is bi-directional and CKD patients are at substantially greater risk of suffering an episode of AKI. As a result, AKI is frequently superimposed on CKD and therefore plays a key role in CKD progression.

In this chapter, we examine antecedents and outcomes associated with AKI using the Medicare 5 percent sample. Medicare administrative data do not contain clinical or biochemical data with which to identify an AKI episode using consensus criteria based on changes in serum creatinine or urinary output. Instead, episodes of AKI, including those requiring dialysis, are identified using ICD-9-CM (International Classification of Diseases, 9th revision, clinical modification) diagnosis codes from billing claims. While this approach carries a high degree of specificity, an important limitation of this indirect method is poor sensitivity, generally <30%, and even lower for less severe cases of AKI. In addition, time trends in AKI incidence must be interpreted with caution due to the possibility of "code creep," whereby non-clinical factors (such as changing billing thresholds or increased awareness/recognition of AKI) increase the likelihood of administrative coding for AKI. Thus, a rising incidence of AKI may represent a true increase in AKI cases, an increased likelihood to code for AKI, or a combination of both factors. In addition, a lower threshold for coding for AKI would lead to identification of less severe episodes and an apparent decrease in the rate of associated adverse outcomes. For this chapter, we identified and included all hospitalizations during which a diagnosis of AKI was coded, referring to these as AKI hospitalizations, even if AKI was not the primary diagnosis.

We begin this chapter by exploring trends in AKI hospitalizations and characteristics of these patients, including age, sex, race, and comorbidity status. We focused on hospitalizations because AKI occurring exclusively in the community is uncommon and often unrecognized. In general, AKI has increased over time while the percent of AKI hospitalizations that required dialysis has decreased, although that may have started

to level off in 2013. Rates of AKI per 1,000 patient years at risk increase with increasing age. Patients with diabetes and/or CKD also have higher rates, while patients with CKD alone are associated with higher risk than those with diabetes alone.

Next we explore outcomes and follow-up after an AKI hospitalization. Among Medicare patients aged 66 years and older, 35% have a recurrent AKI hospitalization by one year, and 48% have a recurrent AKI hospitalization within two years. These findings highlight the at-risk nature of this population, and support published recommendations for post-AKI follow-up care. However, only 12.7% and 16.1% of patients are seen by a nephrologist at 3 and 6 months post-discharge respectively. The proportion of patients seen for follow-up care is higher among those with pre-existing CKD, but even among this group with recognized kidney disease fewer than 25% are seen within 6 months.

As noted above, AKI plays an important role in CKD development and progression. Among patients without pre-existing CKD who experienced an AKI hospitalization, nearly 30% were reclassified as having some degree of CKD in the subsequent year.

Lastly, we explore patient disposition following an AKI hospitalization. Among patients not admitted from a nursing facility, 48% of Medicare patients suffering an AKI hospitalization return directly to their homes, while 30% are institutionalized in a skilled nursing facility. These outcomes highlight the significant morbidity associated with AKI.

Analytical Methods

In 2013, the Medicare 5 percent sample was received by the Coordinating Center from the Medicare Chronic Conditions Warehouse, a different source than in previous years. When this data was tabulated, rates per patient year at risk for AKI were lower for 2013 than in 2012. We cannot rule out that this is an artifact of the differing source for the Medicare 5 percent data files, so caution should be used in drawing conclusions regarding trends.

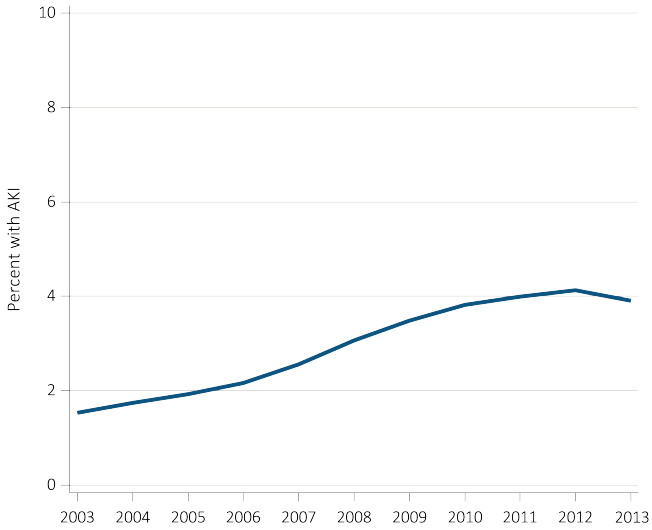
Note that all the figures except Figure 5.14 include all beneficiaries meeting the specified inclusion criteria. In Figure 5.14, those beneficiaries who were admitted to the inpatient setting where the AKI hospitalization occurred from a long-term care facility ('point of origin for admission,' previously named 'source of admission,' is 5) are excluded. Therefore, the category of institution in this figure includes only those newly admitted following their hospitalization. See the CKD Analytical Methods chapter for a more detailed explanation of the analytical methods used to generate the figures and table in this chapter.

