REPORT TO CONGRESS: RISK ADJUSTMENT IN MEDICARE ADVANTAGE

DECEMBER 2024

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PREFACE

This report is provided in accordance with Section 17006(f)(2)(A)(ii) of the 21st Century Cures Act (Public Law No: 114-255, enacted December 13, 2016). The 21st Century Cures Act requires the Secretary to submit to Congress a report on the Centers for Medicare & Medicaid Services (CMS) Hierarchical Condition Categories (HCC) risk adjustment model and the End-Stage Renal Disease (ESRD) CMS-HCC risk adjustment model (hereafter referred to as the ESRD model) under the Medicare Advantage (MA) program every three years. Each report is to include any revisions to either model since the previous report, as well as information on how such revisions impact the predictive ratios under either such model for groups of enrollees in MA plans, including very high- and very low- cost enrollees, and groups defined by the number of chronic conditions of enrollees.

CMS released its first report in December 2018, and in accordance with the timeline required in the 21st Century Cures Act, we are now releasing the third report on risk adjustment in MA. This report provides information on the accuracy of the CMS-HCC and ESRD risk adjustment models. The standard measure of accuracy applied to the risk adjustment models is the predictive ratio, which is a ratio of predicted expenditures to actual expenditures, for subgroups of beneficiaries within the model sample. We include predictive ratios to evaluate the revisions to CMS-HCC and ESRD risk adjustment models since the 2021 report. Predictive ratios are provided for the 2020 and 2024 CMS-HCC models and the 2020 and 2023 ESRD models. Predictive ratios are provided by decile of predicted medical expenditure, individual conditions and groups of similar diseases (body systems), counts of chronic conditions, and counts of conditions included in the model.

The report follows CMS' standard metric of evaluation for the risk adjustment models, which is based on predictive ratios for beneficiaries enrolled in the Traditional Medicare Fee-for-Service (FFS) program. While CMS collects MA cost information both in aggregate from plan bids, and at an enrollee level from encounter data records that MA organizations submit to CMS, CMS has not yet completed a comprehensive assessment of this information. As part of our efforts to explore the possibility of using diagnostic and cost data from encounter data submissions to develop a risk adjustment model based on MA data, CMS is currently closely examining the cost data from these submissions. (Our approach to our research into an encounter data-based risk adjustment model is described in Section 4.) As that research is ongoing, CMS continues to evaluate the CMS-HCC and ESRD risk adjustment models using a beneficiary sample and associated diagnoses and cost data from the FFS program. We provide the predicted and actual cost for each population subgroup considered so that interested stakeholders may review and compare the cost expected in FFS for each defined subgroup.

EXECUTIVE SUMMARY

This report, as required by Section 17006(f)(2)(A)(ii) of the 21st Century Cures Act, provides information on the performance of the 2024 CMS-HCC risk adjustment model and the 2023 ESRD risk adjustment model. The report compares the performance of the current models to previous versions of these models that were in effect when the 2021 report was published: the 2020 CMS-HCC model and the 2020 ESRD model, respectively. We provide information on the models' accuracy for groups of beneficiaries, including groups with very high and very low predicted cost, and groups defined by the number of chronic conditions beneficiaries may have. With each update of the CMS-HCC and ESRD risk adjustment models, CMS balances maintaining or improving the predictive accuracy of the model with ensuring appropriate payment incentives, stability, and transparency. Importantly, this report demonstrates that CMS achieved that goal with the technical updates in 2024 for the CMS-HCC model and in 2023 for the ESRD risk adjustment model. Based on the data, these models appropriately compensate Medicare Advantage plans with varying risk profiles commensurate with their expected cost.

As the models age and are used to predict relative risk for more recent enrollees in Medicare Advantage plans, we find that the models' ability to predict costs accurately in future years declines due to changes in prices, utilization, demographics, and health status. Therefore, to support payment accuracy, it is necessary to update the models with more recent underlying data and clinical refinements, so that the relative factors associated with each demographic factor and HCC reflect more recent utilization, expenditures, coding, and diagnostic patterns. As noted above, both the CMS-HCC and the ESRD risk adjustment models have been updated since the 2021 report was published. Starting in CY 2024, the CMS-HCC model clinical classification system was revised to use *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) codes instead of ICD-9-CM codes to align with the classification system used by providers. The HCCs also incorporated clinically informed revisions to ensure that conditions included in the model are stable predictors of costs, as well as an update to the underlying data years. Updates to the ESRD model since the last report include an update to the underlying data years and to the clinical classification of HCCs. These updates improved each model's ability to predict the relative cost of care because the relative weights for the HCCs in the model reflect more recent utilization, coding and expenditure patterns in FFS Medicare, which better ensures the accuracy of MA risk-adjusted payments and ultimately makes sure MA plans are paid enough to deliver the benefits to which their enrollees are entitled. Thus, updating risk adjustment models with more recent diagnostic, utilization, and cost data, and making clinical revisions to HCCs to be based on the classification system used by the healthcare system, improve overall model performance and predictive accuracy.

When measuring the predictive accuracy of an updated model, CMS utilizes the predictive ratio – the ratio of predicted cost to actual cost. The predictive ratio is a point in time measure using the data from beneficiaries in each model's sample and is used to assess whether the model accurately predicts expenditures for subgroups of beneficiaries, ensuring the model performs well in its prediction of risk. When predictive ratios are calculated from each model's sample, the predictive accuracy of the updated 2024 CMS-HCC and 2023 ESRD models is on par with prior models. Specifically, we find that both models accurately predict costs for key subgroups of beneficiaries, such as those grouped by their predicted cost, specific conditions, and the number of chronic conditions. While there are differences in predictive accuracy for some of the subgroups, these differences are due to ordinary variation caused by changes in the

beneficiary sample population and the HCC classification used to calibrate each model rather than fundamental change in the models' predictive accuracy.

Key findings from the evaluation are included below for the 2020 and 2024 CMS-HCC models, the 2020 and 2023 ESRD Dialysis models, and the 2020 and 2023 ESRD Functioning Graft models. Our most typically used sets of predictive ratios – grouping beneficiaries by decile of predicted risk (beneficiaries sorted into ten equal groups by predicted cost) and by the number of chronic conditions each beneficiary has – assess the overall ability of a model calibration to achieve the goal of paying accurately across levels of risk. These ratios show that:

- The 2020 and 2024 CMS-HCC models predict well across all levels of risk. On average, the models somewhat overpredict costs for beneficiaries with the highest predicted cost, meaning risk scores result in higher payments than predicted costs for beneficiaries with high risk scores, while both models tend to underpredict costs for beneficiaries with the lowest predicted cost, who tend to be beneficiaries who do not use many services.
- The 2020 and 2024 CMS-HCC models on average predict accurately for beneficiaries with seven or more chronic conditions, while both models over predict cost for beneficiaries with six or fewer chronic conditions.
- Similar to the non-ESRD CMS-HCC models, the 2020 and 2023 ESRD Dialysis models both predict well across all levels of risk while on average slightly overpredicting costs for beneficiaries with the highest predicted costs and underpredicting costs for beneficiaries with the lowest predicted costs.
- The 2020 and 2023 ESRD Functioning Graft models on average predict well. The 2023 ESRD Functioning Graft model on average overpredicts costs for beneficiaries with the lowest predicted cost whereas the 2020 ESRD Functioning Graft model on average underpredicts costs for beneficiaries with the highest predicted costs more when compared to the 2023 ESRD Functioning Graft model.

The remainder of this report is organized into five sections. Sections 1 and 2 provide a detailed introduction to this report, Medicare risk adjustment, and the CMS-HCC and ESRD risk adjustment models. Section 3 is a detailed evaluation of the CMS-HCC and ESRD models including the methodology for identifying chronic HCCs for the purpose of evaluating the model count variables. Section 4 highlights research related to risk adjustment policy proposals raised by stakeholders in recent years, including our research into calibrating the CMS-HCC and ESRD risk adjustment models using Medicare Advantage encounter data. CMS continues to assess the risk adjustment models keeping in mind its statutory authority and fiscal responsibility. Finally, Section 5 provides the data tables underlying CMS evaluation of the CMS-HCC and ESRD risk adjustment models in Section 3.

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Section 1.
INTRODUCTION

1.1 Background on Payment in the Medicare Advantage Program

The Medicare Advantage (MA) program allows Medicare beneficiaries to receive Part A and Part B benefits from MA organizations, which are private insurers that contract with the Centers for Medicare and Medicaid Services (CMS) to provide benefits as an alternative to the Traditional Medicare Fee-for-Service (FFS) program. Anyone who is entitled to benefits under Medicare Part A and is enrolled in Part B may elect to enroll in an MA plan offered in the service area in which he or she resides.[1] The MA program is an attractive option for some Medicare beneficiaries. Plans typically offer additional benefits ("supplemental benefits") in the form of reduced cost sharing or coverage of services that are not covered under the Traditional Medicare benefit (e.g., dental and vision care). There has been a steady increase in MA enrollment as a proportion of total Medicare enrollment over time. As of March 2024, 50 percent of Medicare beneficiaries (33.9 million people) enrolled in MA.[2]

CMS pays each MA organization a monthly amount for each beneficiary enrolled in its plan (or plans). The payment rates for beneficiaries without end stage renal disease (ESRD) are determined by the plan's bid, which MA organizations submit to CMS on an annual basis and represents the dollar amount that the plan estimates will cover the Part A and Part B benefit package for a beneficiary of average health status in the area where service is offered. Plan bid submissions are compared to a benchmark that CMS sets for the county or region where the plan is offering services. The benchmark is based on the average projected Medicare FFS cost in the service area with adjustments prescribed in statute and regulation. The benchmark is the maximum rate CMS will pay an MA organization to provide Part A and Part B benefits in that service area over the next year. If the plan bid exceeds the benchmark, the plan is required to charge each member a premium for the amount by which the bid exceeds the benchmark. If the plan bid is below the benchmark, the plan retains a percentage of the difference between the bid and the benchmark, referred to as the "beneficiary rebate amount," which varies from 50 to 70 percent depending on the plan's Star Rating. The plan must then use the beneficiary rebate amount to reduce cost sharing for services covered by Traditional Medicare, to pay for supplemental benefits not covered under the Traditional Medicare FFS program, or to buy down premiums.

