

The impact of earlier CKD detection and delayed disease progression

A claims-based model of spending levels and resource utilization by CKD stage

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Chronic kidney disease (CKD) is a progressive and irreversible condition that affects over 37 million adults in the United States.¹ We examined administrative claims data to characterize patients diagnosed with CKD at different stages and modeled the potential impact in costs and outcomes of modest delays in CKD progression.

Our analysis found that early CKD is understated in claims data, which is consistent with the lack of provider and payer incentives for early detection and intervention. Given that the cost of CKD treatment increases exponentially with each stage, keeping patients from progressing to more severe stages of CKD is key to managing costs and avoiding the need of dialysis and kidney transplants.

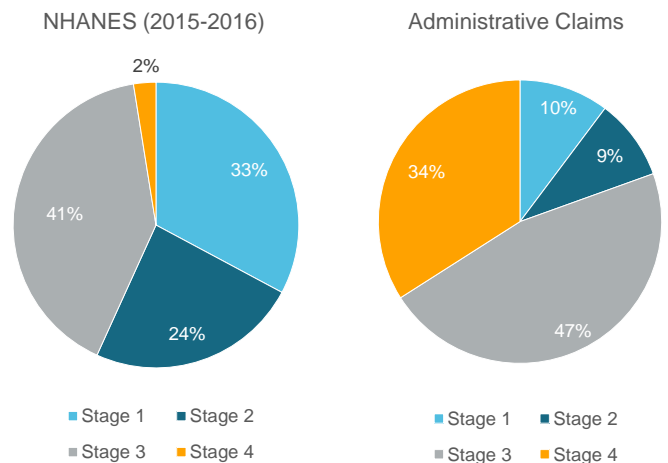
Medicare fee-for-service (FFS) beneficiaries with chronic kidney disease (CKD) and end stage renal disease (ESRD) drive as much as 33.8% of total FFS spending.² CKD is characterized by renal damage or dysfunction, which results in the buildup of fluids and other waste in the body. Ultimately, patients require dialysis to assist with blood filtration, or a kidney transplant, to survive.³

Patients with CKD are generally stratified into five stages of disease – mild (stages 1-2), moderate (stage 3), severe (stage 4), and failure/end-stage (stage 5). Patients who are stage 5 and dialysis dependent are classified as having ESRD.³ Unfortunately, CKD is usually silent until its more advanced stages, and without screening, patients often escape detection until symptomatic disease is imminent.⁴ Disease progression can be rapid once patients reach moderate and severe stages.⁵ This analysis explores the increased cost and resource utilization of patients with progressing CKD and identifies opportunities for earlier CKD detection in the commercial and Medicare populations.

Early-stage CKD is under-coded in administrative claims

Our analysis of administrative claims data found that Medicare FFS prevalence of CKD (stages 1-5 and ESRD) increased from 12.7% in 2014 to 21% in 2018. Commercial prevalence increased from 0.6% in 2014 to 1.3% in 2018. These prevalence rates are lower than those reported by the Centers for Disease Control and Prevention (CDC). Based on the 2015-2016 National Health and Nutrition Examination Surveys (NHANES), 14.2% of the US population age 20 and older are living with CKD.⁶ CKD stages 1–4 alone were present among 38% of adults aged 65 years or older, 7% of adults aged 18 to 44 years, and 13% of adults aged 45-64 years.¹

FIGURE 1: DIFFERENCES IN THE SHARE OF CKD PATIENTS BY STAGES 1-4 AMONG PATIENTS IDENTIFIED IN SURVEY (NHANES) VS. ADMINISTRATIVE CLAIMS DATA



This discrepancy in prevalence is explained in large part by the dearth of early-stage CKD diagnoses in claims data. NHANES, which is bolstered by medical records, indicates 4.7% of US adults have CKD stage 1 and 3.4% have CKD stage 2.⁶ However, our analysis found that, across both Commercial and Medicare populations, only 0.8% percent of beneficiaries were in stage 1 and 0.7% were in stage 2. In fact, most patients identified with CKD in the claims data were in stage 3 (3.2% of all beneficiaries).

