



chapterSEVEN

the transition to end-stage renal disease

All things flow, nothing abides.

Heraclitus

FROM THE EARLIEST STAGES OF THEIR DISEASE, PATIENTS WITH CHRONIC KIDNEY DISEASE FACE MANY CHALLENGES. CONTROL OF SALT INTAKE, BLOOD PRESSURE, LIPID LEVELS, AND WEIGHT ARE NEEDED TO ADDRESS THE MANAGEMENT OF CARDIOVASCULAR RISK FACTORS. AND THE



disease's progression, with the potential for accelerating cardiovascular disease and for reaching kidney failure, poses additional issues.

In Chapter Three we give one perspective on these issues, looking prospectively at CKD patients to determine their care in the year following diagnosis. Since progression to ESRD is a rare event, however, compared to death or survival, it is important also to assess the care of patients who do reach ESRD, to determine if they receive comparable services.

At two years prior to the initiation of ESRD therapy, 50 percent of Medicare ESRD patients have no claims for CKD services, and, while recognition grows each quarter, 28 percent still have no claim six months before ESRD. The constellation of reported CKD codes also changes as progressing kidney failure manifests itself in major complications. The proportion of patients with Stage 3–5 CKD rises, as does the frequency of acute kidney injury, particularly in the quarter before ESRD.

While these findings are consistent across populations, there are important differences in delivered care. Whether or not they have a reported CKD diagnosis code, EGHP patients are far less likely to see any doctor — particularly a nephrologist — prior to ESRD than are their Medicare counterparts. A planned transition to ESRD, with modality selection, vascular access placement, and work-ups for kidney transplantation, is difficult when visits to the primary physicians who coordinate this care are delayed.

We next address laboratory testing during the transition to ESRD. Compared to the data presented in Chapter Three, on prospectively measured care of identified CKD patients, microalbuminuria testing is less frequent in those who reach ESRD. Creatinine testing, not unexpectedly, is lowest in those without a CKD stage code, even though these individuals are clearly progressing to ESRD. And other testing to identify the usual complications of progressive kidney disease is lacking as well, with low rates of calcium/phosphorus, parathyroid hormone, lipid, and glycemic testing. Among diabetic Medicare patients with Stage 3–5 CKD who go on to ESRD, nearly 80 percent receive a glycosylated hemoglobin test in the two years prior to initiation, compared to 51 percent of their Ingenix I3 counterparts. Care of patients who reach ESRD is clearly less than recom-

mended, and may contribute to progression of their disease. In addition, testing rates are considerably lower among EGHP patients than for those with Medicare coverage, a major concern.

Information on the pre-ESRD use of prescription medications can also be compared to data in Chapter Three, on the management of the known CKD population. At two years prior to ESRD, 50–62 percent of CKD patients are using an ACEI, ARB, or renin inhibitor, and this falls to 33–44 percent in the three months before initiation. It is not clear whether this decline arises from concern over rising creatinine levels as kidney failure progresses, or if complications such as hyperkalemia may contribute to these patterns.

Use of beta blockers and dihydropyridine calcium channel blockers rises as patients near ESRD, possibly reflecting increased treatment for hypertension and congestive heart failure (CHF) in the later stages of CKD. The use of thiazide diuretics, known to be relatively ineffective in advanced kidney disease, averages about 10 percent among CKD patients advancing to ESRD. Use of loop diuretics, in contrast, and of the combination of loop plus thiazide diuretics, both increase, indicative of the increasing difficulty in managing fluid overload, pedal edema, hypertension, and CHF. These diuretic combinations can be also used to treat the hyperkalemia which may develop under the use of ACEIS/ARBs.

We conclude by examining medication continuity after ESRD initiation. While use of ACEIS, ARBs, and renin inhibitors appears similar before and after initiation, analysis shows that half the patients using these drugs three months prior to ESRD are taken off them by one month after initiation, and new patients are started on these medications. Findings related to phosphate binders are dramatically different, with just 10 percent on these medications three months before ESRD, and 53 percent at one month after initiation. These data may provide important insights into the high prevalence of hyperparathyroidism at the start of ESRD, as it

appears that few patients receive treatment for the control of phosphorus levels. Medication use in the Medicare population will be assessed further when more Part D data becomes available to the USRDS and we can construct a more complete treatment history for the incident population.

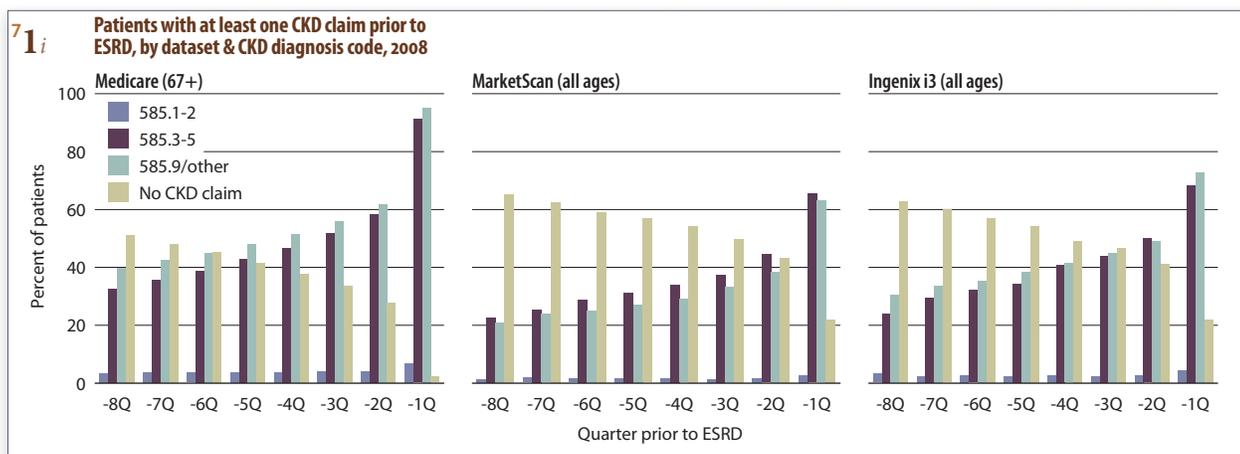
✦ **FIGURE 7.1;** see page 171 for analytical methods. *Incident Medicare ESRD patients age 67 & older, & incident MarketScan & Ingenix i3 ESRD patients (all ages), 2008.*

