

Muhammad al-Idrisi, 1154



Cardiovascular disease in patients with chronic kidney disease

76 cardiovascular disease,
intervention,
& survival
78 medication use
80 heart failure
82 summary

As shown in the Venn diagrams on the next page, elderly patients with CKD have a greater burden of cardiovascular disease (CVD) than do their non-CKD counterparts. Congestive heart failure (CHF), acute myocardial infarction (AMI), and stroke (CVA/TIA) were identified in 18.5, 6.4, and 20.3 percent of non-CKD patients with CVD in 2011; fewer than 4 percent had more than one cardiovascular condition. Forty-three percent of CKD patients with CVD, in contrast, had CHF, while 15.1 and 26.7 percent had a history of AMI or stroke; 10–12 percent had either CHF and AMI or CHF and stroke.

We next look at CVD and interventions by age, race, and CKD status. One primary finding is a marked increase in CVD in the presence of CKD and advanced age. In 2011, for example, the prevalence of CHF, at just 7 percent in general Medicare non-CKD patients, was at 31 percent in those with CKD.

The strongest predictor of atrial fibrillation (AFIB) in the Medicare population is age (Lakshminaryan et al., 2006). In the 2011 prevalent general Medicare population, the overall prevalence of AFIB was 9.5 percent in non-CKD patients, and 24 percent in the CKD population. Among patients age 85 and older, percentages reached 17.5 and 31.9, respectively.

Data on this spread also show that there is a stepwise decrease in survival related to advanced CKD stage, and that mortality after CHF or AMI in patients with Stages 4–5 CKD is similar to that in dialysis patients.

We next examine cardiovascular disease and pharmacologic treatment related to CKD status and to CVD and therapeutic interventions. Among 2011 non-CKD patients with no cardiac event, 45 percent received an angiotensin converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) and 30 percent received a beta blocker; 5.0, 2.4, 45, and 0.2 percent, respectively, received clopidogrel, warfarin, a statin, and amiodarone. The use of ACEI/ARB and beta blocker therapy is probably attributable to hypertension and, in this group, statin therapy may be for the primary prevention of cardiovascular disease. The low usage of clopidogrel and warfarin might relate to prior remote cardiovascular disease not identified by recent claims.

Time is more complex near the sea than in any other place, for in addition to the circling of the sun and the turning of the seasons, the waves beat out the passage of time on the rocks and the tides rise and fall as a great clepsydra.

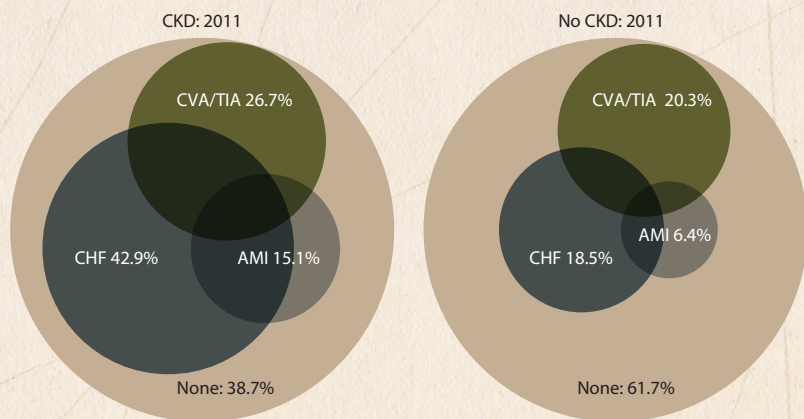
John Steinbeck
TORTILLA FLAT

Among patients with CKD but no cardiac event, the corresponding percentages for medication use were 63 and 47 percent for ACEI/ARB and beta blocker therapy, and 8.4, 4.7, 56, and 0.6 for clopidogrel, warfarin, a statin, and amiodarone. The high use of ACEI/ARB therapy probably represents a combination of hypertension and, perhaps, therapy designed to retard the progression of renal disease. Use of beta blocker therapy most likely also relates to the treatment of hypertension and, perhaps in both cases, ischemic heart disease not associated with myocardial infarction.

At the end of the chapter we present a new focus for the cvsc, and parallel the chapter on cardiovascular disease

and ESRD in Volume Two. A 2013 publication by Ahmed et al. found that discharge with a prescription for an ACEI or ARB was associated with a significant reduction in all-cause mortality among patients with diastolic heart failure (HF) and CKD, but not among non-CKD patients. We look here at the epidemiology and unadjusted survival of prevalent CKD patients as related to CKD stage and to the presence of systolic HF, diastolic HF, combined systolic and diastolic HF, and "unspecified" HF, and examine as well the adjusted mortality risk of systolic and diastolic HF. • **Figure 4.1;** see page 144 for analytical methods. December 31, 2011 point prevalent Medicare enrollees with CVD, age 66 & older, with fee-for-service coverage for the entire calendar year.