The payment rates for ESRD beneficiaries are determined by rates established by CMS' Office of the Actuary. These rates are based on the average Medicare FFS cost in the applicable area with adjustments prescribed in statute and regulation. The rates are set at the state level for ESRD dialysis payments; payments for beneficiaries with a functioning kidney transplant utilize the county rates used in developing the benchmarks for the non-ESRD payments.

The per person amount – either the bid amount or the applicable state or county rate – is adjusted to account for differences in health status between enrolled beneficiaries in order to determine the monthly payment. (The rebate amount paid also reflects the risk of the beneficiaries expected to enroll in the plan but is adjusted through the bid process.) This is

[1] Beneficiaries entitled only to Part A and not enrolled in Part B are not eligible to enroll in an MA plan. Effective 2021, per Section 17006(a) of the 21st Century Cures Act, beneficiaries with end stage renal disease (ESRD) can enroll in a Medicare Advantage plan.

[2] Medicare Enrollment Dashboard, accessed 7/11/2024.

referred to as "risk adjustment," and was authorized by the Balanced Budget Act of 1997 (BBA) (Pub. L. 105-33) as part of the payment structure in the Medicare+Choice (M+C) program, later renamed "Medicare Advantage" (MA) by the Medicare Prescription Drug, Improvement and Modernization Act of 2003 (MMA) (Pub. L. 108-173), enacted on December 8, 2003. The BBA broadly mandated that plan payments be risk adjusted for variations in per capita cost based on enrollee health status and demographic factors. Plans that disproportionately enrolled healthy beneficiaries would be paid less than they would have been if they had enrolled beneficiaries with the average risk profile, while plans that disproportionately enrolled the sickest beneficiaries would be paid more than if they had enrolled beneficiaries with the average risk profile. The specific method of risk adjustment adopted by CMS was detailed in a 1999 Report to Congress, "Proposed Method of Incorporating Health Status Risk Adjusters into Medicare+Choice Payments," that was also required by the BBA.[3]

Risk adjustment that included an adjustment for health status (the same general method that is employed in MA today) was first authorized by the BBA in response to how individual enrollees' risk was taken into account in Medicare private health plans, the so-called "risk HMOs." Prior to the establishment of the M+C program by the BBA, Medicare beneficiaries could choose private Health Maintenance Organizations (HMOs) or prepaid health plans under contract with Medicare for Medicare benefits. These risk HMOs were paid a capitated (per person) rate for each beneficiary set at 95 percent of the "adjusted average per capita cost" (AAPCC) for the FFS program for a given beneficiary's county of residence. Payments were discounted 5 percent based on the assumption at the time that HMOs could operate more efficiently than the Medicare FFS program. Final payment amounts were adjusted for the relative risk associated with individual enrollees' demographic characteristics: age, sex, institutional status, and eligibility for Medicaid. Enrollment in Medicare HMOs grew to around 6 million beneficiaries, approximately 15 percent of Medicare enrollment during that time,[4] but the Government Accountability Office (GAO), among others, expressed concerns over studies that found excess payments to Medicare HMOs as a result of Medicare's rate-setting method, which did not accurately reflect the healthier than average population that was enrolled in the Medicare HMOs.[5] By broadening CMS authority to implement a risk adjustment methodology that took into account health status as part of payment in the M+C program in the BBA, which was in many ways similar to the HMO risk program, the intention was to reduce the incentive for plans to prefer enrolling healthier than average beneficiaries.

CMS began implementing health-based risk adjustment using the Principal Inpatient Diagnostic Cost Group (PIP-DCG) model in 2000. The PIP-DCG model estimated health status using demographic factors and the most serious principal reason for an inpatient stay from any hospital admission that occurred during the prior year. Specifically, the PIP-DCG model was adjusted for age, gender, Medicaid eligibility, whether the enrollee was originally entitled to Medicare due to disability, and working aged status, as well as health status derived from

[3] Health Care Financing Administration, "Proposed Method of Incorporating Health Status Risk Adjusters Into Medicare+Choice Payments" (March 1999).

[4] 2005 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds.

[5] GAO, "Medicare HMOs: HCFA Can Promptly Eliminate Hundreds of Millions in Excess Payments" GAO/HEHS-97-16, Apr. 25, 1997.

inpatient claims only.[6] Risk adjustment was then expanded by the Medicare, Medicaid, and SCHIP Benefits Improvement and Protection Act of 2000 (BIPA) (Pub. L. 106-554), enacted December 21, 2000, to require that the risk adjustment model identify health status not only from diagnoses related to inpatient hospital stays, but also from ambulatory settings. The MMA later removed this requirement that data for risk adjustment be from specific sources (e.g., inpatient stays and ambulatory settings) and required only that an adjustment be made for health status. This change allowed the agency to determine the best sources of health status for risk adjustment purposes. As a result, CMS selected a new risk adjustment model to begin using for payment in 2004: the Centers for Medicare & Medicaid Services (CMS) Hierarchical Condition Categories (CMS-HCC) model, which included diagnoses recorded on professional, inpatient, and outpatient claims.[7] Similar to the PIP-DCG model, the CMS-HCC models adjust Medicare capitation payments to MA organizations for the variation in health expenditure risk of enrollees in their plans. This model more accurately captured the risk of enrolling beneficiaries with varying health status, thus addressing the BBA mandate that MA organizations be paid based on the variation in expected health care costs of the population they enroll in order to reduce the incentive for biased selection in Medicare's risk-based payment program.

1.2 Risk Adjustment Provisions in the 21st Century Cures Act

The MA program provides Parts A and B services under Part C of Title XVIII of the Social Security Act ("the Act"). Section 1853(a)(1)(C)(i) of the Act provides the Secretary of Health and Human Services (HHS) broad discretion to determine how to adjust for health status in risk adjustment. Since the initial risk adjustment models were implemented in the Medicare program, the methodology for calculating beneficiary risk scores – the output of the CMS-HCC model – has been regularly revised to pay MA organizations more accurately, improve the quality of care provided to MA enrollees, and promote competition among MA organizations.

In 2016, Section 17006(f) of the 21st Century Cures Act amended Section 1853(a)(1) of the Act in several ways to achieve improvements to risk adjustment for Medicare Advantage for 2019 and subsequent years. As amended by the 21st Century Cures Act, Section 1853(a)(1)(C)(i) is subject to the following subparagraph (I):

> (I) IMPROVEMENTS TO RISK ADJUSTMENT FOR 2019 AND SUBSEQUENT YEARS.—
>
> (i) IN GENERAL.—In order to determine the appropriate adjustment for health status under subparagraph (C)(i), the following shall apply:
>
> (I) TAKING INTO ACCOUNT TOTAL NUMBER OF DISEASES OR CONDITIONS.—The Secretary shall take into account the total number of diseases or conditions of an individual enrolled in a Medicare Advantage plan. The Secretary shall make an additional adjustment under such subparagraph as the number of diseases or conditions of an individual increases.

[6] Pope, G.C., Ellis, R.P., Ash, A.S., et al., "Principal Inpatient Diagnostic Cost Group Model for Medicare Risk Adjustment" Health Care Financing Review 21(3):93-118, Spring 2000a.

[7] Pope, G.C., Kautter, J., Ellis, R.P., et al., "Risk Adjustment for Medicare Capitation Payments Using the CMS-HCC Model" Health Care Financing Review 25(4):119-141, Summer, 2004.

(II) USING AT LEAST 2 YEARS OF DIAGNOSTIC DATA.—The Secretary may use at least 2 years of diagnosis data.

(III) PROVIDING SEPARATE ADJUSTMENTS FOR DUAL ELIGIBLE INDIVIDUALS.—With respect to individuals who are dually eligible for benefits under this title and title XIX, the Secretary shall make separate adjustments for each of the following:

(aa) Full-benefit dual eligible individuals (as defined in Section 1935(c)(6)).

(bb) Such individuals not described in item (aa).

(IV) EVALUATION OF MENTAL HEALTH AND SUBSTANCE USE DISORDERS.—The Secretary shall evaluate the impact of including additional diagnosis codes related to mental health and substance use disorders in the risk adjustment model.

(V) EVALUATION OF CHRONIC KIDNEY DISEASE.—The Secretary shall evaluate the impact of including the severity of chronic kidney disease in the risk adjustment model.

(VI) EVALUATION OF PAYMENT RATES FOR END-STAGE RENAL DISEASE.—The Secretary shall evaluate whether other factors (in addition to those described in subparagraph (H)) should be taken into consideration when computing payment rates under such subparagraph.

Thus, Section 17006(f) of the 21st Century Cures Act required CMS to fully implement a risk adjustment model in 2022 that takes into account the number of conditions a beneficiary has, making an adjustment as the number of conditions increases, and separately adjusts for full benefit dual eligible individuals (as defined in Section 1935(c)(6) of the Act) and individuals who are not full benefit dual eligible.[8] Section 17006(f) further required CMS to evaluate the impact of including additional factors for substance use disorder, mental health, and chronic kidney disease in the risk adjustment model.

In response to the requirements added by the 21st Century Cures Act, CMS conducted research in 2017 and considered several changes in how health status is taken into account when adjusting payments to MA plans to account for the varying level of risk of providing benefits to the Medicare beneficiaries they enroll. Independent of the 21st Century Cures Act, CMS implemented a risk adjustment model in Calendar Year (CY) 2017 that made an adjustment for differences in health status between beneficiaries who are dually eligible for Medicare and Medicaid and those who are not. Beneficiaries in the community receive a separate adjustment depending on whether they are full benefit dual (aged or disabled), partial benefit dual (aged or disabled), or non-dual (aged or disabled). We believe that splitting the community segment of the CMS-HCC model into six segments based on dual and aged/disabled status, which was first done in CY 2017, fulfills the directive established in the 21st Century Cures Act to make separate adjustments for full benefit dual eligible individuals. Therefore, in our research, we built upon

[8] The Secretary was given the option, which was already granted under the authority in Section 1853(a)(1)(C), to use at least 2 years of diagnosis data when calibrating the risk adjustment model.

the model implemented in 2017 by also taking into account the number of conditions a beneficiary has, making an adjustment as the number of diseases or conditions increased, and including additional diagnosis codes related to mental health, substance use disorders, and chronic kidney disease.