patient care prior to ESRD 112

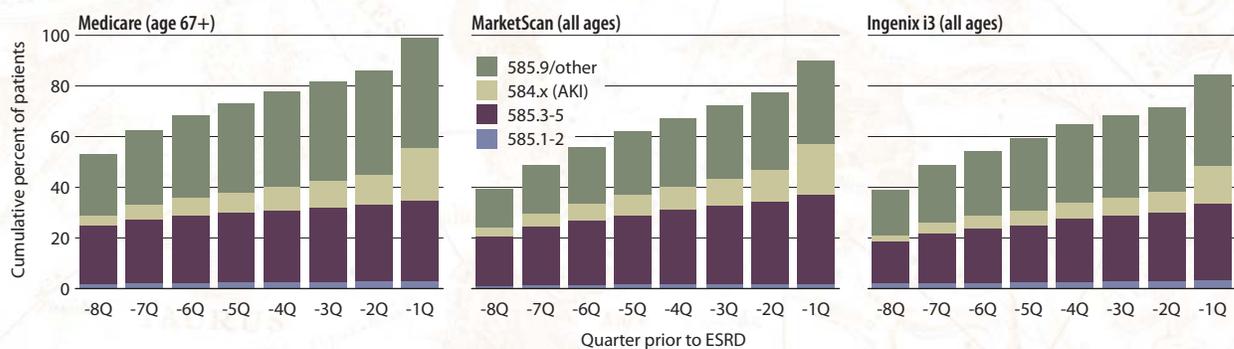
laboratory testing prior to ESRD 114

prescription drug therapy in the transition to ESRD 116

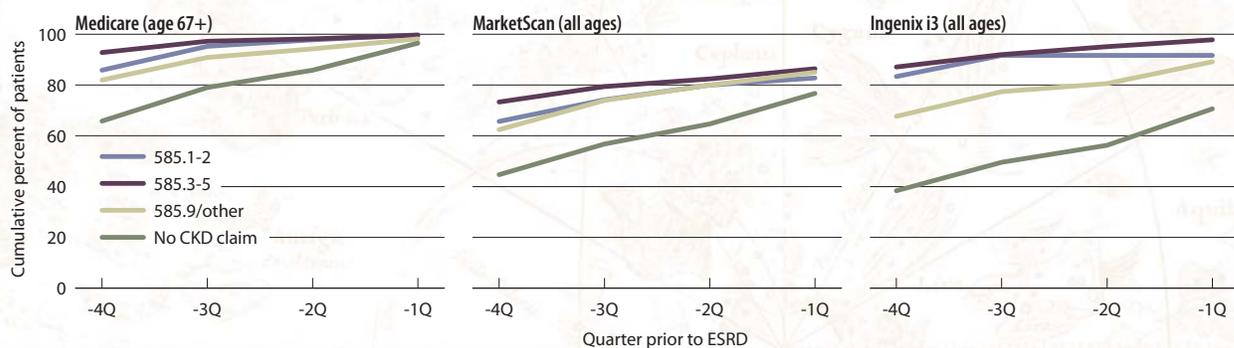
medication continuity in the transition to ESRD 118



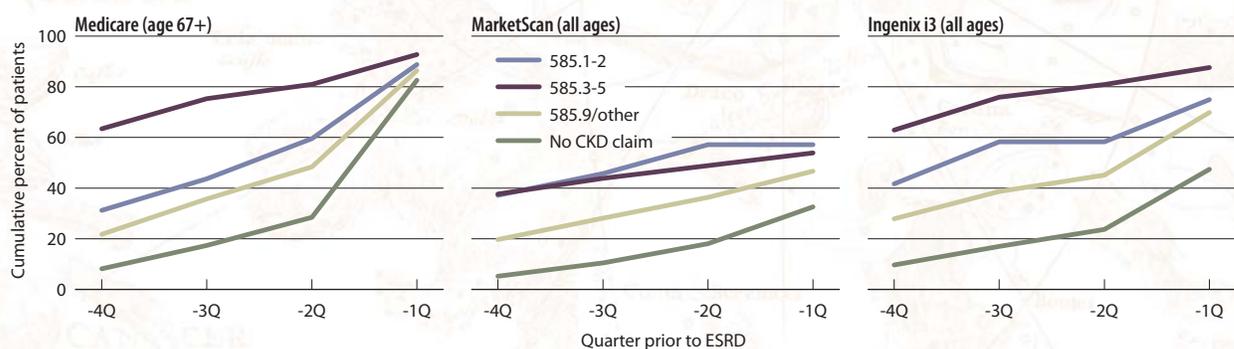
72i Cumulative percent of patients with a CKD claim prior to ESRD, by dataset & CKD diagnosis code, 2008



73i Cumulative percent of patients with a first physician visit in the year prior to ESRD, by dataset & CKD diagnosis code, 2008

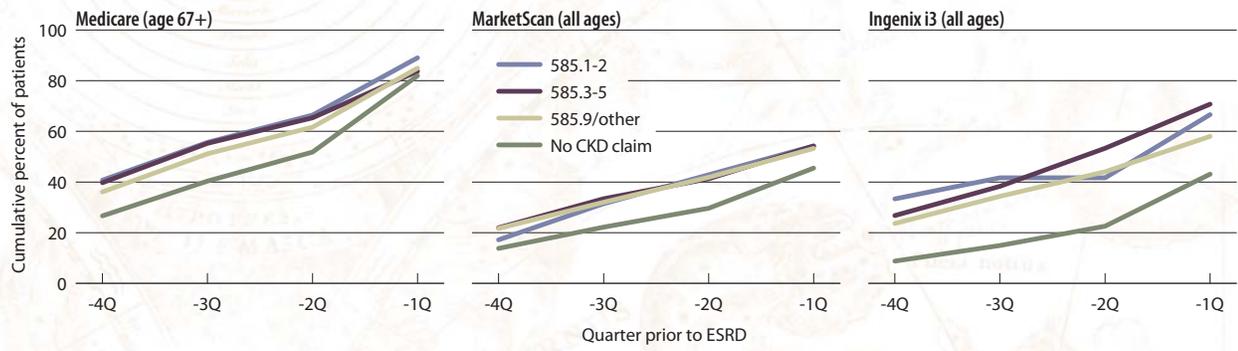


74i Cumulative percent of patients with a first nephrologist visit in the year prior to ESRD, by dataset & CKD diagnosis code, 2008