Low rates of early-stage CKD in the administrative claims data are reflective of current preventive care guidelines that do not encourage CKD screening in asymptomatic adults.⁷ Indeed, the United States Preventive Services Task Force (USPSTF) gave kidney disease screening an “I” or insufficient recommendation, stating that “the evidence on routine screening for CKD in asymptomatic adults is lacking, and that the balance of benefits and harms cannot be determined.”⁸ Yet, 1 in 2 people with severely reduced kidney function and not on dialysis do not know that they have CKD¹, and numerous studies indicate that early interventions with these patients could effectively delay CKD progression.⁹ Sadly, this means many patients who could benefit from proactive management are not being identified until they reach more severe and costly stages of disease.

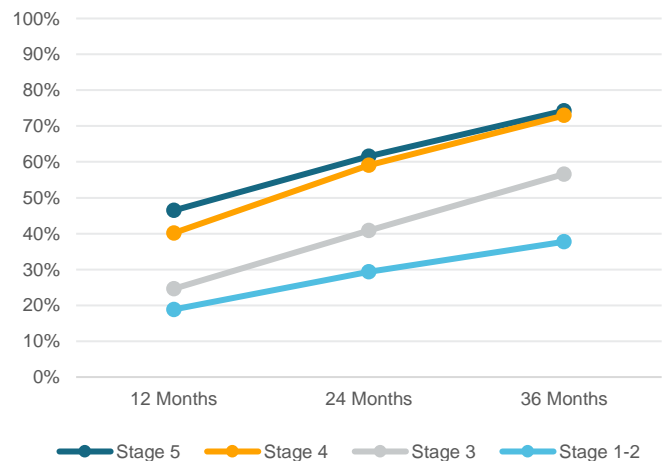
Early intervention gives providers time to address kidney failure while still progressing slowly, potentially reducing costs

We analyzed the empirical probabilities of CKD patients’ progression to the next disease stage and then modeled the impact of a reduction in these transition probabilities. The reduction was equivalent to a one-year delay in disease progression across all disease stages.

Our analysis indicates that there is a tangible shift in the speed of disease progression between CKD stages 3 and 4. While patients in stages 4-5 are 40%-46% likely to progress to a higher disease stage within one year, patients in stages 1-3 are only 19%-25% likely to progress. This means that patients with late stage (4-5) CKD are 1.5- to 2-times as likely to advance to a worsened disease state within 12 months as patients in the early stages (1-3) of their disease (see Figure 2). Differences in the probability of disease progression persist over time, although patients of all stages see increases in their progression risk over longer time horizons. Despite under-coding of early-stage CKD in claims data, our results are consistent with prior findings of progression rates by CKD stage in the published literature.¹⁰

Real-world clinical studies found that longer nephrology care before ESRD has been linked with better outcomes.^{11,12} Specifically, they indicate that intervening with patients in the early stages of their disease progression can have an important impact on health care utilization over time. For example, treating CKD-associated anemia at stages prior to dialysis is associated with increased patient interaction with nephrologists and key other specialists¹³ as well as improved quality of life, attenuation of cardiovascular and renal complications, delayed ESRD onset, and even reduced mortality on dialysis.¹⁴ Thus, effective early interventions are available and critical to implement, and additional research may be warranted to elucidate potential barriers to their use.