We proposed a model that met all of the requirements in the 21st Century Cures Act in Part I of the CY 2019 Advance Notice, and discussed two other models, one that also met all of the requirements in the 21st Century Cures Act, and another that met part of the requirements (i.e., included additional HCCs but did not take into account the number of conditions a beneficiary has) in order to gather stakeholder comments on approaches to implementing the 21st Century Cures Act requirements. We received extensive feedback and inquiries from stakeholders. Ultimately, for CY 2019, CMS implemented the model that included additional HCCs for chronic kidney disease, mental health, and substance use disorder but no adjustment for condition count. In CY 2020, CMS began implementing a model that also takes into account the number of conditions a beneficiary has, thereby meeting all of the 21st Century Cures Act requirements. This model, known as the 2020 CMS-HCC model, was fully phased in for CY 2022.

As finalized in the CY 2024 Rate Announcement, beginning for CY 2024, CMS implemented the 2024 CMS-HCC model, which maintains the 21st Century Cures Act requirements and incorporates important technical updates to improve the model's predictive accuracy. Technical updates in the 2024 CMS-HCC model include updated underlying FFS data years (from 2014 diagnoses and 2015 expenditures to 2018 diagnoses and 2019 expenditures), an updated denominator year in determining the average per capita predicted expenditures to create relative factors in the model, and a clinical reclassification of the hierarchical condition categories (HCCs) using the *International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM)* classification system (instead of the ICD-9-CM classification system used for prior models). As part of the clinical reclassification, CMS applied our longstanding principles, including making revisions focused on conditions that are subject to more coding variation (see section 2.3).

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Section 2.
PRIMER ON RISK ADJUSTMENT AND THE CMS-HCC MODEL

In this section, we present an introduction and overview of Medicare Advantage (MA) risk adjustment and the CMS-HCC and ESRD risk adjustment models used for MA payment. As mentioned in the introduction, risk adjustment is a method of adjusting capitation payments to MA health plans to account for the differences in expected health costs of individuals enrolled in the plan. For health plans not offered through the Medicare program, insurers determine their revenue needs based on a variety of factors, including trends in medical expenditures, benefits offered, and anticipated enrollment, and then determine how to set the premium, deductible, and copayment amounts charged to individuals or groups of enrollees within the rules of markets in which they operate. The risk adjustment models used in the MA program function as a more comprehensive method of underwriting in which diagnoses and demographic information are used to adjust each enrollee's monthly capitation rate to account for the predicted cost associated with their age, sex, and medical conditions. As with any insurance design, risk adjustment is intended to be accurate at the group level. While at the individual level, predicted medical costs can be lower or higher than actual medical costs, at the group level, below-average predicted costs balance out above-average predicted costs. In the following section, we first present relevant background on the function of risk adjustment and then describe the main components of the CMS-HCC models.

2.1 The Function of Risk Adjustment

As of January 2024, the Medicare program (FFS and MA), administered by CMS, provides benefits coverage to approximately 67 million beneficiaries.[9] Medicare beneficiaries vary greatly in terms of their health status, which in turn affects their utilization of health care services and the total cost of services they receive. Those with serious illnesses, multiple chronic conditions, or who are frail have persistent costs and may require more care, which will lead to higher medical costs on average than their healthier counterparts. In the MA program, if capitation rates were unadjusted and only the highest cost beneficiaries (high risk) enrolled in a plan, that plan would have difficulty remaining viable. In contrast, if healthier than average (low risk) beneficiaries enrolled in a plan, the plan would make excess profits at the expense of the Medicare program. Thus, without an adjustment for health status, there is a strong incentive for MA plans to target the enrollment of beneficiaries who are healthier than average. Risk selection can occur by chance or by practices implemented by health plans.[10] For example, if a health plan were to set high copayment rates for office visits to specialists, beneficiaries needing care from specialists might not enroll in that plan. To address this issue of risk selection and to compensate MA plans for accepting the risk of enrolling beneficiaries of varying health statuses, the MA program uses risk adjustment along with benefit-related policies that serve to maintain a level playing field and encourage competition among plans.

The MA risk adjustment models use data from a large pool of beneficiaries in the Medicare FFS program. We use beneficiaries from the entire FFS program that meet the model criteria to estimate the costs associated with the factors in each model segment, including having both Part A and Part B and at least one month of enrollment in the payment year. Most segments

[9] Medicare Enrollment Dashboard, accessed 5/23/2024.

[10] Nonnemaker, L. Beyond Age Rating: Spreading Risk in Health Insurance Markets. AARP Public Policy Institute, Insight on the Issues 135. Washington DC, October 2009.

of the CMS-HCC model have sample sizes over 1 million beneficiaries, with some having much more. This method of risk assessment is in accordance with the Actuarial Standard Board's Actuarial Standard of Practice for risk classification—the risk characteristics are related to expected outcomes and the risk classes are large enough to allow credible statistical inferences.[11] The costs associated with each risk factor in the model are then converted to a relative factor (i.e., risk adjustment model factor) so that payment adjustments can be made relative to the average predicted cost for a Medicare FFS beneficiary. It is important to understand that the underlying risk assessment is designed to accurately explain the variation at the group level, not at the individual level, because risk adjustment is applied to large groups.[12] As the American Academy of Actuaries notes:

"... Determining average experience for a particular class of risk is not the same as predicting the experience for an individual risk in the class. It is both impossible and unnecessary to predict expenditures for individual risks. If the occurrence, timing, and magnitude of an event were known in advance, there would be no economic uncertainty and therefore no reason for insurance."

By risk adjusting the payments to MA plans, CMS reduces the incentives of these plans to risk select only the healthiest beneficiaries and pays plans appropriately for providing care for the most seriously ill beneficiaries. For MA organizations with beneficiaries with lower-than-average predicted costs, CMS pays an amount that is incrementally lower based on their risk profile; while for MA organizations with beneficiaries with higher than average predicted costs, CMS pays an amount that is incrementally higher based on their risk profile.

The suitability of a risk adjuster depends on the nature of the groups to be paid using the adjuster. Sections 2.3 to 2.8 describe the characteristics and ability of the CMS-HCC risk adjustment model to account for the costs of conditions as well as the comorbidities and complications related to those conditions. Section 3 presents the evaluation of the models' ability to predict risk for enrollee groups that have concentrations of beneficiaries with different medical conditions, as well as other profiles.

2.2 History of Risk Adjustment Models for Medicare Managed Care

CMS has developed its risk adjustment methodology over time, modifying it to better account for differences in expected health expenditures. Changes to the model structure (e.g., subpopulation segmentation) are proposed in the annual Advance Notice, then subsequently finalized in the Rate Announcement pursuant to Section 1853(b) of the Act. Types of changes to the model include updates to data years – pairwise years of diagnosis and cost information – in order to take into account more recent patterns of health status, utilization, and cost in the Medicare FFS program, and revisions to the model specifications, which includes adding or removing factors or conditions that are included in the model and segmenting the model to account for distinct subpopulations. In MA, all risk adjustment models currently in use for payment are hierarchical condition category (HCC)-based models.

The AAPCC risk adjustment methodology that was in effect from 1985 through 1999 included only demographic information and explained about 1 percent of the individual variation

[11] Actuarial Standard of Practice No. 12: Risk Classification (for All Practice Areas). Actuarial Standards Board, Doc. No. 101. December 2005.

[12] Risk Assessment and Risk Adjustment. American Academy of Actuaries, Issue Brief. Washington DC, May 2010.

in expenditures for Medicare beneficiaries and, for beneficiaries with similar demographic profiles, did not pay more for sicker people. Research showed that the managed care program increased total Medicare expenditures because its enrollees were generally healthier than FFS enrollees and the AAPCC did not account for this favorable risk selection (Brown et al., 1993; Riley et al., 1996; Mello et al., 2003).[13,14,15] Also, this payment methodology did not appropriately compensate plans enrolling sicker beneficiaries or plans specializing in treating high cost populations, such as beneficiaries with particular chronic diseases or high levels of functional impairment.

The 1997 Balanced Budget Act (BBA) modified the Medicare managed care and other capitated programs, creating a new program known as Medicare+Choice (M+C) authorizing contracts with private insurance companies to provide Medicare benefits for eligible beneficiaries. The BBA included a mandate for health-based Medicare capitation payments for M+C plans by 2000. In 2000, CMS implemented the PIP-DCG model as its health-based payment risk adjuster (Pope et al., 2000a). This model estimated beneficiary health status (the predicted cost) from AAPCC-like demographics and the most serious principal inpatient diagnosis (principal reason for inpatient stay) associated with any hospital admission from the prior year.

The PIP-DCG model was an improvement over the AAPCC payment methodology, increasing explanatory power of individual variation in beneficiaries' expenditures from about 1 percent to about 5.5 percent. The PIP-DCG model was intended as a transition model, a feasible way to implement risk adjustment based on the readily available, already adjudicated inpatient diagnostic data. However, relying on inpatient diagnoses was the PIP-DCG model's major shortcoming because only illnesses that resulted in hospital admissions were counted. Therefore, M+C organizations that reduced admissions (e.g., through good ambulatory care) could end up with apparently healthier patients and be penalized through lower payments. The Benefits Improvement Protection Act (BIPA 2000) addressed the PIP-DCG limitations by requiring the use of ambulatory diagnoses in Medicare risk adjustment to be phased in from 2004 to 2007.

CMS evaluated several risk adjustment models that used both ambulatory and inpatient diagnoses and ultimately chose the DCG-HCC model for Medicare risk adjustment, partly because it "…would lend itself most easily to necessary modifications that would be clear to analysts and physicians."[16] The model, part of the same DCG family of models as the PIP-DCG, was developed with CMS funding by economists at RTI International and Boston University, with clinical input from physicians at Harvard Medical School (Pope, Kautter, Ingber, et al., 2004). Prior to its 2004 implementation, the model was modified to fit Medicare subpopulations and CMS' data collection system and became the CMS-HCC risk adjustment model that is the basis of the risk adjustment models in use today. The HCC-based structure of these models is described thoroughly in the next sections. The CMS-HCC model was again an improvement over

[13] Mello, M.M., Stearns, S.C., Norton, E.C., and Ricketts, T.C. III: Understanding Biased Selection in Medicare HMOs. Health Services Research 38(3):961-992, June 2003.