Characteristics of Patients With Acute Kidney Injury

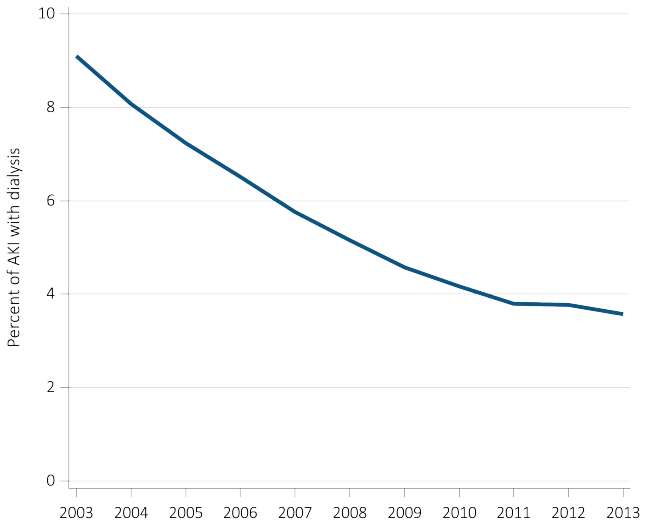
As shown in Figure 5.1, the percentage of patients with an AKI hospitalization in the Medicare fee-for-service population has risen over the past decade, reaching 3.9% in 2013, compared to 1.5% in 2003 (n=51,909 for 2013). Notably, the percentage in 2013 showed a decline from 4.1% in 2012. The proportion of AKI patients requiring dialysis has continued to decline, falling from 9.1% in 2003 to 3.6% in 2013 (n= 1,854 in 2013). These findings suggest that code creep for AKI is indeed occurring: while the threshold for defining (and thus coding for) AKI has decreased over the last 10 years, the threshold for dialysis initiation has likely remained fairly stable.

vol 1 Figure 5.1 Percent of Medicare patients aged 66+ (a) with at least one AKI hospitalization, and (b) with an AKI hospitalization that included dialysis, by year, 2003-2013

(a) Percent with an AKI hospitalization



(b) Percent of first AKI hospitalizations with dialysis



Data Source: Special analyses, Medicare 5 percent sample. Panel 5.1.a: Percent with an AKI hospitalization among all Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were alive on January 1 of year shown. Panel 5.1.b: Percent of patients receiving dialysis during their first AKI hospitalization among patients with a first AKI hospitalization. Dialysis is identified by a diagnosis or charge for dialysis on the AKI hospitalization inpatient claim or a physician/supplier (Part B) claim for dialysis during the time period of the AKI inpatient claim. Abbreviations: AKI, acute kidney injury; ESRD, end-stage renal disease.

Acute kidney injury occurs commonly in older adults, and the incidence rises with age. In the fee-for-service Medicare population, patients aged 80 years and older comprise nearly 55% of all patients with an AKI hospitalization, as shown in Table 5.1. Males accounted for a slight majority of all AKI hospitalizations in all years. Diabetes mellitus and pre-existing CKD are recognized as two major risk factors for AKI; at least one of these risk factors was present in 57.3% of Medicare patients with an AKI hospitalization and 20.3% of patients had both.

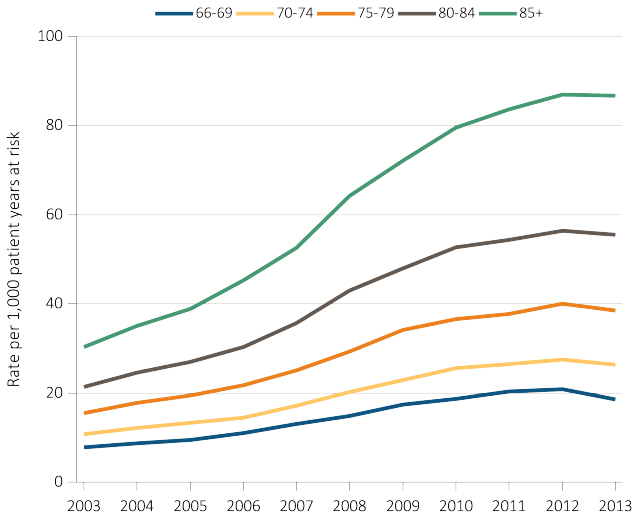
Rates of AKI are strongly influenced by age, as shown in Figure 5.2. Among fee-for-service Medicare patients in 2013, the rate of AKI for those ages 66-69 is 18.5 per 1,000 patient years, increasing to 26.4, 38.5, 55.5, and 86.7 respectively, for ages 70-74, 75-79, 80-84, and 85 years and older. Between 2003 and 2012, unadjusted rates of AKI increase across all age ranges. The most recent data from 2013 show a decrease in AKI rates in the Medicare population; the overall rate falls from 43.0 to 40.9 per 1,000 patient years, and similar decreases are observed within each age group.

vol 1 **Table 5.1 Characteristics of Medicare patients aged 66+ with at least one AKI hospitalization, by age, sex, race, CKD, DM, and year, 2003-2013**