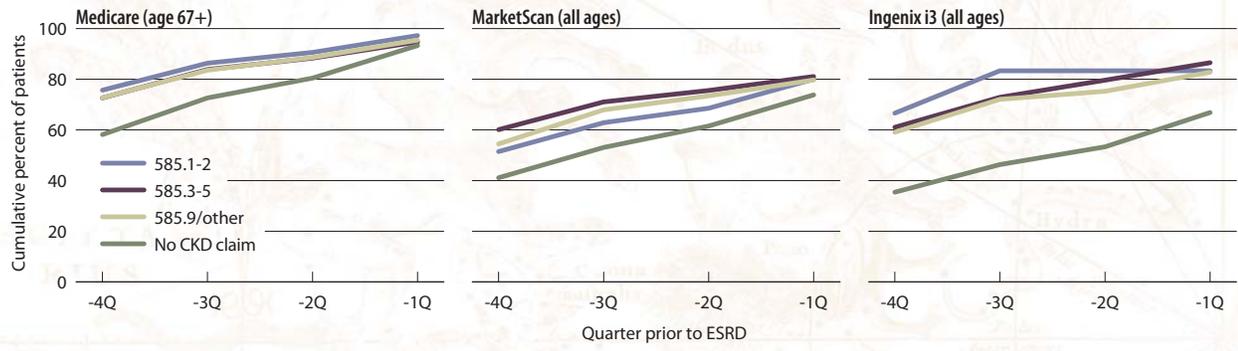
75i

Cumulative percent of patients with a first cardiologist visit in the year prior to ESRD, by dataset & CKD diagnosis code, 2008



76i

Cumulative percent of patients with a first primary care physician visit in the year prior to ESRD, by dataset & CKD diagnosis code, 2008



In 2008, the cumulative percent of Medicare patients with CKD claims in the quarter prior to ESRD initiation reached 98.9 percent, compared to 89.7 and 84.3 percent, respectively, in the MarketScan and Ingenix i3 populations. And nearly all Medicare CKD patients saw a physician — a nephrologist, cardiologist, or primary care specialist — by the end of the quarter prior to ESRD, compared to 83–85 and 89–98 percent of MarketScan and Ingenix i3 patients.

Medicare patients were also more likely than their MarketScan or Ingenix i3 counterparts to see a nephrologist prior to ESRD. By the end of the quarter prior to ESRD, for example, 93 percent of Stage 3–5 Medicare CKD patients had visited a nephrologist, compared to 54 and 88 percent in the MarketScan and Ingenix i3 populations. These data show that, while CKD is often recognized by a physician, many privately insured patients do not proceed early enough to the next logical step of seeing a nephrologist. This may have significant impact on therapeutic choices, such as access use, as these patients initiate ESRD treatment. As we show in Chapter Three of Volume Two, patients with no pre-ESRD nephrology care are far more likely to use a catheter at dialysis initiation — an access associated with higher rates of infectious complications and early mortality.

By the end of the quarter prior to ESRD, visits to a cardiologist are more common in the Medicare population, at 82–89 percent, compared to 46–54 and 58–71 percent in MarketScan and Ingenix i3 patients. Medicare patients are also more likely to see their primary care physicians than patients in the employed population. * FIGURES 7.2–6; see page 171 for analytical methods. Incident Medicare ESRD patients age 67 & older, & incident MarketScan & Ingenix i3 ESRD patients (all ages), 2008.

ICD-9-CM codes

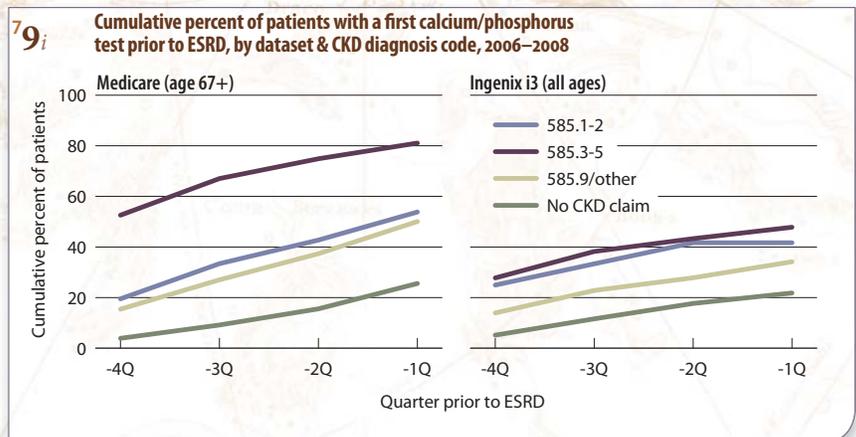
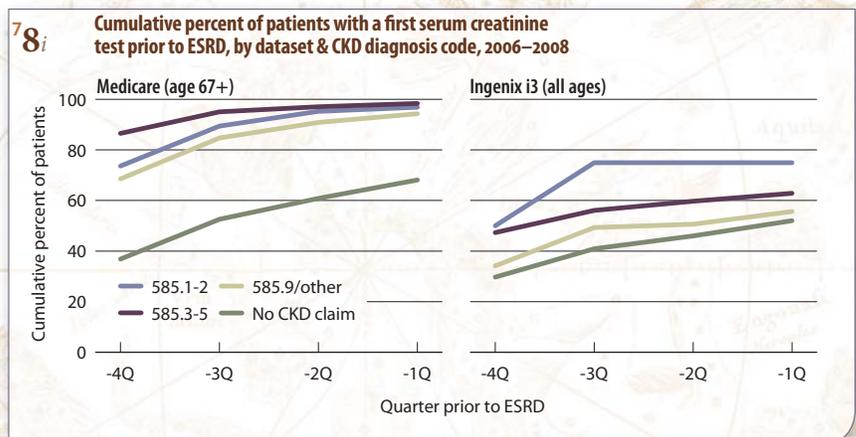
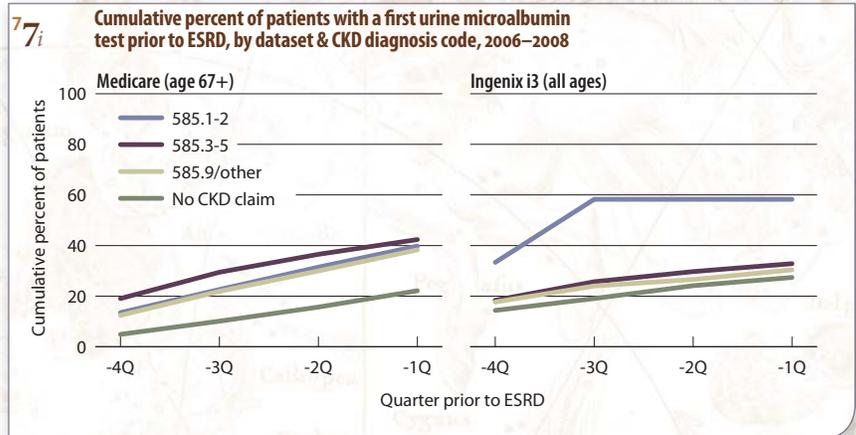
- 585.1 Chronic kidney disease, Stage 1
- 585.2 Chronic kidney disease, Stage 2 (mild)
- 585.3 Chronic kidney disease, Stage 3 (moderate)
- 585.4 Chronic kidney disease, Stage 4 (severe)
- 585.5 Chronic kidney disease, Stage 5 (excludes 585.6: Stage 5, requiring chronic dialysis.)[^]
- 585.9/oth. Chronic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