vol 1
4.1 Cardiovascular disease in patients with or without CKD, 2011

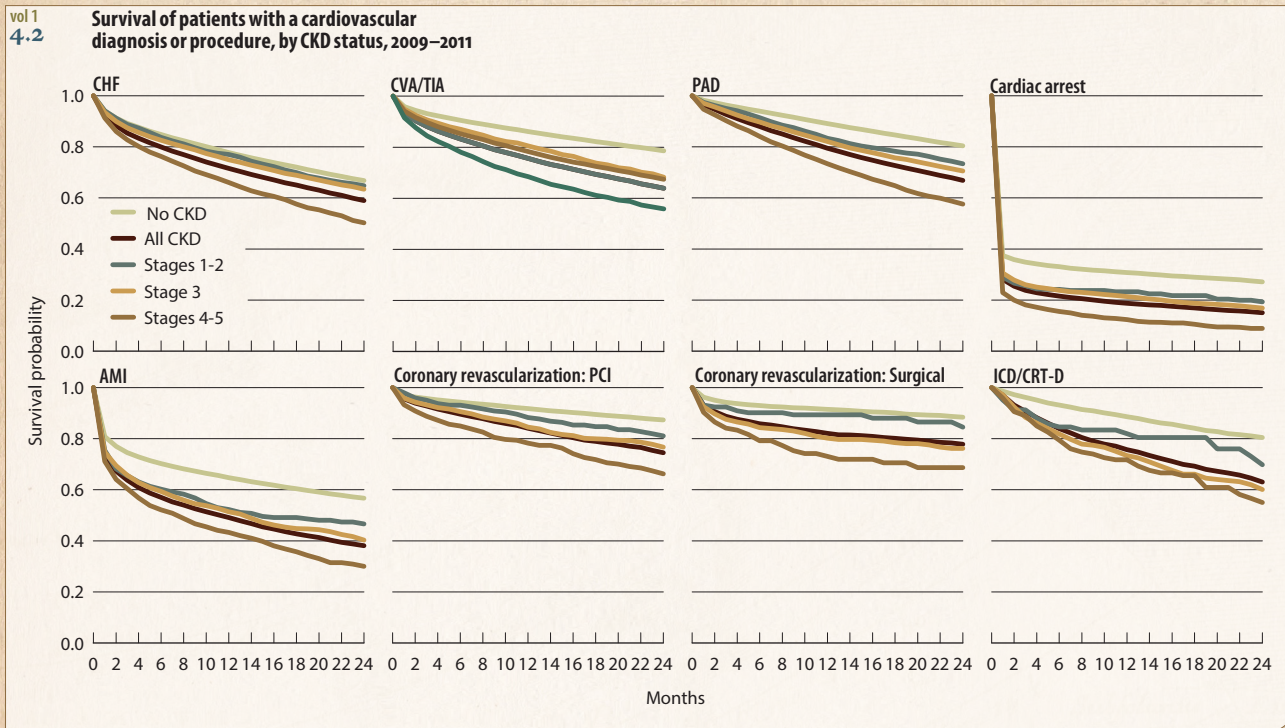


Patients with advanced CKD are the most likely to have cardiovascular disease (CVD), and the prevalence of comorbid CVD increases with age. Among prevalent Medicare patients age 66 and older, 31 percent of those with any CKD, and 41 percent of those with Stage 4–5 CKD, had congestive heart failure (CHF) in 2011. For Stage 3 CKD, the percentage rose from 23 percent in patients age 66–69 to 40 percent in those age 85 and older; for Stages 4–5, it rose from 34 to 47 percent.

This “axis of risk” is present for both atherosclerotic and non-atherosclerotic CVD. Conceptually, AFIB may be similar to CHF; both may be spawned by CVD leading to increases in left ventricular (and left atrial) diastolic pressure (due to hypertension, left ventricular hypertrophy, ischemic heart disease, valvular heart disease, etc). Although there is a large difference in AFIB prevalence between CKD and no-CKD patients, the gradient related to CKD stage appears to be less for AFIB than for CHF, ranging, overall, from 21.2 percent for Stage 1–2 CKD to 26.1 percent for CKD of Stages 4–5. Among patients age 85 and older there are minimal differences by CKD stage, implying that the association with age may be considerably stronger than the association with CKD stage for these patients. + [Table 4.a](#); see page 143 for analytical methods. December 31, 2011 point prevalent Medicare enrollees, age 66 & older.