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Age											
66-69	10.6	10.5	10.3	10.6	10.6	10.3	10.8	10.8	11.3	11.3	11.4
70-74	16.5	16.3	16.0	15.3	15.4	15.5	15.4	15.6	15.6	15.9	16.1
75-79	21.8	21.3	21.0	20.2	19.4	18.5	18.6	18.0	17.7	18.0	17.9
80-84	22.5	22.9	22.9	22.3	22.4	22.4	21.5	21.3	20.7	19.9	19.5
85+	28.6	29.0	29.9	31.6	32.1	33.4	33.7	34.3	34.7	34.8	35.2
Sex											
Female	47.9	48.0	47.7	48.1	47.8	47.8	47.8	47.5	47.7	48.2	47.7
Male	52.1	52.0	52.3	51.9	52.2	52.2	52.2	52.5	52.3	51.8	52.3
Race											
White	82.9	82.6	81.7	82.0	82.8	83.2	83.2	83.1	83.1	82.7	83.1
Black/African American	12.7	13.0	13.7	13.5	12.5	12.0	12.0	12.1	12.0	12.2	11.6
Native American	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Asian	1.0	1.3	1.2	1.2	1.2	1.4	1.4	1.4	1.5	1.5	1.6
Other	3.0	2.9	3.1	2.9	3.0	3.0	3.0	3.0	2.9	3.1	3.2
Pre-existing comorbidities											
No DM or CKD, prior year	55.0	53.3	52.2	51.2	49.4	48.2	47.2	46.0	44.5	43.5	42.7
DM no CKD, prior year	24.6	25.2	25.1	25.1	23.1	23.0	22.5	22.5	22.0	21.2	21.3
CKD no DM, prior year	8.8	9.5	9.5	10.0	12.1	12.8	13.5	13.9	14.8	15.2	15.7
Both CKD & DM, prior year	11.7	12.0	13.2	13.7	15.4	16.0	16.8	17.7	18.7	20.1	20.3

Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were alive on January 1 of year shown. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease.

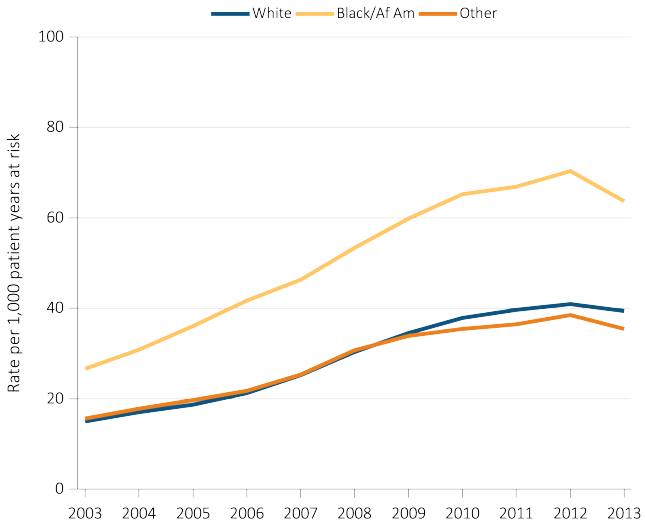
vol 1 Figure 5.2 Unadjusted rates of first hospitalization with AKI for Medicare patients aged 66+, by age and year, 2003-2013



Data Source: Special analyses, Medicare 5 percent sample. Age as of January 1 of specified year. All patient-years at risk for Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were alive on January 1 of year shown. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Abbreviations: AKI, acute kidney injury; ESRD, end-stage renal disease.

Rates of AKI in fee-for-service Medicare patients aged 66 and older vary considerably by race, as shown in Figure 5.3. In 2013, the incidence rate was 63.7 per 1,000 patient years at risk in Blacks compared to 39.3 and 35.5, respectively, in Whites and individuals of other races. The rates of diagnosed AKI have more than doubled in the past decade in all race groups. The decrease in AKI rates in 2013 noted above was observed in all race groups and was most pronounced in Blacks, who had a relative 9.4% decrease compared to 3.9% and 7.8% decreases in Whites and individuals of other races, respectively.

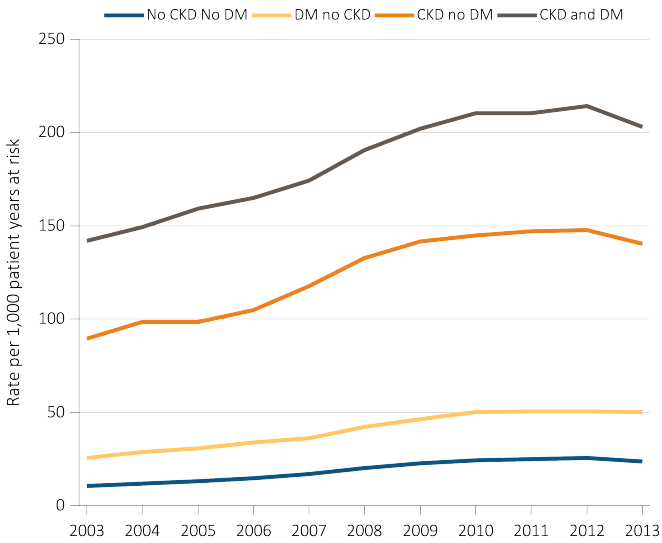
vol 1 Figure 5.3 Unadjusted rates of first hospitalization with AKI for Medicare patients aged 66+, by race and year, 2003-2013



Data Source: Special analyses, Medicare 5 percent sample. All patient-years at risk for Medicare patients aged 66 or older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were alive on January 1 of year shown. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Abbreviations: Af Am, African American; AKI, acute kidney injury; ESRD, end-stage renal disease.