[^] In USRDS analyses, patients with ICD-9-CM code 585.6 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.

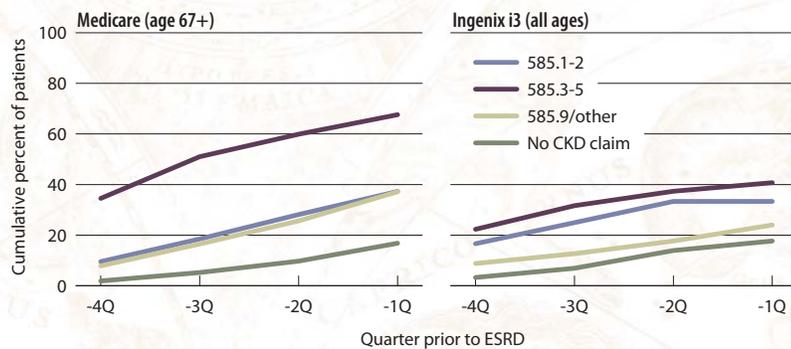
The presence of microalbumin in urine is an indicator of possible kidney damage, and early detection is important in order to slow the progression of chronic kidney disease. In 2008, only 12–19 percent of Medicare CKD patients had a first microalbumin test in the fourth quarter prior to ESRD initiation, compared to 18–33 percent in the Ingenix i3 population. By the end of quarter one prior to ESRD, 38–42 percent of Medicare patients had been tested, compared to 30–58 percent in the Ingenix i3 population. More than one in two Ingenix i3 patients with CKD of Stages 1–2 had been tested for the first time by the third quarter prior to ESRD.

Serum creatinine is also an important marker of kidney function. Sixty-nine to 87 percent of Medicare patients have their first serum creatinine test in the fourth quarter prior to ESRD, compared to 34–50 percent of Ingenix i3 patients. By the end of the quarter just prior to ESRD, the percentage tested for the first time rises to 94–98 and 56–75 percent, respectively.

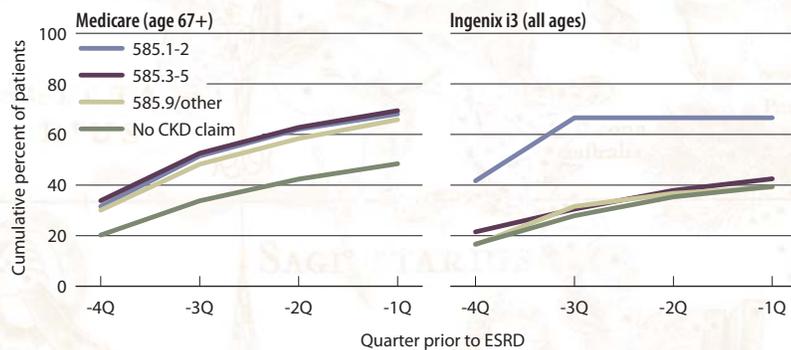
Calcium/phosphorus testing can be used to identify bone and mineral disorders. When compared to Ingenix i3 patients, those with Medicare coverage are far more likely to have their first test by the end of the quarter prior to ESRD, at 50–81 versus 34–48 percent. More than 80 percent of Medicare patients with Stage 3–5 CKD receive their first calcium/phosphorus test by the end of quarter one. **FIGURES 7.7–9;** see page 171 for analytical methods. *Incident Medicare ESRD patients age 67 & older, & incident Ingenix i3 ESRD patients (all ages), 2006–2008.*



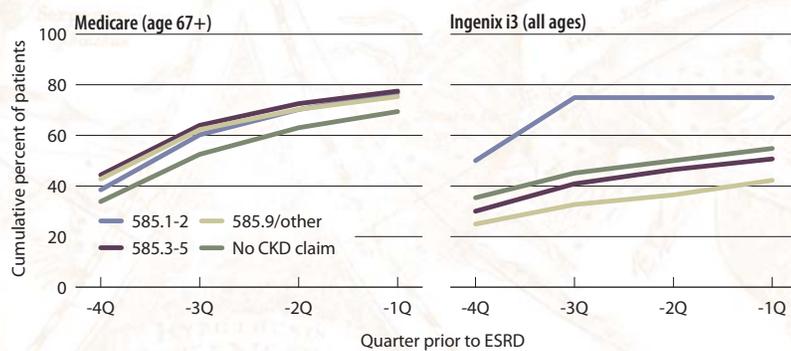
710i Cumulative percent of patients with a first parathyroid hormone (PTH) test prior to ESRD, by dataset & CKD diagnosis code, 2006–2008



711i Cumulative percent of patients with a first lipid test prior to ESRD, by dataset & CKD diagnosis code, 2006–2008



712i Cumulative percent of diabetic patients with a first glycosylated hemoglobin (A1c) test prior to ESRD, by dataset & CKD diagnosis code, 2006–2008



PTH testing is used to determine causes of calcium imbalance. Among Medicare patients with Stage 3–5 CKD, 68 percent have their first PTH test by the quarter prior to ESRD, compared to 41 percent of those in the employed population.