vol 1 4.a Prevalence of cardiovascular disease & intervention (cell percent), by CKD status, age, & race, 2011								
	Overall	66–69	70–74	75–84	85+	White	Blk/Af Am	Other
CHF								
No CKD	7.0	3.4	4.7	7.8	14.4	6.9	8.5	5.9
All CKD	31.2	22.8	24.7	30.7	40.9	31.3	32.3	27.5
Stages 1–2	26.8	18.8	20.9	26.5	39.6	27.2	28.7	19.7
Stage 3	30.9	23.3	25.1	30.4	39.9	30.9	32.3	27.8
Stages 4–5	40.9	33.6	36.2	39.8	47.3	41.6	39.0	37.1
AMI								
No CKD	2.4	1.7	2.1	2.7	3.3	2.5	1.9	1.7
All CKD	11.0	9.9	10.1	11.1	12.0	11.4	9.0	8.3
Stages 1–2	9.7	7.9	8.0	10.2	11.9	10.3	7.7	6.9
Stage 3	10.9	10.2	9.8	10.9	12.1	11.4	9.2	7.5
Stages 4–5	12.9	11.3	13.9	12.6	13.5	13.5	9.7	12.2
PAD								
No CKD	9.3	4.7	6.5	10.6	18.2	9.3	10.2	7.6
All CKD	26.9	20.2	23.2	27.1	32.7	27.3	26.0	22.6
Stages 1–2	24.1	15.4	20.0	25.6	32.0	24.4	24.5	19.3
Stage 3	25.7	19.8	22.1	25.5	31.5	26.0	24.5	22.2
Stages 4–5	29.6	24.0	27.2	29.3	33.1	30.2	28.2	25.1
CVA/TIA								
No CKD	7.7	4.3	5.9	9.2	12.3	7.7	8.6	6.6
All CKD	19.4	15.0	16.5	20.3	22.4	19.2	21.5	18.5
Stages 1–2	18.1	13.3	14.5	19.7	22.7	18.1	18.6	17.6
Stage 3	18.5	14.7	15.4	19.1	21.9	18.5	19.5	17.1
Stages 4–5	20.2	16.5	19.4	21.1	20.8	19.9	21.3	21.8
Atrial fibrillation (AFIB)								
No CKD	9.5	4.3	6.6	11.8	17.5	10.2	4.7	5.3
All CKD	24.0	14.1	17.8	25.0	31.9	25.9	14.1	15.6
Stages 1–2	21.2	11.4	15.3	22.9	31.7	23.5	11.0	13.3
Stage 3	24.3	14.8	18.4	25.4	31.7	26.2	13.9	15.7
Stages 4–5	26.1	15.9	20.8	26.2	32.2	28.5	15.6	17.6
ICDs/CRT-D								
No CKD	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0
All CKD	0.4	0.6	0.5	0.5	0.2	0.4	0.4	0.3
Stages 1–2	0.5	0.6	0.2	0.8	0.3	0.6	0.5	0.1
Stage 3	0.4	0.6	0.4	0.5	0.2	0.4	0.5	0.3
Stages 4–5	0.6	0.9	1.0	0.5	0.3	0.6	0.6	0.1
Revascularization (PCI)								
No CKD	0.8	0.8	0.9	0.9	0.5	0.8	0.6	0.6
All CKD	2.3	3.0	2.7	2.5	1.5	2.4	1.8	1.7
Stages 1–2	2.4	2.5	2.7	2.5	1.5	2.5	1.9	2.2
Stage 3	2.3	3.2	2.6	2.4	1.7	2.4	1.9	1.9
Stages 4–5	2.1	2.6	2.7	2.3	1.3	2.2	1.5	2.0
Revascularization (CABG)								
No CKD	0.2	0.2	0.3	0.2	0.1	0.2	0.1	0.2
All CKD	0.8	1.2	1.2	0.9	0.3	0.9	0.5	0.6
Stages 1–2	0.9	1.2	1.1	1.0	0.3	1.0	0.7	0.8
Stage 3	0.8	1.2	1.1	0.9	0.3	0.9	0.5	0.5
Stages 4–5	0.7	1.1	1.0	0.8	0.2	0.8	0.5	0.4

pr
1
2
3
4
5
6
7



Data here show the gradient of mortality related to cardiovascular disease (CVD) and CKD stage. These data do not take proteinuria into account, which, based on KDIGO data, we would expect to provide an even finer calibration of survival than CKD stage alone.

In patients with congestive heart failure (CHF), two-year survival is 67 percent in non-CKD patients and 59 percent in those with CKD — 65 percent for those with CKD of Stages 1–2, and 50 percent for those with Stages 4–5. For CVA/TIA, two-year survival is 79 percent in non-CKD patients, and 64, 68, and 56 percent for CKD overall, Stages 1–2, and Stages 4–5. And for peripheral arterial disease (PAD), survival at two years is 80 percent for those without CKD, compared to 67, 73, and 58 percent, respectively, in the CKD population.

For patients with AMI, even those without CKD have a two-year survival of only 57 percent (reflecting the high mortality burden associated with AMI in the elderly) compared to 38 percent among CKD patients — 47 percent for Stages 1–2 and 30 percent for Stages 4–5.