The incidence rates for AKI, shown in Figure 5.4, also vary substantially by underlying comorbidity. In 2013, Medicare patients with diabetes and no known CKD had an AKI incidence rate of 50.1 per 1,000 patient years compared to 23.7 per 1,000 patient years in non-diabetic, non-CKD patients. Non-diabetic patients with CKD experienced an AKI incidence rate of 140.3 per 1,000 patient years, while the rate in patients with both diabetes and CKD was 203.1 per 1,000 patient years. That is, about 20 percent of patients with both CKD and diabetes will experience a hospitalization with AKI in a year.

vol 1 Figure 5.4 Unadjusted rates of first hospitalization with AKI for Medicare patients aged 66+, by CKD, DM, and year, 2003-2013



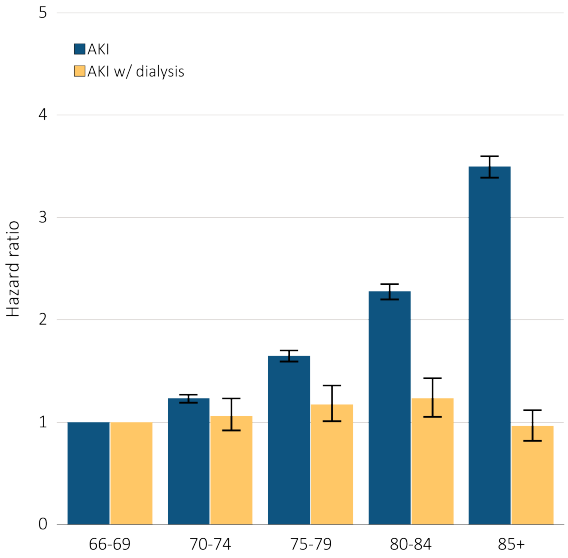
Data Source: Special analyses, Medicare 5 percent sample. All patient-years at risk for Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were alive on January 1 of year shown. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease.

Hospitalization for Acute Kidney Injury

As indicated in Figure 5.5, the adjusted hazard for an AKI hospitalization is highly associated with age and increases with older age groups. After controlling for comorbid conditions, persons ages 85 and over are 3.5 times more likely to have an AKI hospitalization than

persons 65 to 69. However, age does not affect the probability of dialysis-requiring AKI. Since dialysis is a treatment choice between physicians and patients, this relationship could reflect either a decline in AKI severity with increasing age, or a higher threshold to pursue dialysis therapy in older age groups.

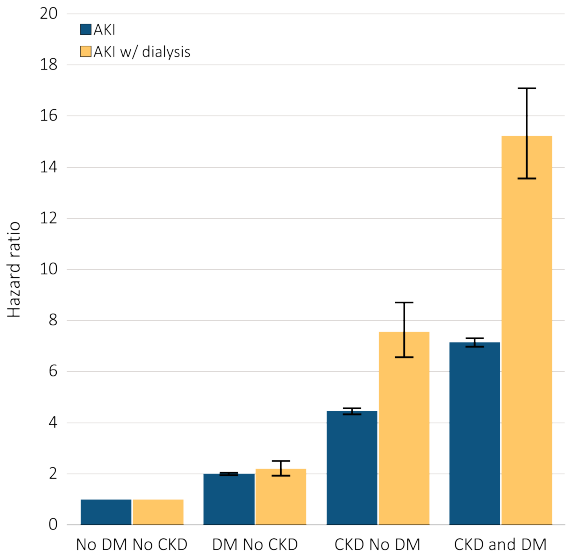
vol 1 Figure 5.5 Adjusted hazard of a first AKI hospitalization in Medicare patients aged 66+, overall and dialysis-requiring, by age, 2013



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 or older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were alive on 1/1/2013. Dialysis is identified by a diagnosis or charge for dialysis on the AKI inpatient claim or a physician/supplier (Part B) claim for dialysis during the time period of the AKI inpatient claim. Models each include age, race, sex, DM, and CKD status in prior year. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Error bars represent 95% confidence interval of estimates. Abbreviations: AKI, acute kidney injury; ESRD, end-stage renal disease.

As shown in Figure 5.6, when examining baseline comorbid conditions, it is apparent that diabetes and CKD influence AKI risk both independently and synergistically. Compared to patients with neither comorbidity, patients with both diabetes and CKD have an adjusted hazard ratio of 7.15 for an episode of AKI. Having either diabetes or CKD alone confers a hazard ratio of 1.99 and 4.44, respectively. The relationship is even more pronounced for AKI requiring dialysis, as patients with both diabetes and CKD have an adjusted hazard ratio of 15.22 compared to patients with neither comorbidity.

vol 1 Figure 5.6 Adjusted hazard of a first AKI hospitalization in Medicare patients aged 66+, overall and dialysis-requiring, by DM & CKD status, 2013