FIGURE 2: PROBABILITY OF DISEASE PROGRESSION BY CKD STAGE WITHIN 12, 24, AND 36 MONTHS



Because early-stage CKD diagnoses are omitted, risk score models fail to capture the economic burden of CKD and miss incentives for early detection

The absence of early-stage CKD diagnoses in claims data also has a real impact on the efficacy of models used for risk adjustment. Without accurate diagnoses in claims data, these predictive models are less precise and fail to compensate plans for their CKD burden. Health risk scores like the Centers for Medicare & Medicaid Services (CMS) and Health and Human Services (HHS) Hierarchical Condition Categories (HCC) risk models rely on demographic information and diagnosis codes captured in claims data. They are used to adjust the revenue collected by Medicare Advantage and Affordable Care Act (ACA) plans for their members. Therefore, these models should reflect

the relative health status of plans' covered populations as accurately as possible.^{15,16} However, these risk score models do not comprehensively capture plans' CKD burden. Early-stage (1-2) CKD is included in neither the CMS- nor the HHS-HCC risk score calculations, while Stage 3 CKD is included only in the CMS-HCC risk score calculation.^{17,18} As a result, plans do not receive additional revenue to offset the costs of managing these patients, so there are limited incentives to identifying and managing these patients early. This is problematic since earlier intervention facilitates more favorable patient outcomes and healthcare cost avoidance.^{9,11-12,14}

Under-coding is detrimental to payers, as it creates a vicious cycle whereby early-stage CKD cannot be leveraged in risk score calculations because it is not sufficiently coded in claims data, yet coding is not incentivized by payers precisely because it is not critical to their bottom lines. This cycle results in lost revenue for plans and lost predictive power for the CMS and HHS models. According to our analysis, CMS currently pays Medicare Advantage plans on average an additional \$600 a year for beneficiaries with stage 3 CKD, since it is captured in the CMS-HCC model. ACA plans, on the other hand, do not get compensated for the additional healthcare costs of patients with stage 3 CKD, as it is not included in the HHS-HCC model.

Only one CKD-related metric has been adopted by HEDIS, resulting in limited revenue incentives for health plans to perform kidney health activities

The National Quality Forum (NQF) recently released a shared decision-making playbook intended to provide guidance to providers and healthcare organizations caring for patients with CKD and ESRD.¹⁹ In this playbook, the NQF repeatedly notes that lack of early screening for CKD combined with limited patient education, resources, and access to care are key barriers to effective management of CKD. Both result in frustratingly late diagnosis and often in patients' requiring urgent intervention. Indeed, patients and advocates also "overwhelmingly prefer earlier CKD screening and diagnosis" to more reactive care, as they provide opportunities for patient education and subsequently improved self-management and disease prognosis.¹⁸ In light of this, the NQF proposes the enactment of new industry measurements focused on closing gaps in patient education and screening.

Currently, the Healthcare Effectiveness Data and Information Set (HEDIS), which is a performance assessment tool used broadly to assess healthcare plan quality, falls short. As of July 2020, the only CKD-related measure included in the HEDIS portfolio

evaluates the percentage of adults with diabetes who receive an annual kidney health evaluation.²⁰ This singular measure leaves out other high-risk groups that would benefit from regular screening, such as patients with high blood pressure, a family history of kidney failure, and those of high-risk racial and ethnic backgrounds (e.g., African Americans, Hispanic Americans, Asians, Pacific Islanders, and Indigenous peoples).²¹ This measure also does little to capture the value of access to kidney care, which is critical to delaying disease progression.