Detection and treatment of elevated lipids is important in order to prevent associated cardiovascular disorders and high blood pressure. Overall, Medicare CKD patients have their first pre-ESRD lipid test earlier than Ingenix i3 patients. In the fourth quarter prior to ESRD initiation, for example, 30–34 percent of Medicare patients have a first lipid test; this rises to 66–69 percent by the quarter just prior to ESRD. In employed patients with CKD of Stages 1–2, 42 percent have their first lipid test during the fourth quarter prior to ESRD; this rises to 67 percent by the quarter prior.

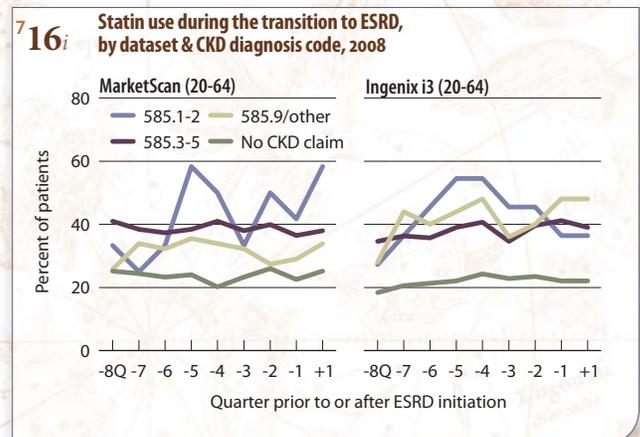
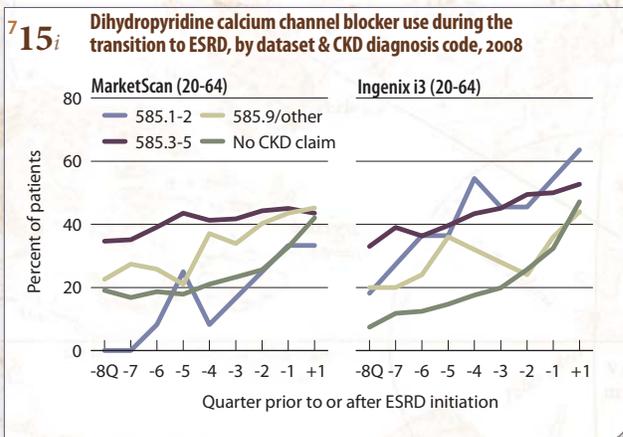
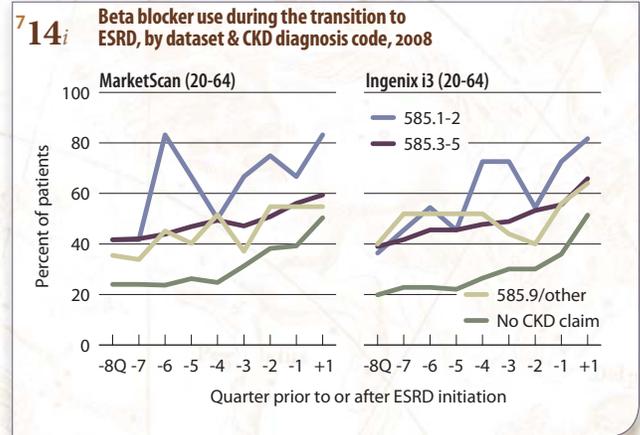
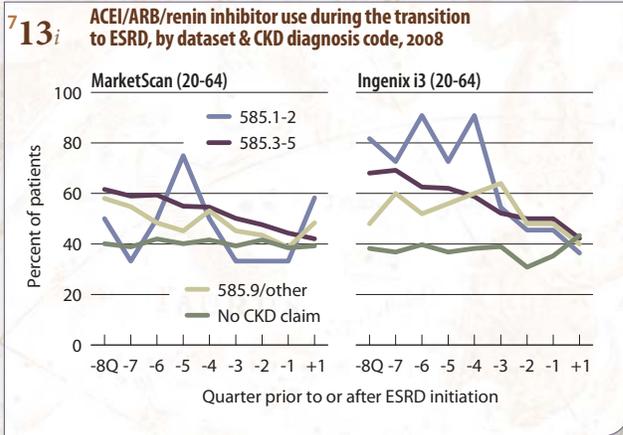
The monitoring of A1c levels in patients with diabetes is important in the control and treatment of the disease. In Medicare patients, 39–44 percent have a first A1c test in the fourth quarter prior to ESRD, while 75–78 percent receive a first test by the end of the quarter prior. In the Ingenix i3 population, 50 percent of Stage 1–2 CKD patients receive a first A1c test in the fourth quarter before ESRD; by the end of the quarter prior to ESRD, 75 percent have been tested for the first time. **FIGURES 7.10–12; see page 171 for analytical methods. Incident Medicare ESRD patients age 67 & older, & incident Ingenix i3 ESRD patients (all ages), 2006–2008. Figure 7.12 limited to patients with diabetes.**

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.^a)
- 585.9/oth. Chronic kidney disease, unspecified

^a In USRDS analyses, patients with ICD-9-CM code 585.6 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.



These figures illustrate patterns of medication use in the transition to ESRD. One limitation here is the small sample size for Stage 1–2 CKD and for CKD of an unspecified stage; this results in large data variability in these two groups. Comments for these figures thus focus mainly on patients without a CKD code or with CKD of Stages 3–5 at eight quarters prior to ESRD.