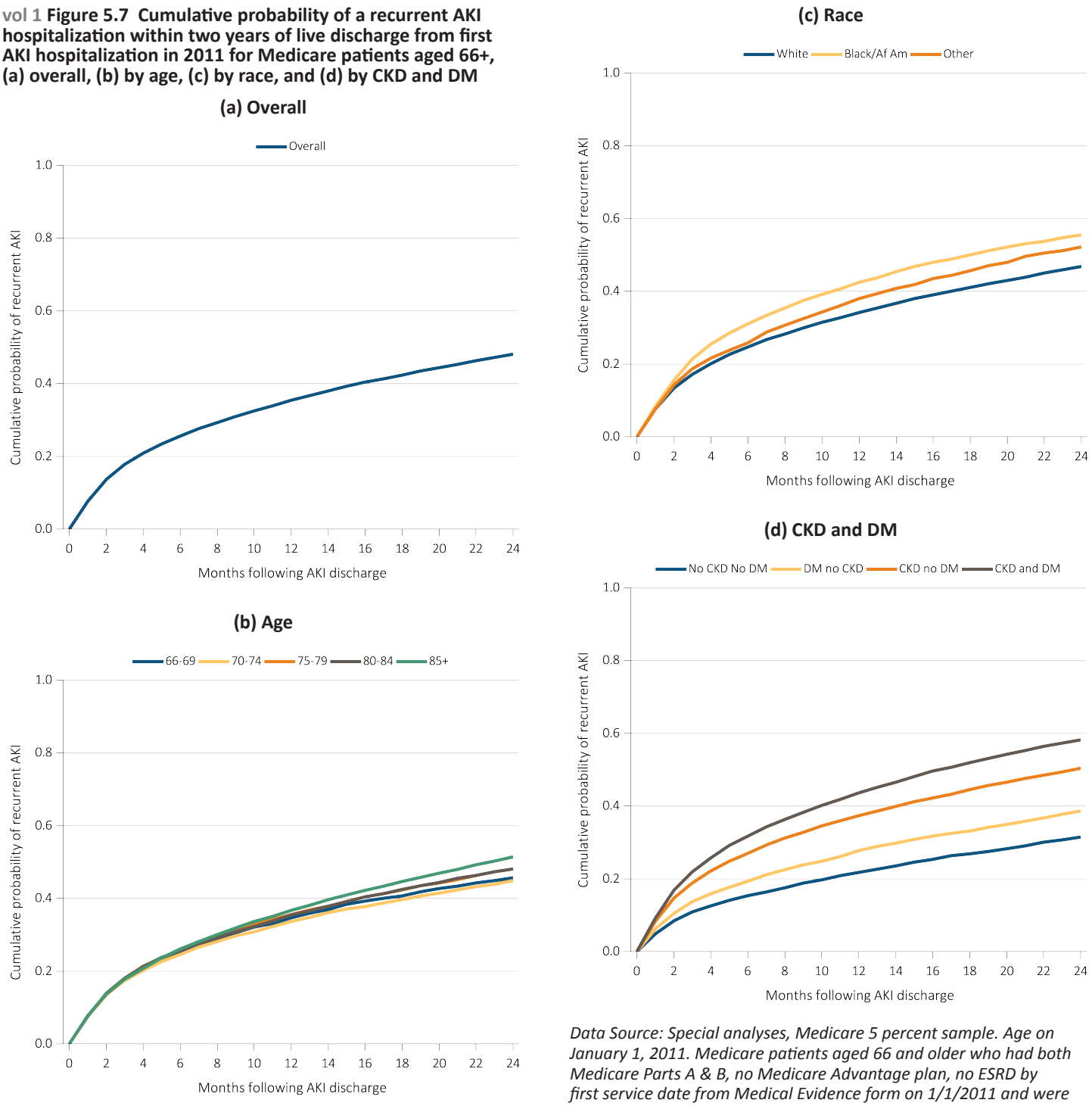


Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were alive on 1/1/2013. Dialysis is identified by a diagnosis or charge for dialysis on the AKI inpatient claim or a physician/supplier (Part B) claim for dialysis during the time period of the AKI inpatient claim. Models each include age, race, sex, DM, and CKD status in prior year. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Error bars represent 95% confidence interval of estimates. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease.

Following an AKI hospitalization in 2011, the overall probability of a recurrent AKI event is 0.35 in the next 12 months and 0.48 by 24 months, as shown in Figure 5.7a. In contrast to first episodes, the rate of recurrent AKI is relatively similar across age groups in the fee-for-service Medicare population (5.7b); however, interpretation of this finding is limited due to the effect of death censoring, which is higher in older age groups.

Whites are less likely to have a recurrent AKI hospitalization than other races, with a probability of 0.47 at 24 months compared to 0.55 and 0.52 in Blacks and individuals of other races, respectively (Figure 5.7c). Similarly, having either diabetes or CKD is associated with an increased probability for recurrent AKI compared to having neither (Figure 5.7d). The highest probability for recurrent AKI is seen in patients with both diabetes and CKD, in whom the probability reaches 0.58 by 24 months. In contrast, patients with neither comorbidity have a cumulative probability for recurrent AKI hospitalization of 0.32 by 24 months.

vol 1 Figure 5.7 Cumulative probability of a recurrent AKI hospitalization within two years of live discharge from first AKI hospitalization in 2011 for Medicare patients aged 66+, (a) overall, (b) by age, (c) by race, and (d) by CKD and DM



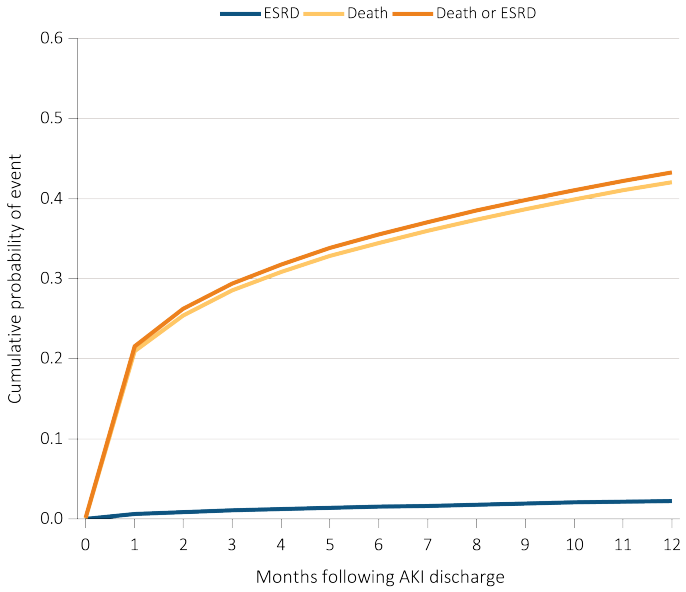
Data Source: Special analyses, Medicare 5 percent sample. Age on January 1, 2011. Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form on 1/1/2011 and were discharged alive from an AKI hospitalization in 2011. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease.