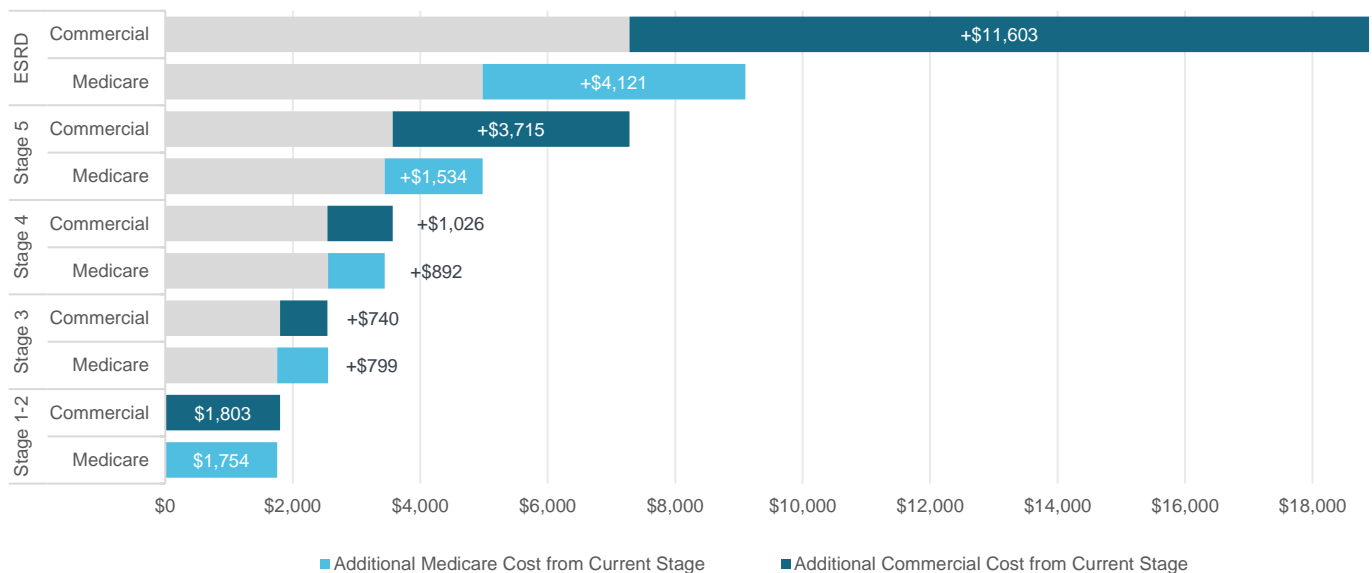
Since performance on HEDIS measures is tied directly to Medicare Advantage health plan ratings and thus to plan revenue, HEDIS could have a real impact on early-stage kidney care by expanding its measure set. Not only would this change signal the importance of patient education and screening to the clinical community, but also it could alter health plan and provider behavior by incentivizing these key kidney health activities.

Patient costs increase exponentially with advancing CKD stage

Patients' overall care becomes increasingly expensive as their CKD worsens. (See Figure 3.) Patients with commercial insurance in our analysis exhibited average monthly total cost of care that climbed from \$1,803 in stages 1-2 and \$2,543 in stage 3 to \$3,569 in stage 4 and \$7,284 in stage 5. Total cost of care then skyrockets to \$18,887 per month upon reaching ESRD. We observed a similar, albeit less severe pattern, in the Medicare population where monthly average total cost of care per patient increased from \$1,754 in stages 1-2 and \$2,553 in stage 3 to \$3,445 in stage 4 and \$4,978 in stage 5. Again, total care costs were highest for patients with ESRD, \$9,099 per month. For patients with ESRD, Medicare has implemented a bundle payment covering all dialysis services and drugs. It is worth noting that commercial plans pay nearly twice as much per month on patients with ESRD than Medicare does. This is because commercial plans do not benefit from Medicare's lower provider reimbursement levels.

In both the commercial and Medicare populations, the largest incremental increases in total cost of care were observed between stages 4 and 5 and, most dramatically, between stage 5 and ESRD. This makes sense, as dialysis is a key driver of cost, and dialysis utilization increases significantly beginning in stage 5 disease. Moreover, dialysis dependency is a defining characteristic of ESRD. Interestingly, in a study of new CKD guideline implementation in the United Kingdom, new screening and early-intervention guidelines resulted in significant increases in nephrology referral and follow-up testing; however, the authors estimated that the associated costs could be recouped by delaying dialysis requirement by 1 year in just one out of every 10,000 patients.¹¹