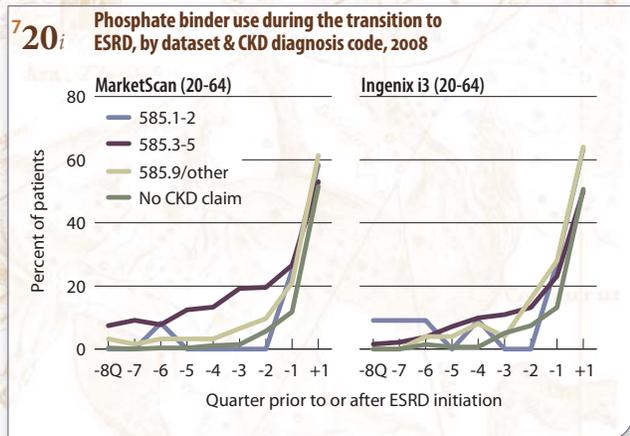
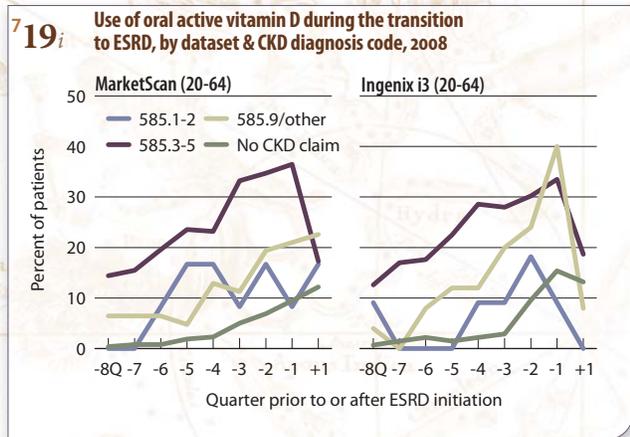
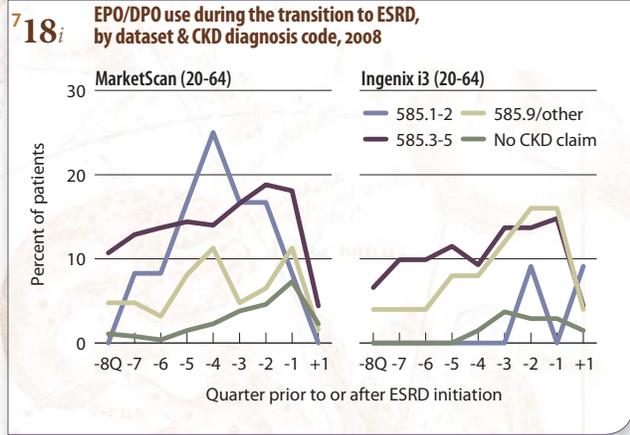
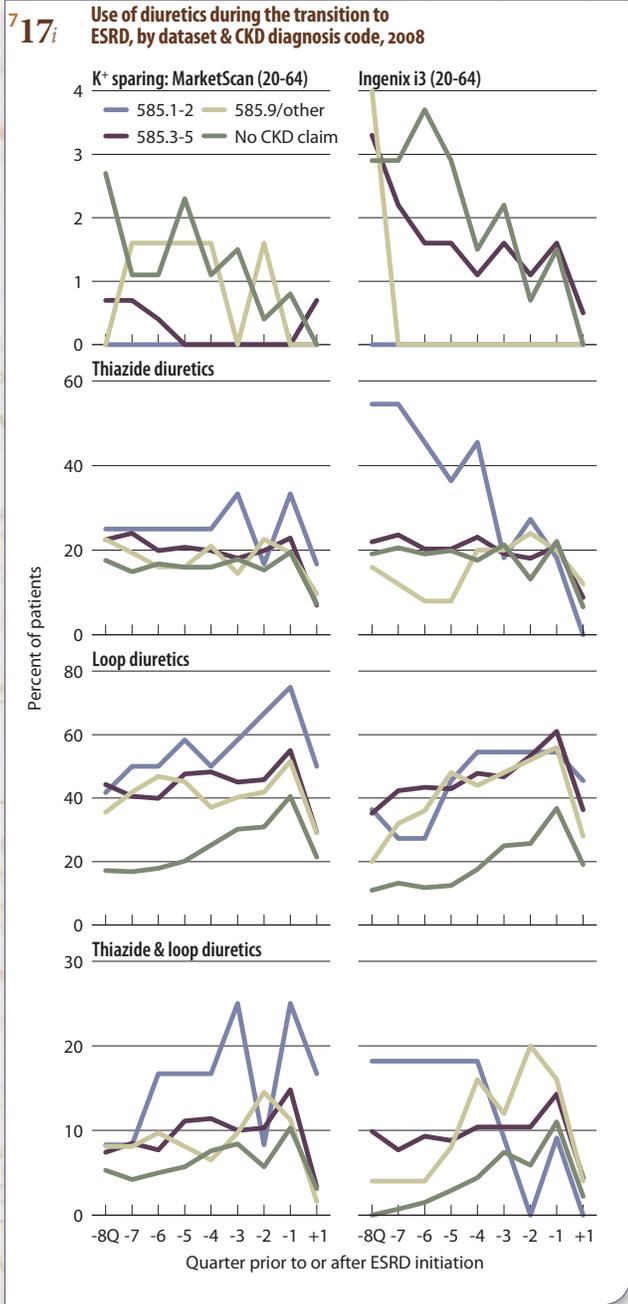
Among patients with recognized CKD of Stages 3–5 at eight quarters prior to ESRD, ACEI/ARB/renin inhibitor use falls from 62–68 percent to 42 percent in the quarter following ESRD diagnosis. For patients without a CKD code, in contrast, use remains at approximately 40 percent. The opposite pattern is seen with beta blockers, with use in Stage 3–5 CKD patients increasing from 39–42 percent to 59–66. Beta blocker use is lower in patients without a CKD code at eight quarters prior to ESRD, rising from 20–24 percent at this point to approximately 50 percent in the quarter after ESRD diagnosis. The pattern of use for dihydropyridine calcium channel blockers is similar to that of beta blockers, although overall use is lower.

A third pattern emerges with statin medications. Use remains fairly constant over time in patients with a diagnosis of Stage 3–5 CKD and in those without a CKD code, but is higher for CKD patients.