[14] Brown, R.S., Clement, D.G., Hill, J.W., et al.: Do Health Maintenance Organizations Work for Medicare? Health Care Financing Review 15(1):7-23, Fall 1993.

[15] Riley, G., Tudor, C., Chiang, Y., and Ingber, M.J.: Health Status of Medicare Enrollees in HMOs and Fee-for-Service in 1994. Health Care Financing Review 17(4):65-76, Summer 1996.

[16] Centers for Medicare & Medicaid Services (CMS). 45 Day Notice for 2004 M+C Rates: Attachment 2. Last Modified, March 28, 2003.

previous methodologies, explaining about ten percent of variation in individual beneficiaries' expenditures (compared to 5.5 percent in the PIP-DCG model).

One of the CMS-HCC model's strengths is its facility to accommodate improvements through modification—as evidenced by the most recent updates implemented starting in 2024. Additionally, CMS annually updates the mappings of *International Classification of Diseases, Clinical Modification* (ICD-CM) diagnosis codes to HCCs for each risk adjustment model to accurately reflect the most current diagnostic codes in use for a given payment year. CMS also recalibrates the model regularly on more recent diagnosis and expenditure data.

Periodically, CMS conducts a clinical review and revision of the CMS-HCC model to adjust for changes in disease patterns, treatment methods, and coding practices, as well as compositional changes within the Medicare population. Each CMS-HCC model is associated with a version number (see **Table 2-1**), which indicates the version of the clinical classification of the conditions (HCCs). HCCs may be redefined to make condition categories more clinically meaningful, improve the degree to which they predict medical expenditures, or increase the specificity of the diagnoses included in the category. When the diagnosis classifications change, the version number changes to indicate a new clinical specification. A major clinical revision was implemented for the Program of All-Inclusive Care for the Elderly (PACE) starting in 2012 and phased in for MA payment starting in 2014. Additional clinical revisions were implemented for MA in 2019 and 2020, in response to the 21st Century Cures Act, and, in 2024, a clinical version with HCCs that were reconstructed using ICD-10-CM diagnostic codes rather than ICD-9-CM was implemented. Moving to the ICD-10-CM diagnosis coding system as the basis for HCCs in the 2024 CMS-HCC risk adjustment model aligned the model with the coding classification system that has been used throughout the U.S. healthcare system since 2015. Additionally, the use of ICD-10-CM provides CMS with a greater level of precision and granularity than exists with ICD-9-CM. This change helps ensure that MA plan payments more accurately reflect the costs of beneficiaries' care so that plans serving beneficiaries with greater health care needs receive appropriately higher payments.

The model may also undergo periodic structural changes to improve its predictive accuracy for subpopulations. For example, in CY 2017 CMS implemented a CMS-HCC model with additional segments to better address disease patterns and cost differences between the aged versus disabled subpopulations and by status of Medicare-Medicaid dual eligibility (non-dual versus partial benefit dual versus full benefit dual). CMS maintained these structural changes in the 2019, 2020, and 2024 CMS-HCC models.

Consistent with the primary goal for the CMS-HCC risk adjustment models to accurately predict costs across large groups, the models' accuracy is evaluated using predictive ratios (the ratio of predicted expenditures to actual expenditures), which measure the ability of the model to accurately predict expenditures for large subgroups. Sections 3 and 5 provide further detail on CMS-HCC model predictive ratios. The R^2 is a statistical measure of the proportion of the variance in individual expenditures that can be explained by the model. Given the model's goal of predicting costs over subgroups, the R^2 is only provided for information about the extent to which the model can explain variation in individual expenditures. The R^2 of the CMS-HCC model has increased over time. Under the 2024 CMS-HCC model, the R^2 ranges from 0.1159-0.1889 across segments. This represents the highest R^2 values for each segment when compared to the historical segmented CMS-HCC model, including the 2020 CMS-HCC model.

Table 2-1 presents a summary of the CMS-HCC risk adjustment models and their explanatory power for an individual beneficiary's cost as measured by R^2.[17]

Table 2-1
Medicare Managed Care historic CMS-HCC (non-ESRD) risk adjustment model R^2 statistics

CMS-HCC Risk adjustment model	Payment years[2]	R^2
Adjusted Average Per Capita Cost (AAPCC)[3]	pre-2000	0.0077
PIP-DCG[3]	2000-2003	0.0550
2004 CMS-HCC (Version 12)[3]	2004-2006	0.0976
2007 CMS-HCC (Version 12)[4]	2007-2008	0.1049
2009 CMS-HCC (Version 12)[4]	2009-2012	0.1091
2013 CMS-HCC (Version 12)[4]	2013-2015	0.1184
2014 CMS-HCC (Version 22)[5]	2014-2016	0.1189
2017 CMS-HCC (Version 22, Six Community Segments)[4,6]	2017-2021	
Non-dual aged		0.1189
Non-dual disabled		0.1200
Partial benefit dual aged		0.1117
Partial benefit dual disabled		0.1234
Full benefit dual aged		0.1207
Full benefit dual disabled		0.1140
2019 CMS-HCC (Version 23, Six Community Segments)[4,7,9]	2019	
Non-dual aged		0.1245
Non-dual disabled		0.1142
Partial benefit dual aged		0.1107
Partial benefit dual disabled		0.0981
Full benefit dual aged		0.1198
Full benefit dual disabled		0.1310
2020 CMS-HCC (Version 24, Six Community Segments)[4,7,9]	2020-2024	
Non-dual aged		0.1257
Non-dual disabled		0.1148
Partial benefit dual aged		0.1122
Partial benefit dual disabled		0.0986
Full benefit dual aged		0.1214
Full benefit dual disabled		0.1317
2024 CMS-HCC (Version 28, Six Community Segments)[4,8,9]	2024	

(continued)

[17] Throughout this report, we refer to V12, V21, V22, V23, V24, and V28 in the context of the CMS-HCC risk adjustment model. These refer to the clinical version of the HCC classification used for model calibration Version numbers are updated when the diagnosis-to-HCC mappings are changed, such as when we recalibrate to incorporate clinical and other updates. Not all clinical versions have been used for payment.

Table 2-1
Medicare Managed Care historic CMS-HCC (non-ESRD) risk adjustment model R^2 statistics (continued)

CMS-HCC Risk adjustment model	Payment years[2]	R^2
Non-dual aged		0.1355
Non-dual disabled		0.1472
Partial benefit dual aged		0.1159
Partial benefit dual disabled		0.1589
Full benefit dual aged		0.1246
Full benefit dual disabled		0.1889

Table 2-1 Notes:
[1.] The R^2 statistic refers to the proportion of variation in individual expenditures explained by the model, typically ranging between 0-1.
[2.] Payment years listed are for non-PACE organizations. Overlapping payment years for different risk adjustment models occurs when a model is phased in over time while another is phased out.
[3.] The R^2 statistics for the three earliest models are based on the 1999-2000 calibration sample which included both community and institutional beneficiaries.
[4.] The R^2 statistic is calculated using the community continuing enrollees only; no months of institutional status are included.
[5.] The R^2 statistic for the V22 single segment community model is based on the 2010-2011 calibration sample.
[6.] The R^2 statistics for the V22 six community segments are based on the 2013-2014 calibration sample.
[7.] The R^2 statistics for the V23 and V24 six community segments are based on the 2014-2015 calibration sample.
[8.] The R^2 statistics for the V28 six community segments are based on the 2018-2019 calibration sample.
[9.] The V23, V24, and V28 models use diagnoses filtered by Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) codes to estimate the HCC factors. Previous models used diagnoses filtered by specialty type to estimate the HCC factors. The risk adjustment types of bills (TOBs) for inpatient and outpatient diagnoses are consistent across the models.
SOURCE: RTI analysis of Medicare claims and enrollment data—1999-2000, 2004-2005, and 2006-2007 5% sample; 2010-2011, 2013-2014, 2014-2015, and 2018-2019 full 100% samples.

Though the MA risk adjustment models have been revised over time, the risk adjustment rules used to identify which diagnoses are eligible for risk adjustment are long-standing. For a diagnosis to be acceptable for risk adjustment, it must be from an acceptable provider type (hospital inpatient, hospital outpatient, or professional), coded in accordance with ICD-CM coding guidelines, result from a face-to-face visit, and be documented in a medical record.[18] CMS has established which inpatient and outpatient facilities, and which professional encounters, are acceptable for risk adjustment and developed filtering methodologies to identify diagnoses that are used for risk adjustment purposes based on the risk adjustment rules. The filtering methodologies used to identify risk adjustment eligible diagnoses differ depending on whether the risk adjustment data was submitted to the encounter data system (EDS)[19] or the legacy Risk Adjustment Processing System (RAPS)[20]; however, the long-standing risk adjustment rules are the basis for both methodologies. The objective of these rules, and the goal

[18] Chapter 7. Risk Adjustment. Medicare Managed Care Manual, Section 40 - Role and Responsibilities of Plan Sponsors
[19] https://www.hhs.gov/guidance/sites/default/files/hhs-guidance-documents/FinalEncounterDataDiagnosisFilteringLogic.pdf
[20] Chapter 7. Risk Adjustment. Medicare Managed Care Manual, Section 120 - Operations

of both filtering methodologies, is to ensure that we only use reasonably definitive diagnoses to predict costs.