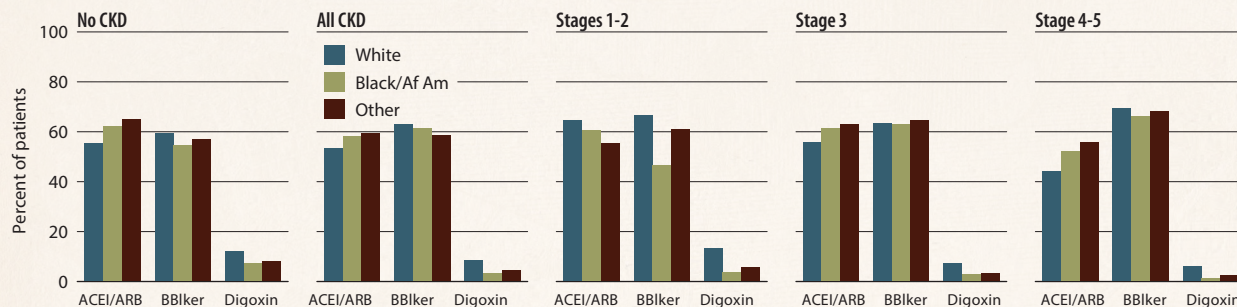
Although coronary revascularization procedures are associated with higher mortality rates in the elderly compared to younger patients, rates are still lower than in patients with other cardiovascular conditions. Two-year mortality after PCI in elderly patients without CKD, for example, is just 13 percent versus 25 percent in CKD patients overall, and 34 percent in those with CKD of Stages 4–5. Similar trends are noted for coronary bypass surgery. + **Figure 4.2;** see page 144 for analytical methods. *Medicare enrollees age 66 & older with a first cardiovascular event or procedure in 2009–2011 (index date).*

Although prior publications have demonstrated a strong inverse relationship between the likelihood of cardioprotective therapy use and advanced CKD stage, our overview of 2011 prevalent Medicare patients with Part D coverage provides some reassurance that this practice pattern has changed. While ACEI/ARB use in CHF patients does decline with advancing CKD, the same is not true of beta blocker therapy, which increases with CKD stage. The use of beta blocker therapy after AMI also demonstrates a change with respect to CKD. Despite earlier data indicating underutilization inversely related to eGFR, 76 percent of 2011 CKD patients with AMI — and a surprising 82 percent of those with Stage 4–5 CKD — received a beta blocker.

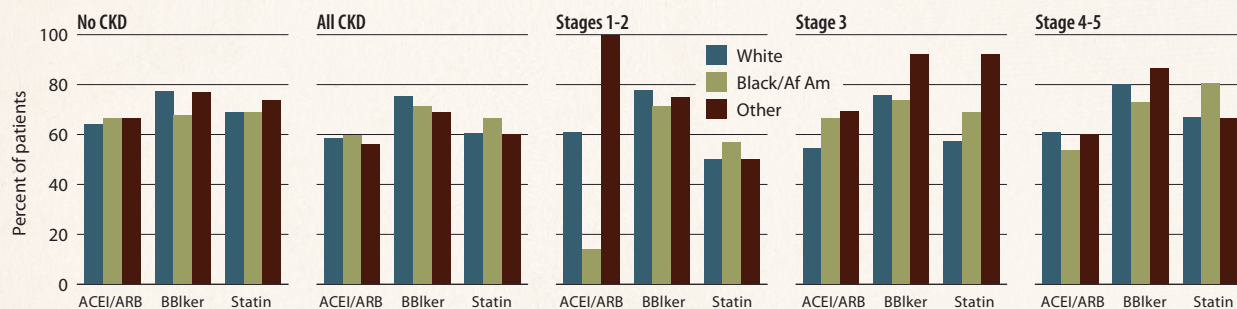
The treatment of AFIB presents a special clinical problem in CKD patients. In comparisons of warfarin to newer oral anticoagulants in CKD patients, dabigatran was associated with the largest reduction in risk of ischemic stroke and apixaban with the greatest reduction in risk of serous hemorrhage (Hart et al, 2012). None of these trials, however, enrolled patients with estimated creatinine clearances of <25 ml/min. Despite the absence of clinical trial data, approval in the U.S. was given to newer oral anticoagulants — dabigatran, rivaroxaban, and apixaban — for prevention of ischemic stroke in non-valvular AFIB in patients with estimated creatinine clearances as low as 15. All three agents are approved for use in patients with CKD of Stage 3 or Stage 4, but not for those with Stage 5 CKD. In 2011, 2.4 percent of AFIB and with CKD of Stages 4–5 received dabigatran. Close attention will need to be paid to the expected increase in serious hemorrhagic events associated with these agents in patients with advanced CKD, but available data imply that newer oral anticoagulants are superior to warfarin in efficacy and safety. + Table 4.b; see page 144 for analytical methods. January 1 point prevalent patients with Medicare Parts A, B, & D enrollment & with a cardiovascular diagnosis or procedure in 2011.