FIGURE 3: INCREASES IN AVERAGE MONTHLY TOTAL COST OF CARE PER PATIENT WITH CKD STAGE PROGRESSION, 2014-2018



Conclusions

Our study suggests that earlier detection and intervention for patients with CKD could significantly reduce dialysis utilization and dependency, demand for kidney transplants, and healthcare costs for Medicare FFS and Commercial plans. Unfortunately, current preventive screening guidelines do not encourage testing for CKD in certain asymptomatic adults. As a result, patients are often undiagnosed until their disease has advanced to a more advanced, symptomatic stage. At that point, these patients’ likelihood of further disease progression has nearly doubled. Changes to the USPSTF’s screening guidelines and to HEDIS quality metrics for kidney care have the potential to drive early detection and intervention; however, it is equally important that payers also be incentivized to drive early-stage diagnosis and treatment via inclusion of earlier stages of CKD in the CMS- and HHS-HCC risk score models. These changes would be influential to payers and providers managing kidney care costs.

Methodology and data sources

We used 2014-2018 data from the Centers for Medicare and Medicaid Services (CMS) 100% Innovator Research (IR) Data Set and the IBM Health Analytics Market-Scan Commercial Claims Database to estimate rates of CKD progression, resource utilization, and costs at each stage of the disease. Medicare

beneficiaries in our study had at least one month of enrollment in Medicare parts A, B, and D. Patients with commercial insurance in our study were between the ages of 18 and 65 and had at least one month of both medical and pharmacy coverage. Patients with CKD in our study had at least one inpatient claim or two outpatient claims associated with a CKD ICD-9-CM or ICD-10-CM diagnosis code within 24 months or had an outpatient hospital-based or independent renal dialysis center facility claim. Each patient in the study was assigned a CKD index date, which was set equal to the date of the patient’s earliest CKD claim.

Patients were assigned to specific CKD stages (1-5 and ESRD) for each month of the duration of the study unless we observed a kidney transplant procedure. Patients with kidney transplants were no longer considered to have CKD unless a dialysis claim was observed after the procedure. We assigned CKD stages to all patients in the study population according to ICD-10-CM diagnosis codes. Patients for whom no stage-specific CKD diagnosis code was observed were assigned to “unspecified stage 1-2”. Patients were only reassigned to higher stages of CKD when we observed a higher-stage CKD diagnosis code on their claims. We then calculated the empirical probability of patients progressing from one stage of CKD to the next after 12, 24, and 36 months. We also assessed mean total cost of care per patient at each stage of CKD over the study period (2014-2018).

Caveats and limitations

This report was commissioned by Otsuka America Pharmaceutical, Inc. The findings reflect the research of the authors. Milliman does not endorse any product or organization. Otsuka America Pharmaceutical, Inc. did not author this paper or influence the findings.

This study has several limitations. First, this study was performed using data from the Medicare FFS and commercially insured populations. Patterns of disease progression and costs may vary significantly among patients with CKD in other contexts where demography and prices differ. It is also important to note that we examined data from 2014-2018, without trend, and did not consider the potential impact of future therapies or medical technologies on our results nor did we account for longitudinal changes in the costs of care evaluated in this study. As such, the costs presented here may under- or overestimate the future financial impact of CKD.

CKD, especially in the early stages, is under-coded in administrative claims data. This could result in a failure to capture the universe of relevant patients and, thus, could produce an incomplete picture of costs and disease progression. For instance, patients largely present with CKD at stage 3 when first identified in claims. This finding underrepresents the prevalence of earlier stage CKD in the population and makes it challenging to conclusively assess the average costs of patients with less severe disease.

Guidelines issued by the American Academy of Actuaries require actuaries to include their professional qualifications in all actuarial communications. Amy Kwong and Gabriela Dieguez are members of the American Academy of Actuaries and meet the qualification standards for performing the analyses in this report and rendering the actuarial opinions contained herein. The authors thank Amy Kwong, Andrew Yang, and Mila Shapoval for their research assistance.



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ENDNOTES

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