The filtering methodology used in the 2020 and 2024 CMS-HCC model calibrations was that used for encounter data, which relies on Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) procedure codes developed by the American Medical Association and CMS, respectively, to identify diagnoses from outpatient facility and professional settings that are eligible for risk adjustment. Each CPT and HCPCS code is evaluated on whether it meets inclusion criteria for risk adjustment. If at least one included CPT/HCPCS code appears on a FFS outpatient claim along with an eligible Type of Bill (TOB), or on a professional claim, all diagnosis data from that claim are considered for risk adjustment. If a claim or encounter data record contains only CPT/HCPCS codes that do not meet inclusion criteria, diagnoses from that claim or encounter data record are not included for risk adjustment. Prior to the 2019 CMS-HCC model, the filtering methodology CMS used to identify risk adjustment eligible diagnosis was applicable to RAPS data and was based on physician specialty codes to determine if the diagnoses from outpatient and professional claims would be used for risk adjustment, both in calibrating the models and in calculating risk scores. For these earlier models, acceptable physician specialty codes included most specialties, as well as specially trained non physicians (nurse practitioners, physician assistants, certified nurse midwifes, etc.). If a FFS claim came from an approved provider, all diagnosis data on the claim was accepted. Diagnoses from inpatient settings are filtered using TOB in both the pre-2019 and 2019 and later model calibrations.[21]

2.2.1 2024 CMS-HCC Model

For CY 2024, CMS finalized a CMS-HCC risk adjustment model that includes updated data years used for calibration and a clinical reclassification, described in more detail below. This CMS-HCC model has the same structure as the 2020 CMS-HCC risk adjustment model in that it has eight model segments (six community segments, one institutional segment, and a new enrollee segment) as first implemented for payment for CY 2017 and condition count variables as first implemented for payment for CY 2020.

Recalibration: Updated data years used for model calibration from 2014 diagnoses and 2015 expenditures to 2018 diagnoses and 2019 expenditures.

Clinical Reclassification: For the first time, ICD-10-CM codes were used to rebuild the CMS-HCC condition categories to reflect diagnosis coding under ICD-10-CM, which has been in use in the U.S. healthcare system since 2015.[22] The clinical reclassification involved revising condition categories – including adding, deleting, and reconfiguring categories and clinical hierarchies, and freshly considering which categories are included in the payment model. As part of the clinical reclassification, CMS did not include certain codes in the payment model where there is wider variation in diagnosing and coding. Including conditions in the risk adjustment model that are more subject to coding variation – meaning that the coding of these conditions is likely not consistent across the industry – can lead to distortion of the marginal costs estimated by the model, reducing the ability of the HCCs in the model to predict stable costs and accurately

[21] Specialty codes have never been used to filter diagnoses on inpatient claims. For inpatient claims the Type of Bill is used to filter diagnoses.

[22] Refer to Section J. of the CY 2024 Rate Announcement.

predict those costs in alignment with the severity of the condition. The overall goal was to improve predictive ability by better accounting for current disease patterns, treatment methods and costs, as well as diagnosis and coding practices.

The reclassification process is iterative and involves empirical data investigation and analysis by contracted economists and health services researchers, as well as input and review from external contracted clinicians. The clinicians gave insight and recommendations to support the development of the HCCs by providing clinical considerations on the classification of ICD-10-CM diagnoses into diagnostic groupings (DXGs), condition categories (CCs), and hierarchies (see section 2.4).

The HCC classification system is exhaustive (i.e., all diagnosis codes map to an HCC). While all diagnosis codes map to an HCC, only a subset of HCCs is included in the payment model (refer to **Table 2-2** below). When CMS refers to a "payment HCC" we are referring to an HCC that is included in the model for payment, and similarly, references to a "non-payment HCC" are to HCCs that are not included in the model for payment. During model development, multiple iterations of the model are calibrated to evaluate the impact on coefficients to inform diagnosis mappings, HCC reconfigurations, clinical hierarchies, and which HCCs are included in the model for payment. Clinician input was provided, where applicable, for each model iteration. Decisions regarding the model classification (e.g., how diagnoses are grouped) were made based on the level of granularity provided in the ICD-10-CM classification system, the risk adjustment model principles (see Section 2.3), and examination of model performance (i.e., predictive accuracy).

The resulting clinical revision (V28) classifies the approximately 74,000 ICD-10-CM codes into 266 HCCs, 115 of which are included for payment in the 2024 CMS-HCC model. This increase in condition categories from the 2020 CMS-HCC model (204 HCCs; 86 payment HCCs) is attributable to the greater level of detail in ICD-10-CM diagnosis codes, allowing for the development of HCCs with increased clinical specificity and validity that better capture clinical and cost differences between conditions. In aggregate, the 2024 CMS-HCC model contains approximately 20 percent fewer ICD-10-CM codes that are mapped to payment HCCs than the 2020 CMS-HCC model. The inclusion of fewer diagnoses was a result of the application of CMS' risk adjustment principles throughout the reclassification process, as discussed in detail in Section 2.3.

Table 2-2
Summary Statistics for the 2020 CMS-HCC and 2024 CMS-HCC Models

	2020 CMS-HCC Model	2024 CMS-HCC Model
FY22/23 ICD-10-CM codes - total	73,926*	73,926*
FY22/23 ICD-10-CM codes mapped to payment HCCs	9,797 (13.3%)	7,770 (10.5%)
FY22/23 ICD-10-CM codes mapped to non-payment HCCs	64,129 (86.7%)	66,156 (89.5%)
Newly mapped to payment HCC in the 2024 CMS-HCC Model		209
No longer mapped to payment HCC in the 2024 CMS-HCC Model		2,236
Due to ICD-10-CM clinical updates		2,161 (96.6%)
Due to Principle-10 focused clinical updates		75 (3.4%)

(continued)

Table 2-2
Summary Statistics for the 2020 CMS-HCC and 2024 CMS-HCC Models (continued)

	2020 CMS-HCC Model	2024 CMS-HCC Model
HCCs – total	204	266
HCCs – payment	86 (42.2%)	115 (43.2%)
HCCs – non-payment	118 (57.8%)	151 (56.8%)

* The total number of ICD-10-CM diagnosis codes varies by fiscal year. There were 73,926 ICD-10-CM codes at the time of model calibration. The total number of ICD-10-CM codes as of fiscal year 2024 is 74,044.

2.3 Principles for Risk Adjustment Model Development

The CMS-HCC risk adjustment model is prospective—it uses a profile of major medical conditions in the base year, along with demographic information (age, sex, Medicaid dual eligibility, disability status), to predict Medicare expenditures in the next year. It is calibrated on a population of FFS beneficiaries entitled to Part A and enrolled in Part B because CMS has complete Medicare expenditure and diagnoses data for this population. Determining which diagnosis codes should be included, how they should be grouped, and how the diagnostic groupings should interact for risk adjustment purposes was a critical step in the development of the model. The following 10 principles guided the creation of the CMS-HCC diagnostic classification system:

***Principle 1*—Diagnostic categories should be clinically meaningful**. Each diagnostic category is a set of ICD-9-CM or ICD-10-CM codes.[23] These codes should all relate to a reasonably well-specified disease or medical condition that defines the category. Conditions must be sufficiently clinically specific to minimize opportunities for discretionary coding. Clinical meaningfulness improves the face validity (whether the diagnostic category is intuitive to clinicians) of the classification system to clinicians, its interpretability, and its utility for disease management and quality monitoring.

***Principle 2*—Diagnostic categories should predict medical expenditures**. Diagnoses in the same HCC should be reasonably homogeneous with respect to their effect on both current (this year's) and future (next year's) costs.

***Principle 3*—Diagnostic categories that will affect payments should have adequate sample sizes to permit accurate and stable estimates of expenditures.** Diagnostic categories used in establishing payments should have adequate sample sizes in available data sets. Given the extreme skewness of medical expenditure data, the data cannot reliably determine the expected cost of extremely rare diagnostic categories.

***Principle 4*—In creating an individual's clinical profile, hierarchies should be used to characterize the person's illness level within each disease process, while the effects of**

[23] Centers for Disease Control and Prevention (CDC). *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM). Centers for Disease Control and Prevention, 18 June 2013, https://archive.cdc.gov/#/details?url=https://www.cdc.gov/nchs/icd/icd9cm.htm. Centers for Disease Control and Prevention. *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM). Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 7 June, 2024, https://www.cdc.gov/nchs/icd/icd-10-cm/index.html.

unrelated disease processes accumulate. Because each new medical problem adds to an individual's total disease burden, unrelated disease processes should increase predicted costs of care. However, the most severe manifestation of a given disease process principally defines its impact on costs. Therefore, related conditions should be treated hierarchically, with more severe manifestations of a condition dominating and zeroing out the effect of less serious ones.

***Principle 5*—The diagnostic classification should encourage specific coding**. Vague diagnostic codes should be grouped with less severe and lower paying diagnostic categories to provide incentives for more specific diagnostic coding.

***Principle 6*—The diagnostic classification should not reward coding proliferation**. The classification should not measure greater disease burden simply because more diagnosis codes are present. Hence, neither the number of times that a particular code appears, nor the presence of additional, closely related codes that indicate the same condition should increase predicted costs.

***Principle 7*—Providers should not be penalized for recording additional diagnoses (monotonicity)**. This principle has two consequences for modeling: (1) no condition category should carry a negative payment weight, and (2) a condition that is higher ranked in a disease hierarchy (causing lower rank diagnoses to be ignored) should have at least as large a payment weight as lower ranked conditions in the same hierarchy.

***Principle 8*—The classification system should be internally consistent (transitive)**. If diagnostic category A is higher ranked than category B in a disease hierarchy, and category B is higher ranked than category C, then category A should be higher ranked than category C. Transitivity improves the internal consistency of the classification system and ensures the assignment of diagnostic categories is independent of the order in which hierarchical exclusion rules are applied.

***Principle 9*—The diagnostic classification should assign all ICD-9-CM and ICD-10-CM codes (exhaustive classification)**. Because each diagnostic code potentially contains relevant clinical information, the classification should categorize all ICD-9-CM and ICD-10-CM codes.

***Principle 10*—Discretionary diagnostic categories should be excluded from payment models**. Diagnoses that are particularly subject to intentional or unintentional discretionary coding variation or inappropriate coding by health plans/providers, or that are not clinically or empirically credible as cost predictors, should not increase cost predictions. Excluding these diagnoses reduces the sensitivity of the model to coding variation and coding proliferation.