vol 1 4.b Cardiovascular disease & pharmacological interventions (row percent), by CKD status, 2011								
	N	ACEI/ARB	Beta Blocker	Clopidogrel	Warfarin	Dabigatran	Statin	Amiodarone
CHF								
No CKD	50,637	57.3	61.6	15.7	23.8	1.2	49.2	5.4
All CKD	17,659	52.0	67.0	19.9	23.3	0.9	53.2	7.5
Stages 1–2	782	57.8	66.4	18.5	24.3	0.9	53.3	6.3
Stage 3	5,403	55.3	68.2	21.5	24.4	1.1	57.6	7.5
Stages 4–5	3,617	42.4	72.3	19.9	21.0	0.6	55.1	9.3
AMI								
No CKD	3,581	64.5	76.9	48.3	12.6	1.1	68.8	6.0
All CKD	1,110	58.8	76.4	42.3	16.9	0.9	63.7	7.2
Stages 1–2	45	55.6	80.0	35.6	22.2	0.0	60.0	13.3
Stage 3	342	56.7	76.3	45.9	19.3	0.9	63.2	8.2
Stages 4–5	236	58.5	81.8	43.2	15.7	0.0	71.6	8.1
PAD								
No CKD	62,503	49.0	45.0	16.8	12.3	0.5	48.3	2.0
All CKD	14,713	50.5	58.3	22.3	17.2	0.8	53.9	4.7
Stages 1–2	751	55.1	62.3	22.6	14.8	0.5	53.8	5.2
Stage 3	4,648	54.3	60.9	23.3	17.3	0.8	57.9	4.2
Stages 4–5	2,538	44.1	65.1	24.7	17.9	0.7	58.0	6.3
CVA/TIA								
No CKD	41,016	51.6	46.3	22.8	14.6	0.8	55.6	2.1
All CKD	8,739	53.2	59.7	26.4	18.1	0.8	57.8	4.5
Stages 1–2	459	58.2	59.7	25.5	17.6	0.7	56.2	3.7
Stage 3	2,820	55.9	60.9	27.9	17.8	0.7	62.8	4.3
Stages 4–5	1,418	46.0	64.9	28.0	16.8	0.6	59.4	6.2
AFIB								
No CKD	57,243	50.4	61.4	9.2	53.3	2.8	48.1	8.3
All CKD	12,432	50.1	66.5	14.2	48.7	1.8	51.7	12.8
Stages 1–2	598	56.7	66.2	14.7	49.7	2.5	57.0	11.9
Stage 3	4,005	52.7	67.3	13.9	50.4	2.1	56.4	13.2
Stages 4–5	2,180	42.3	69.6	15.0	47.5	1.4	51.7	16.1
ICD/CRT-D								
No CKD	430	77.9	84.9	26.5	32.1	3.5	65.1	20.7
All CKD	178	64.0	88.2	26.4	35.4	2.2	62.9	18.5
Stages 1–2	13	53.8	84.6	30.8	46.2	0.0	69.2	7.7
Stage 3	66	65.2	87.9	28.8	31.8	4.5	66.7	13.6
Stages 4–5	31	58.1	87.1	29.0	32.3	0.0	48.4	38.7
Revascularization: PCI								
No CKD	4,275	67.2	76.8	83.8	9.1	1.2	79.1	3.8
All CKD	767	62.8	78.4	79.0	14.5	1.7	72.9	5.7
Stages 1–2	43	76.7	76.7	79.1	16.3	0.0	72.1	7.0
Stage 3	298	62.1	81.5	80.5	14.4	2.7	73.5	5.0
Stages 4–5	130	46.9	75.4	76.2	17.7	0.0	77.7	10.0
Revascularization: CABG								
No CKD	956	65.9	86.9	33.3	18.3	1.4	80.3	31.8
All CKD	142	63.4	85.9	33.1	23.9	2.1	81.0	31.0
Stages 1–2	10	70.0	90.0	20.0	30.0	0.0	80.0	50.0
Stage 3	60	63.3	86.7	28.3	28.3	3.3	85.0	30.0
Stages 4–5	13	61.5	92.3	23.1	30.8	0.0	84.6	23.1
No cardiac event								
No CKD	390,635	44.8	29.8	5.0	2.4	0.0	45.2	0.2
All CKD	25,334	63.1	47.4	8.4	4.7	0.1	56.0	0.6
Stages 1–2	1,630	66.1	42.2	7.4	3.7	0.0	57.4	0.7
Stage 3	9,418	68.3	49.7	8.9	4.4	0.1	61.6	0.5
Stages 4–5	3,853	60.8	58.4	9.9	4.5	0.1	57.9	1.0

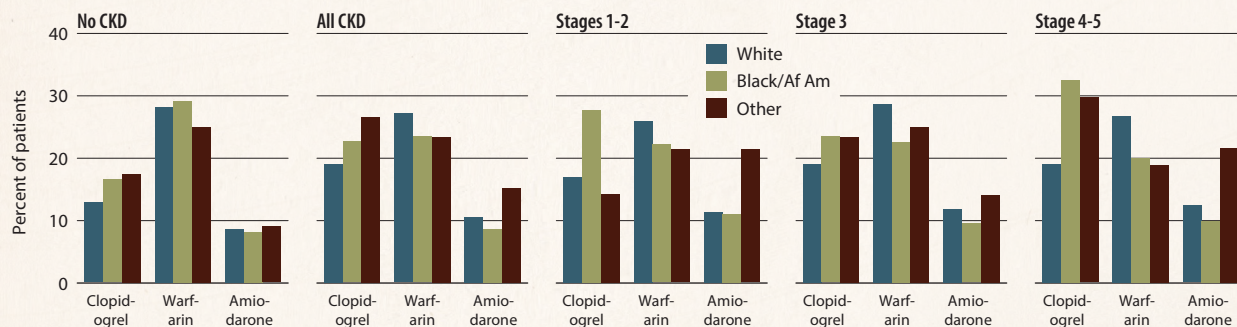
vol 1
4.3 Prescription drug therapy in patients with CHF, by CKD status, 2011



vol 1
4.4 Prescription drug therapy in patients with an AMI, by CKD status, 2011



vol 1
4.5 Prescription drug therapy in patients with atrial fibrillation, by CKD status, 2011