Patient Care and Outcomes

Poor short-term outcomes for AKI, including hospital mortality, are well-described in the literature. Figure 5.8 shows that survivors of an AKI hospitalization (those discharged alive) continue to face significant risk for adverse outcomes following discharge. Among survivors of an AKI hospitalization in 2011-2012,

the overall probability of developing ESRD in the following year is about 2% in the Medicare fee-for-service population aged 66 and older. In this same time frame, the probability of death is nearly 43%.

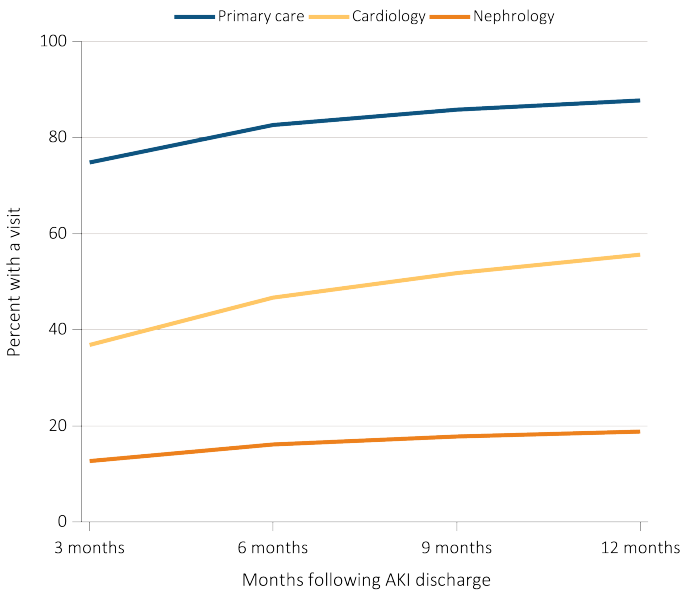
vol 1 Figure 5.8 Cumulative probability of death-censored ESRD, death, and the composite of death or ESRD within one year of live discharge from first AKI hospitalization occurring in 2011-2012 for Medicare patients aged 66+



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 or older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form, and were discharged alive from a first AKI hospitalization in 2011 or 2012. All models censored at the end of Medicare Parts A & B participation, switch to Medicare Advantage program, or 365 days after AKI discharge. Model for ESRD also is censored at death. Model for death is not censored at the start of ESRD. Abbreviations: AKI, acute kidney injury; ESRD, end-stage renal disease.

Following an initial AKI hospitalization, 74.8% of patients see a primary care physician within three months of discharge, while 36.8% and 12.7%, respectively, see a cardiologist or nephrologist, as illustrated in Figure 5.9. Follow-up increases with time, but the percentage of patients seen by a nephrologist at 12 months following an AKI hospitalization is still only 18.8%.

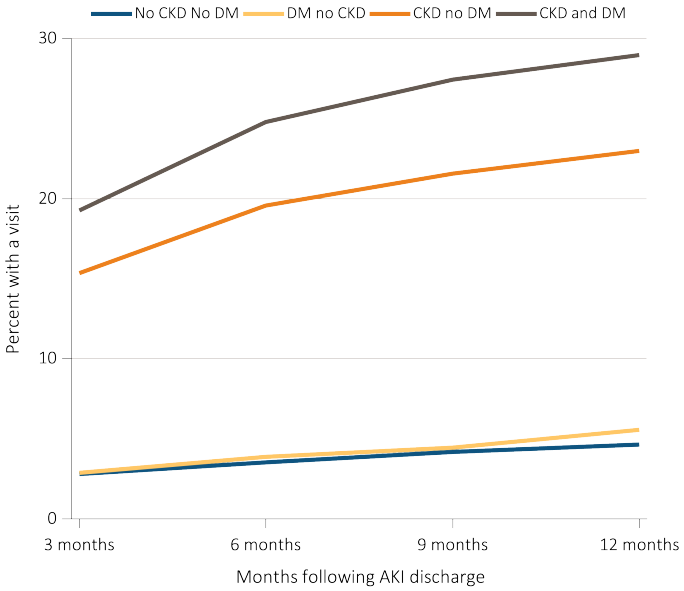
vol 1 Figure 5.9 Outpatient physician visits within one year of live discharge from first AKI hospitalization in 2012 for Medicare patients aged 66+, by physician specialty and time



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form on 1/1/2012, and were discharged alive from a first AKI hospitalization in 2012. For each time point, the denominator is all patients alive, without ESRD, not in a Medicare Advantage plan and with Medicare Parts A & B. Physician visits are from physician/supplier claims with provider specialty codes for primary care (01, 08-family practice, 11-internal medicine), cardiology (06), and nephrology (39) and claim source indicating an outpatient setting. Abbreviations: AKI, acute kidney injury; ESRD, end-stage renal disease.

Figure 5.10 shows that compared to the overall AKI cohort, patients with AKI superimposed on pre-existing CKD were more likely to have a nephrologist visit following an AKI hospitalization. At 3 months, 15.4% of "AKI on CKD" patients without diabetes had seen a nephrologist, and this rose to 23.0% by 12 months. For patients with both CKD and diabetes, 29.0% saw a nephrologist by 12 months. In contrast, just 4.6% of AKI patients without diabetes or CKD were seen by a nephrologist by 12 months following AKI hospitalization.