In designing the diagnostic classification, principles 7 (monotonicity), 8 (transitivity), and 9 (exhaustive classification) were followed absolutely. For example, if the expenditure weights for the models did not originally satisfy monotonicity, constraints were imposed to create models that did. Judgment was used to make tradeoffs among other principles. For example, clinical meaningfulness (principle 1) is often best served by creating a very large number of detailed clinical groupings. But a large number of groupings conflicts with adequate sample sizes for each category (principle 3). Another tradeoff is encouraging specific coding (principle 5) versus predictive power (principle 2). In current coding practice, nonspecific codes are common. If these codes are excluded from the classification system, predictive power may be sacrificed. Similarly, excluding discretionary codes (principle 10) can also lower predictive power

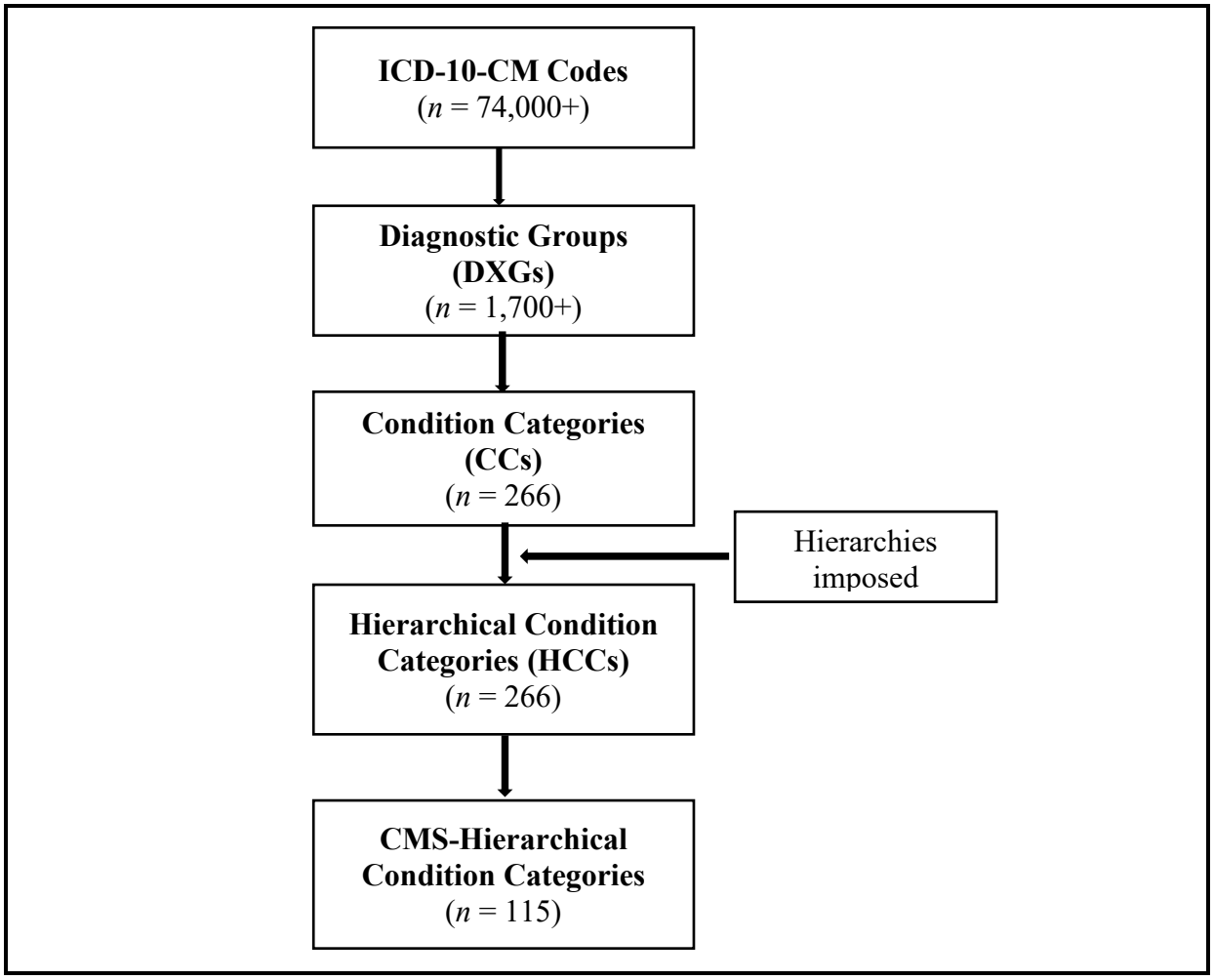
(principle 2). CMS approached the inherent tradeoffs involved in designing a classification system using empirical evidence on frequencies and predictive power, clinical judgment on relatedness, specificity, and severity of diagnoses, and professional judgment on incentives and likely provider responses to the classification system. The CMS-HCC model balances these competing goals to support a feasible, health-based payment system.

2.4 Elements and Organization of the CMS-HCC Model

2.4.1 Diagnostic Classification System

The HCC diagnostic classification system begins by classifying over 74,000 ICD-10-CM diagnosis codes into approximately 1,700 diagnostic groups, or DXGs (see **Figure 2-1**). Each ICD-10-CM code maps to one or more DXGs, which represent well-specified medical conditions. For clinical version 28 (V28), DXGs are further aggregated into 266 Condition Categories, or CCs. CCs describe a broader set of similar diseases. Although they are not as homogeneous as DXGs, diseases within a CC are related clinically and with respect to cost. An example is V28 *CC 249 Ischemic or Unspecified Stroke*, which includes *DXG 96.01 precerebral or cerebral arterial occlusion with infarction*, and *DXG 170.59 neonatal cerebral infarction*.

Figure 2-1
Aggregating ICD-10-CM Codes into Hierarchical Condition Categories – 2024 CMS-HCC Model



NOTE: ICD-10-CM is *International Classification of Diseases, Tenth Revision, Clinical Modification*; example reflects version 28 (V28) of the HCC clinical classification that was used to calibrate the 2024 CMS-HCC model.
SOURCE: RTI International.

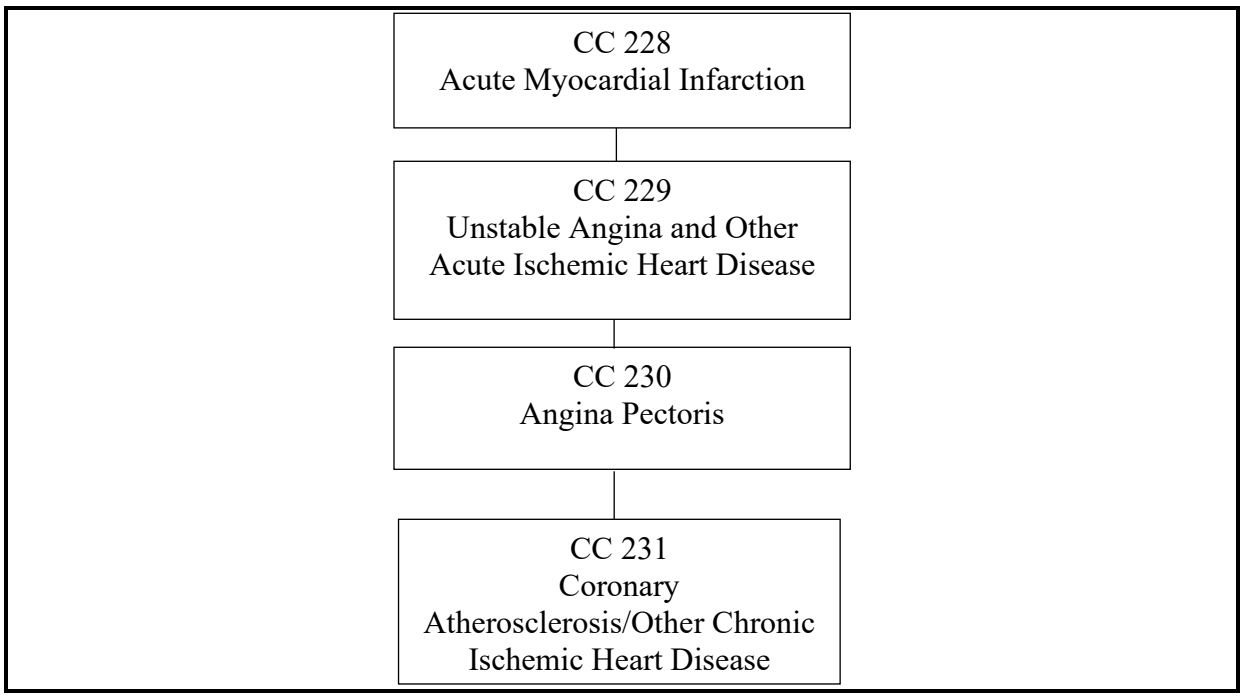
2.4.2 Hierarchies

Hierarchies are imposed among related CCs, so that a person is coded for only the most severe manifestation among related diseases. For example (**Figure 2-2**), ICD-10-CM Ischemic Heart Disease codes are organized in the Coronary Artery Disease hierarchy, consisting of four CCs arranged in descending order of clinical severity and cost, from *CC 228 Acute Myocardial Infarction* to *CC 231 Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease*. All CCs that a person has are coded. For example, a person with ICD-10-CM diagnoses in *CC 229 Unstable Angina and Other Acute Ischemic Heart Disease* and *CC 230 Angina Pectoris* is coded with both CC 229 and CC 230.

After imposing hierarchies, CCs become Hierarchical Condition Categories, or HCCs. If a person is coded with more than one CC in a hierarchy, only the highest (most severe) CC in the

hierarchy will be coded as the HCC. For example, if a beneficiary has an ICD-10-CM code that groups into HCC 228, having CC 228 precludes HCCs 229, 230, or 231 from being assigned, even if ICD-10-CM codes that group into those categories were also present. Similarly, a person with ICD-10-CM codes that group into both *CC 229 Unstable Angina and Other Acute Ischemic Heart Disease* and *CC 230 Angina Pectoris* is coded for HCC 229, but not HCC 230.

Figure 2-2
Hierarchical Condition Categories for Coronary Artery Disease – 2024 CMS-HCC Model



NOTE: Example reflects version 28 (V28) of the HCC clinical classification that was used to calibrate the 2024 CMS-HCC model.
SOURCE: RTI International.