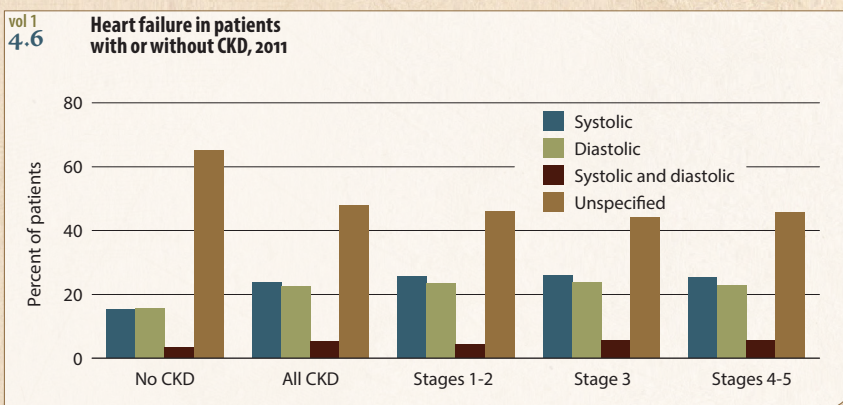
In the non-CKD population with congestive heart failure (CHF), 56 percent of whites and 62 percent of blacks/African Americans receive an ACEI/ARB, compared to 53 and 58 percent in the CKD population. The pattern of beta blocker use is reversed, at 60 and 55 percent among white and black/African American patients without CKD, respectively, and 63 and 62 percent in the CKD population. In patients with CKD of

Stages 4–5 there is, as expected, a reduction in ACEI/ARB use, to 44 percent among whites and 52 percent among blacks/African Americans. Use of beta blocker therapy, in contrast, rises for advanced CKD, to 69 and 66 percent. ♦ **Figures 4.3–5**; see page 145 for analytical methods. *January 1 point prevalent patients with Medicare Parts A, B, & D enrollment with a first cardiovascular diagnosis or procedure in 2011.*

vol 1
4.C

Characteristics of patients with heart failure, by CKD status, 2011

	Systolic heart failure					Diastolic heart failure					Systolic & diastolic heart failure					Unspecified heart failure				
	No CKD	All Stages CKD	Stage 1-2	Stage 3	Stages 4-5	No CKD	All Stages CKD	Stage 1-2	Stage 3	Stages 4-5	No CKD	All Stages CKD	Stage 1-2	Stage 3	Stages 4-5	No CKD	All Stages CKD	Stage 1-2	Stage 3	Stages 4-5
Age: 66-69	14.6	12.1	13.6	12.4	11.5	11.1	9.4	11.7	9.1	8.5	10.9	10.4	17.3	10.1	7.7	10.6	9.8	11.8	9.6	8.9
70-74	19.8	17.2	15.7	18.2	16.2	17.0	15.5	16.1	15.1	17.4	16.7	15.8	16.0	14.4	17.5	15.5	14.9	18.4	15.4	13.3
75-84	38.5	40.8	41.2	41.7	38.2	38.8	39.7	39.0	40.2	37.5	41.1	39.9	37.3	44.4	38.8	36.9	38.7	34.9	40.5	41.0
85+	27.1	30.0	29.5	27.8	34.1	33.0	35.4	33.2	35.5	36.6	31.3	34.0	29.3	31.1	36.1	36.9	36.6	35.0	34.5	36.8
Male	46.1	50.4	53.8	51.2	47.3	26.2	28.8	28.8	29.2	28.9	38.6	42.0	53.3	43.4	40.4	32.6	38.9	39.9	41.5	38.7
Female	53.9	49.6	46.2	48.8	52.7	73.8	71.2	71.2	70.8	71.1	61.4	58.0	46.7	56.6	59.6	67.4	61.1	60.1	58.5	61.3
White	86.0	81.7	81.2	81.3	77.1	85.4	81.1	78.4	81.6	79.6	84.9	81.2	74.7	81.7	76.0	82.9	79.3	76.5	79.0	79.3
Black/Af Am	8.7	12.4	14.0	12.9	14.4	8.9	12.5	14.0	12.4	13.7	8.1	11.0	14.7	10.1	14.8	10.5	13.7	16.2	14.1	13.0
Other	5.4	5.9	4.8	5.7	8.5	5.7	6.3	7.5	6.1	6.7	7.0	7.9	10.7	8.2	9.3	6.6	7.0	7.3	6.9	7.7
Non-diabetes	59.5	41.6	46.0	39.2	35.4	59.1	40.8	42.3	39.2	36.8	57.8	39.1	49.3	35.2	32.2	59.8	43.3	41.1	41.8	40.6
Diabetes	40.5	58.4	54.0	60.8	64.6	40.9	59.2	57.7	60.8	63.2	42.2	60.9	50.7	64.8	67.8	40.2	56.7	58.9	58.2	59.4
ACEI/ARB	74.5	76.9	70.6	61.2	74.1	62.9	70.4	64.1	58.3	67.1	71.4	70.7	68.5	54.6	67.1	59.9	65.3	64.3	55.6	61.5
Beta blocker	82.0	86.0	86.3	86.9	84.6	67.0	73.0	75.8	78.2	73.5	76.0	76.0	81.7	81.4	74.4	62.6	70.1	71.0	74.2	66.6
Digoxin	24.5	28.3	22.7	18.7	26.3	14.4	10.9	10.9	8.0	14.2	20.4	10.7	15.8	10.4	17.6	16.2	12.7	11.9	8.7	13.8