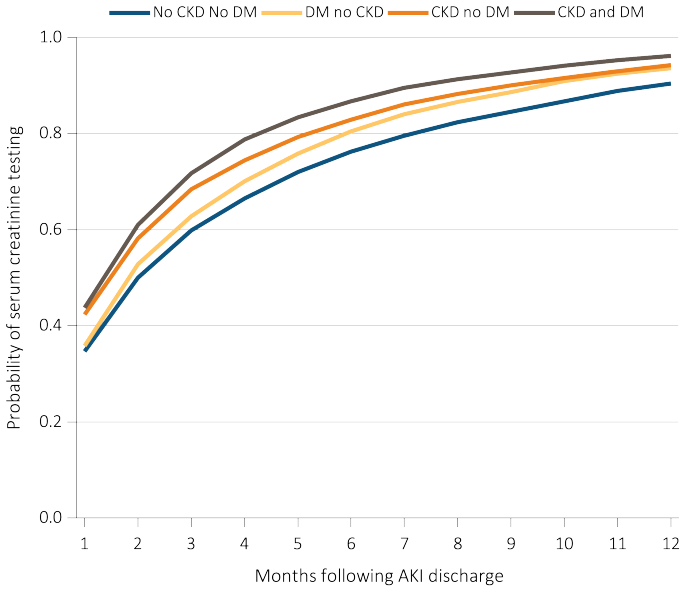
vol 1 Figure 5.10 Outpatient nephrology visits within one year of live discharge from first AKI hospitalization in 2012 for Medicare patients aged 66+, by CKD, DM, and time



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form on 1/1/2012, and were discharged alive from a first AKI hospitalization in 2012. For each time point, the denominator is all patients alive, without ESRD, not in a Medicare Advantage plan and with Medicare Parts A & B. Physician visits are from physician/supplier claims with provider specialty codes for nephrology (39) and claim source indicating an outpatient setting. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease.

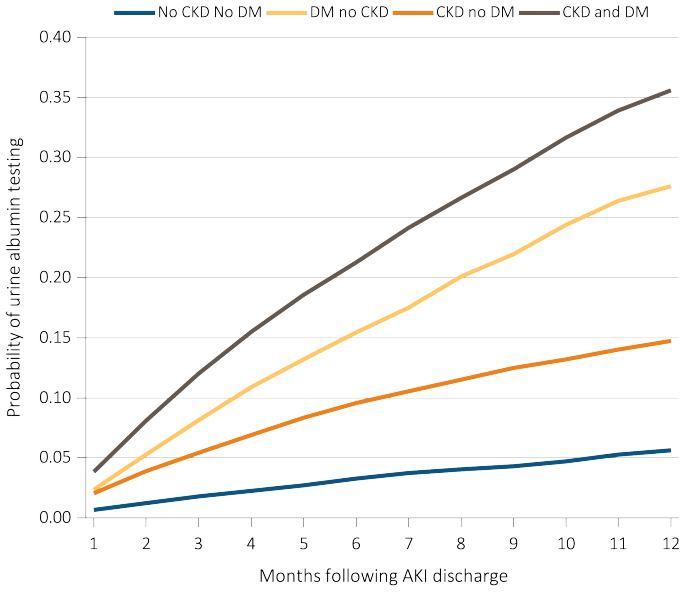
Among individuals suffering an in-hospital AKI event, the probability of serum creatinine and urine albumin testing increased with time following index hospitalization discharge, as shown in Figures 5.11 and 5.12. Of those patients with AKI in 2012, 83% had a follow-up creatinine test billed to Medicare by 6 months after hospitalization, while only 13% had urine albumin testing billed by this point. Rates of serum creatinine testing were relatively similar regardless of diabetes or CKD status, and at least 90% of patients in each comorbidity group were tested by 12 months. However, the probability of urine albumin testing varied considerably by comorbidity status. By 12 months, urine albumin testing occurred in 6% of patients without pre-existing CKD or diabetes, compared to 15% in non-diabetic patients with CKD, 28% in patients with diabetes but not CKD, and 36% in patients with both.

vol 1 Figure 5.11 Cumulative probability of a claim for a serum creatinine test within one year of live discharge from first AKI hospitalization in 2012 for Medicare patients aged 66+, by CKD, DM, and time



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, no ESRD by first service date from Medical Evidence form on 1/1/2012, and were discharged alive from a first AKI hospitalization in 2012. Date of first serum creatinine test following AKI discharge is from inpatient and outpatient claims with healthcare common procedure coding system (HCPCS) codes of 80048, 80050, 80053, 80069, or 82565. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease.

vol 1 Figure 5.12 Cumulative probability of a claim for an urine albumin test within one year of live discharge from first AKI hospitalization in 2012 for Medicare patients aged 66+, by CKD, DM, and time



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 and older who had both Medicare Parts A and B, no Medicare Advantage plan, no ESRD by first service date from Medical

Evidence form on 1/1/2012, and were discharged alive from a first AKI hospitalization in 2012. Date of first urine albumin test following AKI discharge is from inpatient and outpatient claims with healthcare common procedure coding system (HCPCS) codes of 82042, 82043, 82044, or 84156. Censored at death, ESRD, end of Medicare Parts A & B participation, or switch to Medicare Advantage program. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESRD, end-stage renal disease.