Although HCCs reflect hierarchies among related disease categories, for unrelated diseases, HCCs accumulate. For example, a male with heart disease, stroke, and cancer has (at least) three separate HCCs coded, and his risk score (that is, the reflection of his relative predicted cost) will reflect increments for all three conditions.

In addition to the additive terms in the model, the CMS-HCC model also incorporates some interaction terms for conditions where the costs are more than additive. For example, the presence of both diabetes and congestive heart failure (CHF) leads to higher predicted costs than would be calculated by adding the separate increments for diabetes and CHF alone. Therefore, the model includes a set of two-way interactions between pairs of disease groups, those which together have clinical validity and most strongly predict higher additional costs. Many interactions among diseases are tested during model development, and the model reflects those that have significant effects on costs.

Because a single beneficiary may be coded for none, one, or more than one HCC, the CMS-HCC model can predict costs for a wide variety of distinct clinical profiles using the HCCs

included in the model.[24] The model's structure thus provides, and predicts from, a detailed comprehensive clinical profile for each individual.

HCCs are assigned using hospital and physician diagnoses from these sources: (1) hospital inpatient, (2) hospital outpatient, and (3) physicians and clinically trained non physicians (e.g., psychologist, nurse practitioner). (See Section 2.2 for a summary of the filtering method used with outpatient and physician sourced diagnoses.) These sources were found to be the most reliable and to provide the greatest predictive power. The CMS-HCC model does not distinguish among sources; in particular, it places no premium on diagnoses from inpatient care.

2.4.3 CMS-HCC Model Structure

The 2020 CMS-HCC (V24) model includes 86 HCCs (out of a total of 204 HCCs) as payment HCCs. The 2024 CMS-HCC (V28) model includes 115 HCCs (out of a total of 266 HCCs) as payment HCCs. Consistent with principle 10 (see Section 2.3), the CMS-HCC payment model excludes diagnostic categories (HCCs) containing diagnoses that are vague/nonspecific (e.g., symptoms), discretionary in medical treatment or coding (e.g., osteoarthritis), not medically significant (e.g., muscle strain), or transitory or definitively treated (e.g., appendicitis). The payment model also excludes HCCs that do not (empirically) substantially add to costs, as well as HCCs that are fully defined by the presence of procedures or DME, in order to have payments based on medical problems that were present rather than services that were offered.

For some payment HCCs, the predicted costs of the disease are significantly different for the subpopulation entitled to Medicare by disability as opposed to the aged subpopulation. Starting with the CMS-HCC model implemented in 2017 (V22), the CMS-HCC model has six separate community segments defined by aged/disabled status and Medicare-Medicaid dual status (see Section 2.6). All community segments include model variables that are two-way disease group interactions that correspond to conditions among the Medicare population that result in increased costs when both conditions are present. These variables are additional factors in risk scores that reflect the increased costs of having two conditions and are added to the factors for each individual condition. For example, one two-way disease group interaction variable predicts additional costs of having both diabetes and congestive heart failure, on top of having each one individually. Additionally, the three disabled community segments include a disease interaction term specific to that subpopulation—substance use disorders and psychiatric disorders.

The CMS-HCC model also has a separate segment for beneficiaries in long term (greater than 90 days) institutional care. Like the distinction between aged and disabled beneficiaries, this population also has unique cost patterns that differ from beneficiaries residing in the community. The institutional segment includes the same HCCs and two-way disease group interactions as the community segments with the exception of the interaction between heart failure and heart arrhythmias as expert clinical opinion concluded that it is not clinically salient for this population. In addition, the Long Term Institutional (LTI) segment of the model includes separate factors for Medicare-Medicaid dual status and disability to account for the additional effect these statuses may have on cost.

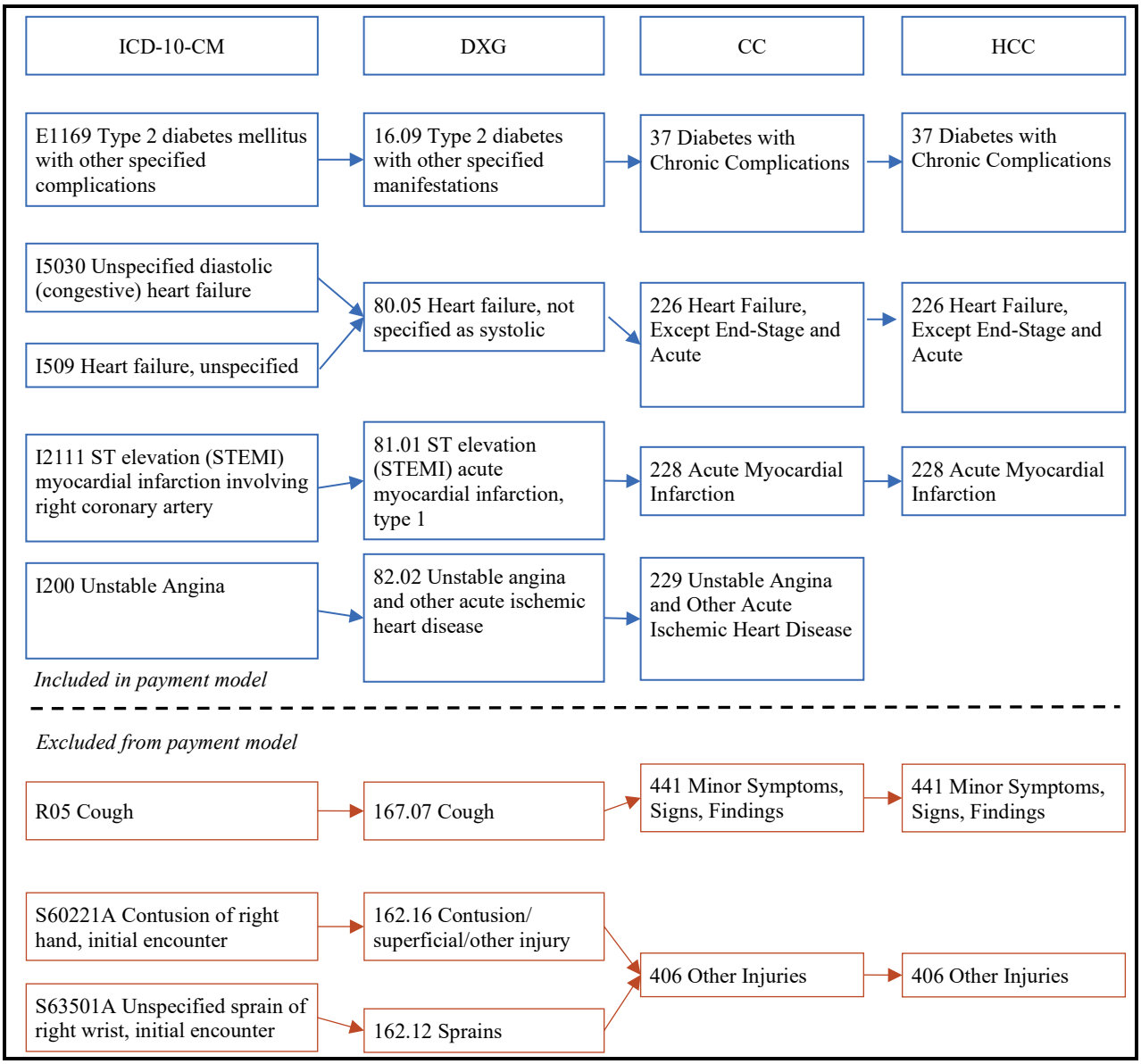
[24] Note that not all HCCs are used in the CMS-HCC payment model. See Section 3.2.2 for details.

Along with HCCs, each segment of the CMS-HCC model also relies on demographics to predict costs. Demographic adjusters include mutually exclusive age-sex categories (e.g., female, age 65–69) and two sex-specific indicators of disability as the original reason of Medicare eligibility in the three aged community segments and the LTI segment. These demographic adjusters pick up the costs of diseases not in the model and differences in spending associated with each demographic factor.

2.4.4 Clinical Vignette

To illustrate how the CMS-HCC model maps diagnoses to HCCs, we have created a hypothetical clinical vignette. **Figure 2-3** displays a hypothetical clinical vignette of a male, age 74, with full benefit dual status, who lives in the community and has multiple conditions, many of which are chronic. He received eight ICD-10-CM diagnosis codes from visits to hospitals and physicians, which are grouped into seven DXGs: diabetes; congestive heart failure; Acute Myocardial Infarction (AMI); unstable angina; cough; contusions; and sprains. These seven DXGs in turn group into six CCs, with the DXGs for contusions and sprains mapping to a single CC of "other injuries." Finally, the six CCs result in three payment HCCs—Diabetes with Chronic Complications; Heart Failure, except End-Stage and Acute; and AMI—that are used in risk adjusting MA payments. Two of the payment HCCs, Diabetes and Heart Failure, have a disease interaction term also used in risk adjusting (not shown in figure). Although this man has been assigned CCs for both AMI and unstable angina, he is not assigned the HCC for unstable angina, and the MA plan will receive no payment for unstable angina, because AMI is a more severe manifestation of coronary artery disease, and thus excludes unstable angina in the coronary artery disease hierarchy. The HCCs for minor symptoms and other injuries are also excluded from the payment calculation. Cough is a symptom associated with a variety of medical conditions ranging from minor to serious, and contusions and sprains are typically transitory, with minimal implications for next year's cost.

Figure 2-3
Clinical vignette for the 2024 CMS-HCC model



NOTE: CC = condition category; DXG = diagnostic group; HCC = Hierarchical Condition Category; ICD-10-CM = *International Classification of Diseases, Tenth Revision, Clinical Modification*.
HCC 229 Unstable Angina and Other Acute Ischemic Heart Disease is a payment HCC. However, it is excluded from the clinical vignette for this patient since HCC 229 is in the same hierarchy as HCC 228, which is more severe.
SOURCE: RTI International

The risk adjustment model factors, total risk score, and predicted expenditures for the man in this hypothetical example are presented in **Table 2-3**. Along with the demographic factors for someone who is age 74 and male, each of the three payment HCCs identified in the clinical vignette contributes additively to this person's risk profile (Diabetes with Chronic Complications; Heart Failure, Except End-Stage and Acute; Acute Myocardial Infarction), and there is an additional two-way disease group interaction (Diabetes and Heart Failure). His total risk score is the sum of the individual risk adjustment model factors, which is equivalent to the total predicted FFS expenditure ($19,703) divided by the average predicted expenditure for the population, also known as the model denominator ($10,402.85), or 1.894.