icd-9-cm codes

- 585.1 Chronic kidney disease, Stage 1
- 585.2 Chronic kidney disease, Stage 2 (mild)
- 585.3 Chronic kidney disease, Stage 3 (moderate)
- 585.4 Chronic kidney disease, Stage 4 (severe)
- 585.5 Chronic kidney disease, Stage 5 (excludes 585.6: Stage 5, requiring chronic dialysis.)

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

In USRDS analyses, patients with ICD-9-CM code 585.6 & with no ESRD 2728 form or other indication of ESRD are considered to have code 585.5; see Appendix A for details.

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

This last spread presents new data from the cvssc on the epidemiology, treatment, and outcome of CKD patients with systolic and diastolic heart failure (HF).

Based on clinical trials in patients with systolic HF, both ACEI/ARBs and beta-blockers are indicated treatments. Consistent with these strong evidence-based recommendations, 75 and 82 percent of non-CKD patients receive ACEI/ARB and beta blocker therapy, respectively, compared to 77 and 86 percent in the CKD population. Not unexpectedly, the use of digoxin is greatest in those with identified systolic HF, at 25 and 28 percent in non-CKD and CKD patients.

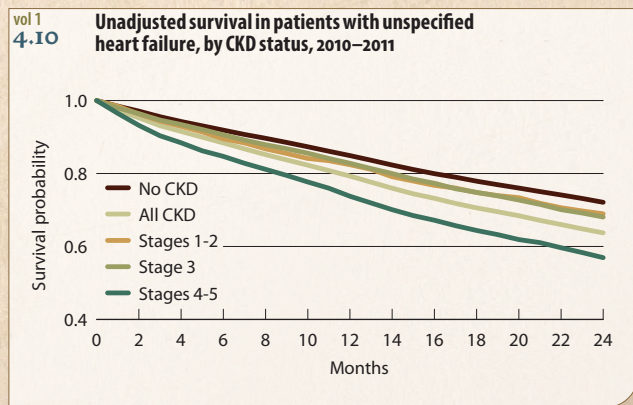
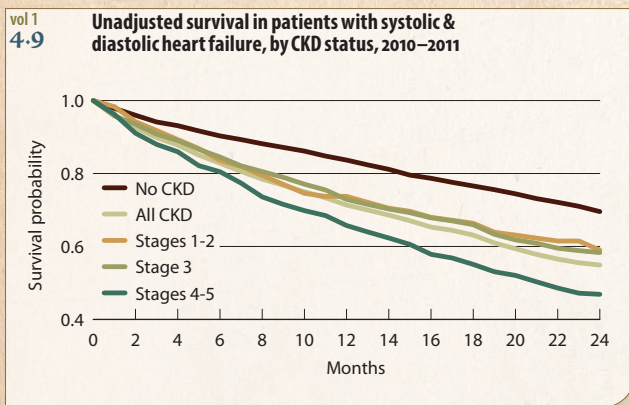
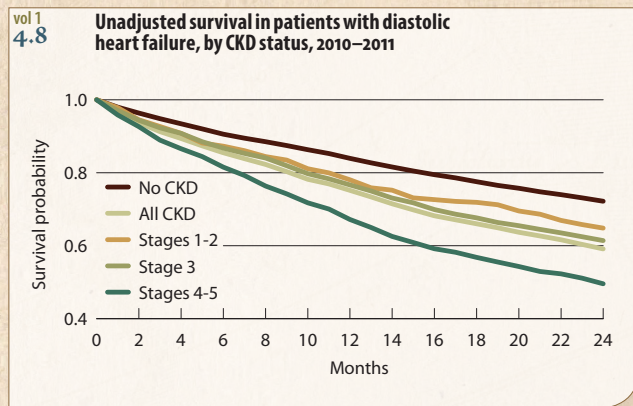
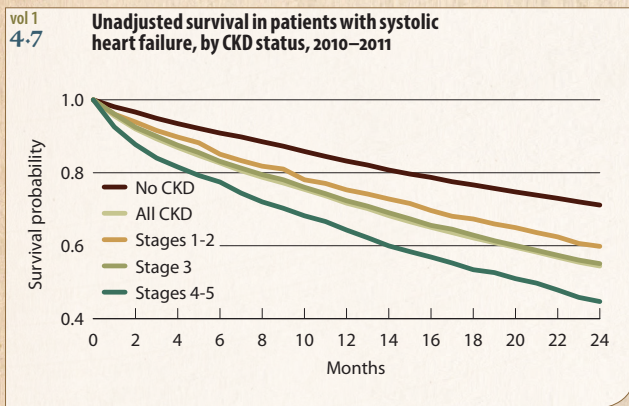
In non-CKD patients with "pure" diastolic HF (for which there is little convincing data on treatment), 63 percent receive an ACEI/ARB, 67 percent a beta blocker, and 14.4 percent digoxin. For CKD, the respective numbers are 70, 73, and 10.9 percent. **+ Table 4.c & Figure 4.6;** see page 145 for analytical methods. *December 31 point prevalent patients with Medicare Parts A, B, & D enrollment, 2011.*