Changes in CKD Status After Acute Kidney Injury

CKD status changes significantly in the year following an AKI hospitalization, as shown in Figure 5.13. Among patients without baseline CKD, nearly 30% are reclassified as having some degree of CKD, including 0.20% being declared ESRD. Table A shows the ICD-9-CM diagnosis codes used to define stages of chronic kidney disease for Figure 5.13.

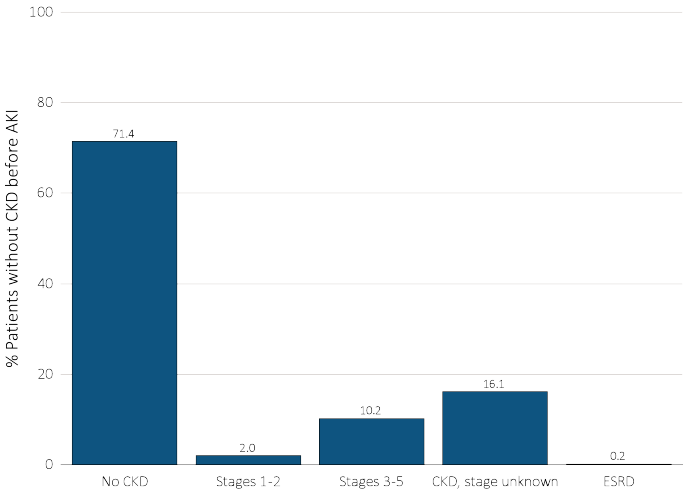
Table A. ICD-9-CM codes for Chronic Kidney Disease (CKD) stages

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.

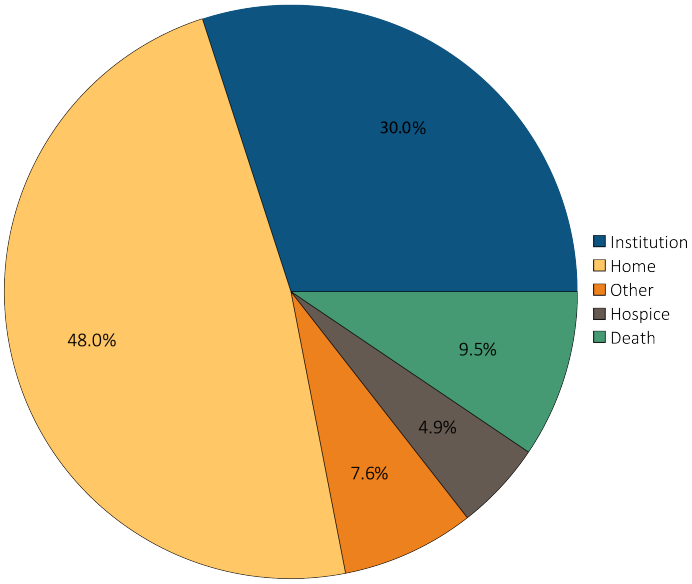
vol 1 Figure 5.13 Renal status one year following discharge from AKI hospitalization in 2011-2012, among surviving Medicare patients aged 66+ without kidney disease prior to AKI hospitalization, by CKD stage and ESRD status



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 and older who had both Medicare Parts A & B, no Medicare Advantage plan, did not have ESRD, were discharged alive from a first AKI hospitalization in 2011 or 2012, and did not have any claims with a diagnosis of CKD in the 365 days prior to the AKI. Renal status after AKI determined from claims between discharge from AKI hospitalization and 365 days after discharge. Stage determined by 585.x claim closest to 365 days after discharge; ESRD by first service date on Medical Evidence form. Abbreviations: AKI, acute kidney injury; CKD, chronic kidney disease; ESRD, end-stage renal disease.

In Figure 5.14, we examine the status and disposition for AKI patients once they are discharged from the hospital. After excluding patients admitted from a skilled nursing facility (n=2,221, leaving a total of 49,688 AKI discharges), among AKI patients aged 66 and older in 2013, fewer than 50% were discharged directly to their home. Mortality (including discharge to hospice) was 14.4%, while 30.0% of patients discharged to institutions including short-term skilled nursing facility stays, rehabilitation hospitals, or long-term care facilities.

vol 1 Figure 5.14 Hospital discharge status of first AKI hospitalization for Medicare patients aged 66+, 2013



Data Source: Special analyses, Medicare 5 percent sample. Medicare patients aged 66 or older who had both Medicare Parts A & B, no Medicare Advantage plan, did not have ESRD on 1/1/2013 and had a first AKI hospitalization in 2013. Institution includes short-term skilled nursing facilities, rehabilitation hospitals, and long-term care facilities. Home also includes patients receiving home health care services. Excludes patients admitted to the acute care hospital from a skilled nursing facility. Abbreviations: AKI, acute kidney injury; ESRD, end-stage renal disease.

References

Chawla LS, Eggers PW, Star RA, Kimmel PL. Acute kidney injury and chronic kidney disease as interconnected syndromes. *N Engl J Med* 2014;371:58-66.

Waikar SS, Wald R, Chertow GM, Curhan GC, Winkelmayer WC, Liangos O, Sosa MA, Jaber BL. Validity of international classification of diseases, ninth revision, clinical modification codes for acute renal failure. *J Am Soc Nephrol* 2006;17:1688–1694.

Grams ME, Waikar SS, MacMahon B, Whelton S, Ballew SH, Coresh J. Performance and limitations of administrative data in the identification of AKI. *Clin J Am Soc Nephrol* 2014;9:682-9.