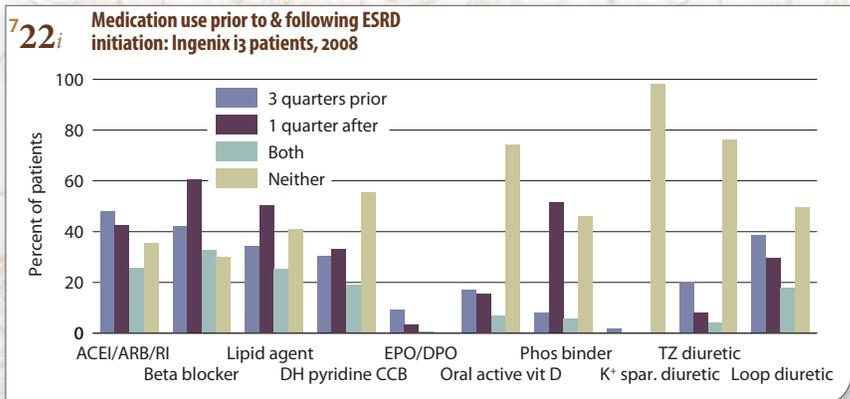
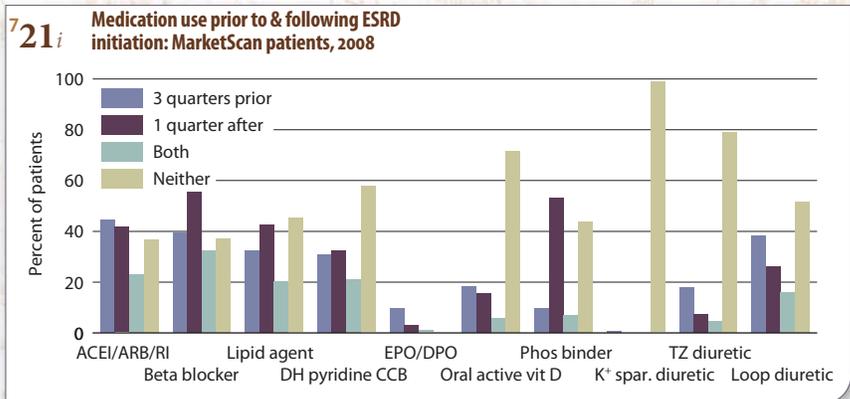
These data suggest that patients with recognized CKD eight quarters before ESRD are treated more aggressively with key cardiovascular medications. More investigation is necessary to determine the reasons for this, but explanations may include a higher comorbidity burden.

As expected, use of potassium-sparing diuretics is very low in patients with Stage 3–5 CKD eight quarters before ESRD; use of thiazide diuretics falls from 22 percent to 7–9 percent by one quarter after diagnosis. Loop diuretic use rises modestly until a precipitous drop at ESRD initiation. While thiazide diuretics are generally ineffective alone at GFRs less than 30 ml/min/1.73 m², they can augment the action of loop diuretics in patients with more advanced CKD. Among patients with Stage 3–5 CKD eight quarters prior to ESRD, or without a CKD code at this time, simultaneous use of these agents increases close to ESRD, but only 10–15 percent are using dual diuretics at one quarter prior to initiation.

For patients with Stage 3–5 CKD eight quarters before ESRD, the use of erythropoiesis stimulating agents (ESAs) doubles by ESRD initiation; only 15–18 percent, however, receive an ESA in the quarter prior to ESRD, a much lower percentage than that seen in the Medicare population. Use of active oral vitamin D



(calcitriol, doxercalciferol, paricalcitol) almost triples between eight quarters and one quarter prior to ESRD, then drops off as patients transition to dialysis and receive intravenous forms of these agents. And, for patients with Stage 3–5 CKD at eight quarters before ESRD, use of phosphate binders increases from less than 10 percent to 50 percent in the quarter following initiation. † **FIGURES 7.13–20**; see page 171 for analytical methods. *Incident MarketScan & Ingenix i3 patients age 20–64, 2008.*



Figures 7.21–22 illustrate the percentage of patients on various medications three quarters prior to ESRD, one quarter after, in both periods, or in neither period. Both the MarketScan and Ingenix i3 commercial datasets show similar trends that vary by medication class.

It is interesting to note that 55 percent of patients do not have a claim for an ACEI/ARB/renin inhibitor three quarters prior to ESRD. Fifty-six percent of patients are on a beta blocker one quarter after ESRD, compared to only 40 percent at three quarters prior. The use of lipid lowering agents increases slightly across the transition to ESRD. And approximately 20 and 40 percent of CKD patients receive a thiazide or loop diuretic, respectively, three quarters prior to ESRD. † FIGURES 7.21–22; see page 171 for analytical methods. Incident MarketScan & Ingenix i3 patients age 20–64.

7a Medication continuity in the transition to ESRD, by dataset, 2008

	MarketScan (20–64)				Ingenix i3 (20–64)							
	N/% on drug at -3 qtr ESRD		N/% of -3 qtr grp on drug at +1 qtr ESRD		N/% on drug at +1 qtr ESRD		N/% on drug at -3 qtr ESRD		N/% of -3 qtr grp on drug at +1 qtr ESRD		N/% on drug at +1 qtr ESRD	
	N	%	N	%	N	%	N	%	N	%	N	%
ACEI/ARB/renin inhibitor	271	44.6	141	52.0	254	41.8	170	48.0	91	53.5	150	42.4
Beta blocker	241	39.7	197	81.7	337	55.5	149	42.1	116	77.9	215	60.7
Dihydropyridine Ca ⁺⁺ channel blocker	197	32.5	125	63.5	260	42.8	121	34.2	90	74.4	178	50.3
Lipid lowering agent	188	31.0	129	68.6	197	32.5	108	30.5	68	63.0	117	33.1
EPO/DPO	60	9.9	6	10.0	19	3.1	33	9.3	3	9.1	12	3.4
Oral active vitamin D	111	18.3	35	31.5	95	15.7	61	17.2	24	39.3	54	15.3
Phosphate binder	60	9.9	43	71.7	324	53.4	28	7.9	20	71.4	183	51.7
Potassium sparing diuretic	4	0.7	.	.	2	0.3	6	1.7	1	16.7	1	0.3
Thiazide diuretic	109	18.0	29	26.6	46	7.6	71	20.1	15	21.1	28	7.9
Loop diuretic	233	38.4	99	42.5	159	26.2	137	38.7	63	46.0	104	29.4