In patients without CKD, systolic heart failure (HF, compared to no HF) is associated with a greater than two-fold risk of death, while diastolic HF is associated with a 79 percent higher risk. Among CKD patients, systolic and diastolic HF have a relative risk of death of 2.34 and 1.93. Systolic HF appears to be associated with a greater risk of death than diastolic HF.

For all types of HF, there is a step-wise increase in mortality related to advancing CKD stage. Patients with systolic HF have the worst outcomes, with a two-year survival of 71 percent for non-CKD patients, 60 percent for those with Stage 1–2 CKD, and 45 percent for those with CKD of Stages 4–5. Two-year survival for patients with diastolic HF is 72, 65, and 50 percent, respectively. **† Table 4.d & Figures 4.7–10; see page 145 for analytical methods. December 31 point prevalent patients with Medicare Parts A, B, & D, enrolled in 2009. Figures 4.7–10: subset of these patients, with a heart failure diagnosis in 2009.**

vol 1 4.d Adjusted hazard ratios of all-cause death in patients with heart failure, by CKD status, 2010–2011

	No CKD			CKD		
	Hazard ratio	CI	p-value	Hazard ratio	CI	p-value
Age: 66–69	reference					
70–74	1.36	1.33-1.40	<.0001	1.13	1.06-1.20	<.0001
75–84	2.62	2.55-2.68	<.0001	1.61	1.53-1.70	<.0001
85+	7.10	6.93-7.27	<.0001	3.14	2.98-3.31	<.0001
Male	reference					
Female	0.83	0.82-0.84	<.0001	0.89	0.87-0.92	<.0001
White	reference					
Black/Af Am	1.02	1.00-1.05	0.106	0.95	0.91-0.99	0.0152
Other	0.80	0.78-0.83	<.0001	0.85	0.80-0.90	<.0001
Diabetes	1.14	1.13-1.16	<.0001	1.09	1.06-1.12	<.0001
Hypertension	0.85	0.84-0.86	<.0001	0.73	0.70-0.77	<.0001
Other cause	reference					
Heart failure: none	reference					
Systolic	2.10	2.02-2.18	<.0001	2.34	2.24-2.44	<.0001
Diastolic	1.79	1.71-1.86	<.0001	1.93	1.83-2.02	<.0001
Both	2.02	1.88-2.17	<.0001	2.21	2.05-2.39	<.0001
Unspecified	1.90	1.87-1.94	<.0001	1.80	1.73-1.86	<.0001



burden of cardiovascular disease

CARDIOVASCULAR DISEASE IN CVD PATIENTS WITH OR WITHOUT CKD, 2011 (FIGURE 4.1)

	CHF	AMI	CVA/TIA
CKD	42.9%	15.1%	26.7%
no CKD	18.5%	6.4%	20.3%

cardiovascular disease intervention and survival

SURVIVAL OF PATIENTS WITH A CARDIOVASCULAR DIAGNOSIS OR PROCEDURE, BY CKD STATUS, 2009–2011 (FIGURE 4.2)

	no CKD	all CKD	stages 1–2	stage 3	stages 4–5
CHF	67%	59%	65%	63%	50%
CVA/TIA	79%	64%	68%	67%	56%
PAD	80%	67%	73%	71%	58%
CARDIAC ARREST	27%	15%	19%	17%	9%
AMI	57%	38%	47%	40%	30%
PCI	87%	75%	81%	77%	66%

heart failure

ADJUSTED HAZARD RATIOS OF ALL-CAUSE DEATH IN PATIENTS WITH HEART FAILURE, BY CKD STATUS, 2010–2011 (TABLE 4.D)

	HR no CKD	HR CKD
age 60–69	reference	
70–74	1.36	1.13
75–84	2.62	1.61
85+	7.10	3.14
heart failure: none	reference	
systolic	2.10	2.34
diastolic	1.79	1.93
both	2.02	2.21
unspecified	1.90	1.80