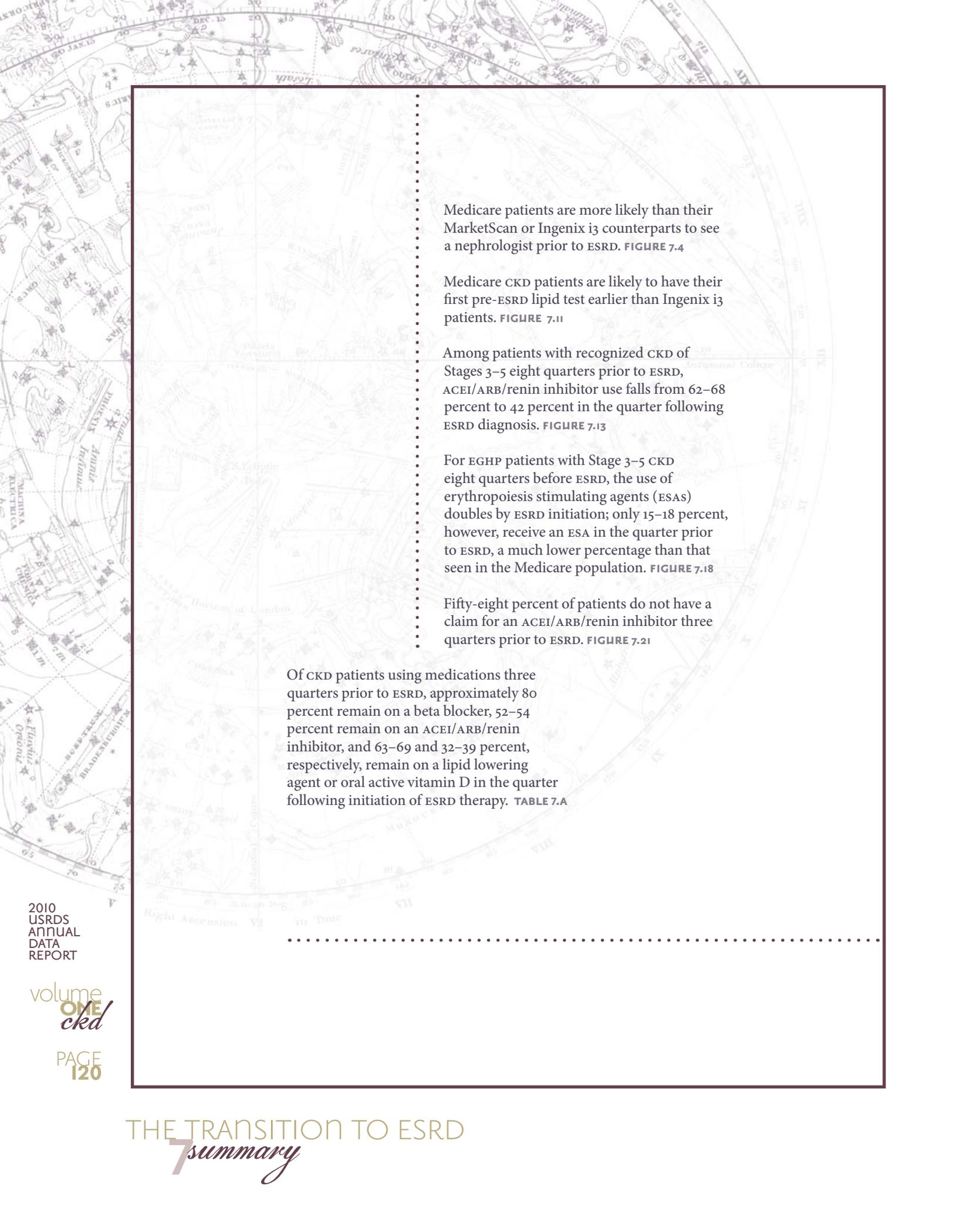
Table 7.a shows the number and percentage of patients with medication claims three quarters prior to ESRD, and those remaining on the medications at one quarter after initiation. We also evaluate overall medication use one quarter following ESRD. Of those using the medications three quarters prior to ESRD, 80 percent remain on a beta blocker, 52–54 percent on an ACEI/ARB/renin inhibitor, 63–69 percent on a lipid lowering agent, and 32–39 percent on oral active vitamin D. Few patients receive EPO/DPO through their commercial prescription drug plan after ESRD initiation. The majority of patients who are on a phosphate binder at three quarters prior to ESRD remain on the medication in the quarter following initiation. And interestingly, only 43–46 percent of patients on a loop diuretic before ESRD use the medication after starting ESRD therapy. • **TABLE 7.A**; see page 171 for analytical methods. Incident MarketScan & Ingenix i3 ESRD patients age 20–64.

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.[^])
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[^] In USRDS analyses, patients with ICD-9-CM code 585.6 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.



Medicare patients are more likely than their MarketScan or Ingenix i3 counterparts to see a nephrologist prior to ESRD. **FIGURE 7.4**

Medicare CKD patients are likely to have their first pre-ESRD lipid test earlier than Ingenix i3 patients. **FIGURE 7.11**

Among patients with recognized CKD of Stages 3–5 eight quarters prior to ESRD, ACEI/ARB/renin inhibitor use falls from 62–68 percent to 42 percent in the quarter following ESRD diagnosis. **FIGURE 7.13**

For EGHP patients with Stage 3–5 CKD eight quarters before ESRD, the use of erythropoiesis stimulating agents (ESAs) doubles by ESRD initiation; only 15–18 percent, however, receive an ESA in the quarter prior to ESRD, a much lower percentage than that seen in the Medicare population. **FIGURE 7.18**

Fifty-eight percent of patients do not have a claim for an ACEI/ARB/renin inhibitor three quarters prior to ESRD. **FIGURE 7.21**

Of CKD patients using medications three quarters prior to ESRD, approximately 80 percent remain on a beta blocker, 52–54 percent remain on an ACEI/ARB/renin inhibitor, and 63–69 and 32–39 percent, respectively, remain on a lipid lowering agent or oral active vitamin D in the quarter following initiation of ESRD therapy. **TABLE 7.A**