Table 2-3
Hypothetical example of Expenditure Predictions – 2024 CMS-HCC Model

Risk marker	Risk adjustment model factor	Incremental prediction of FFS cost[1]
Male, Age 70–74	0.626	$6,512
Diabetes with Chronic Complications (HCC 37)	0.186	$1,938
Heart Failure, Except End-Stage and Acute (HCC 226)	0.406	$4,220
Acute Myocardial Infarction (HCC 228)	0.493	$5,128
Unstable Angina and Other Acute Ischemic Heart Disease (HCC 229)[2]	—	$0
Cough (HCC 441)[3]	—	$0
Hand Contusion and Wrist Sprain (HCC 406)[3]	—	$0
Diabetes and Heart Failure (two-way disease group interaction)	0.183	$1,905
Total raw risk score	1.894	$19,703

Table 2-3 Notes:
[1.] Predicted FFS costs for the full benefit dual aged community segment, as estimated using the 2024 CMS-HCC model as well as 2018 diagnostic data and 2019 expenditure data, are used here for illustrative purposes.
[2.] HCC 229 Unstable Angina and Other Acute Ischemic Heart Disease has an incremental prediction, but the amount is not added because HCC 228 Acute Myocardial Infarction is within the same hierarchy and is the more severe manifestation of cardiovascular disease.
[3.] HCC 441 Cough (symptom associated with a variety of medical conditions from minor to serious) and HCC 406 Hand Contusion and Wrist Sprain (typically transitory) are excluded from the payment model.
SOURCE: RTI International.

2.5 CMS-HCC Model Features Specific to the 21st Century Cures Act

As discussed in Section 1.2, the 21st Century Cures Act required several additional adjustments to improve risk adjustment for MA. These adjustments were required to be completely phased in for payments for 2022 and subsequent years. For CY 2022, CMS had fully implemented the 2020 CMS-HCC model, which met the 21st Century Cures Act requirements.

The 2024 CMS-HCC model maintained those improvements:

- *Diagnoses Classified into HCCs:* The 2024 CMS-HCC model was updated to use version 28 (V28) of the clinical classification of HCCs. The 2024 CMS-HCC model (V28) continues to include conditions added to the 2019 CMS-HCC model (V23) and the 2020 CMS-HCC model (V24) in response to the 21st Century Cures Act. The 2024 CMS-HCC model (V28) payment HCCs for these conditions are detailed in Section 2.5.1.

- *Factors included in the model:* In accordance with the 21st Century Cures Act, a model with count variables was proposed and finalized for the 2024 payment year – the 2024 CMS-HCC model (V28). This model takes into account the number of conditions a beneficiary has; and as the number of conditions increases, an adjustment is made to the total predicted cost (or risk score).

The finalized model with count variables includes variables that indicate the number of payment conditions a beneficiary has. These variables are included in addition to demographic, HCC, and interaction variables. The count variables are somewhat analogous to a non-linear, or highly interactive model. That is, the coefficient for the five payment condition count variable is the expected marginal cost of having any five payment conditions. The count model is further detailed in Section 2.5.2.

2.5.1 HCC Changes

Among the 21st Century Cures Act amendments to Section 1853(a)(1) of the Act to improve risk adjustment for Medicare Advantage for 2019 and subsequent years are directions for the Secretary to evaluate the impact of including the severity of chronic kidney disease in the risk adjustment model and the impact of including additional diagnosis codes related to mental health and substance use disorders in the risk adjustment model. In response to this directive, CMS evaluated and added conditions for chronic kidney disease, mental health, and substance use disorder to the 2019 CMS-HCC model (V23). The 2020 CMS-HCC model (V24) included these conditions and further added conditions for dementia and pressure ulcers in order to better predict medical expenditures for beneficiaries with multiple chronic conditions.

The conditions added to the 2019 (V23) and 2020 (V24) models in relation to the 21st Century Cures Act are also in the 2024 (V28) model. HCCs for these conditions were reconfigured between the 2020 CMS-HCC model (V24) and the 2024 CMS-HCC model (V28) to reflect the current ICD-10-CM classification and recent expenditure patterns observed in 2018-2019 data. Interaction terms involving chronic kidney disease, mental health disorders, substance use disorders, and pressure ulcers in the 2024 CMS-HCC model were updated to reflect the ICD-10-CM HCC classification of these conditions. Below are the specific HCC changes in the 2024 CMS-HCC model (V28).[25]

Dementia

2020 CMS-HCC Payment Model (Dementia)	2024 CMS-HCC Payment Model (Dementia[26])
• HCC 51 Dementia with Complications • HCC 52 Dementia without Complications	• HCC 125 Dementia, Severe • HCC 126 Dementia, Moderate • HCC 127 Dementia, Mild or Unspecified

[25] For more information see the 2024 Advance Notice

[26] Because new ICD-10-CM codes were added for dementia by severity and by complication, V28 HCCs were reconfigured to distinguish severity. New ICD-10-CM codes became effective October 1, 2022, and are not reflected in 2018-2019 data. The three V28 dementia HCCs are constrained equal in the 2024 CMS-HCC model, parallel to the constraint between the two V24 HCCs in the 2020 CMS-HCC model.

Pressure Ulcer

2020 CMS-HCC Payment Model (Pressure Ulcer)	2024 CMS-HCC Payment Model (Pressure Ulcer)
• HCC 157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone • HCC 158 Pressure Ulcer of Skin with Full Thickness Skin Loss • HCC 159 Pressure Ulcer of Skin with Partial Thickness Skin Loss	• HCC 379 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone • HCC 381 Pressure Ulcer of Skin with Full Thickness Skin Loss • HCC 382 Pressure Ulcer of Skin with Partial Thickness Skin Loss

Chronic Kidney Disease

2020 CMS-HCC Payment Model (Chronic Kidney Disease)	2024 CMS-HCC Payment Model (Chronic Kidney Disease[27])
• HCC 136 Chronic Kidney Disease, Stage 5 • HCC 137 Chronic Kidney Disease, Severe (Stage 4) • HCC 138 Chronic Kidney Disease, Moderate (Stage 3)	• HCC 326 Chronic Kidney Disease, Stage 5 • HCC 327 Chronic Kidney Disease, Severe (Stage 4) • HCC 328 Chronic Kidney Disease, Moderate (Stage 3B) • HCC 329 Chronic Kidney Disease, Moderate (Stage 3, Except 3B)

Mental Health

2020 CMS-HCC Payment Model (Mental Health)	2024 CMS-HCC Payment Model (Mental Health)
• HCC 57 Schizophrenia • HCC 58 Reactive and Unspecified Psychosis • HCC 59 Major Depressive, Bipolar, and Paranoid Disorders • HCC 60 Personality Disorders	• HCC 151 Schizophrenia • HCC 152 Psychosis, Except Schizophrenia • HCC 153 Personality Disorders; Anorexia/Bulimia Nervosa • HCC 154 Bipolar Disorders without Psychosis • HCC 155 Major Depression, Moderate or Severe, without Psychosis

Substance Use Disorders

2020 CMS-HCC Payment Model (Substance Use Disorders)	2024 CMS-HCC Payment Model (Substance Use Disorders)
• HCC 54 Substance Use with Psychotic Complications • HCC 55 Substance Use Disorder, Moderate/Severe, or Substance Use with Complications • HCC 56 Substance Use Disorder, Mild, Except Alcohol and Cannabis	• HCC 135 Drug Use with Psychotic Complications • HCC 136 Alcohol Use with Psychotic Complications • HCC 137 Drug Use Disorder, Moderate/Severe, or Drug Use with Non-Psychotic Complications • HCC 138 Drug Use Disorder, Mild, Uncomplicated, Except Cannabis • HCC 139 Alcohol Use Disorder, Moderate/Severe, or Alcohol Use with Specified Non-Psychotic Complications

[27] Because new ICD-10-CM codes were added for chronic kidney diseases stages 3a, 3b, or 3 unspecified, V28 HCCs were reconfigured to reflect this severity distinction. New ICD-10-CM codes became effective October 1, 2020, and are not reflected in 2018-2019 data. V28 HCCs 328 and 329 are constrained equal in the 2024 CMS-HCC model.

2.5.2 Model with Count Variables

As discussed in Section 1.2 of this report, Section 1853(a)(1)(I) "Improvements to Risk Adjustment for 2019 and Subsequent Years," as added by the 21st Century Cures Act, requires the Secretary to "take into account the total number of diseases or conditions" of Medicare Advantage beneficiaries and to "make an additional adjustment … as the number of diseases or conditions of an individual increases." To implement this requirement, we developed and evaluated alternative specifications of a CMS-HCC "count model."

The 2020 CMS-HCC model (V24), which counts payment HCCs and utilizes individual HCC count indicators, was finalized for CY 2020 and was fully phased in for CY 2022. The 2020 CMS-HCC model improved predictions over the range of predicted costs grouped by deciles (all beneficiaries in the model sample sorted into ten equal groups by predicted cost). The finalized count model added a set of individual model variables for counts of payment HCCs to the base 2020 CMS-HCC model (V24). The first of the count variables included in the model corresponds to the lowest positive and statistically significant payment HCC count in each segment (e.g., 5 payment HCCs). The last count variable indicates 10 or more payment HCCs. To identify the lower threshold, separate regressions were run with individual HCC count variables starting at 1, 2, 3 and so on to determine the number that made the lowest variable positive and statistically significant. The HCC count variable was stopped at 10 or more payment HCCs because additional variables resulted in reduced HCC risk adjustment model factors for a few community segments and we were concerned that, if we included all count variables that met the statistical criteria, the clinical nature of the model would be compromised.

The 2024 CMS-HCC model continues to meet this 21st Century Cures Act requirement through the continued use of the count variables. Like the 2020 CMS-HCC model, the 2024 CMS-HCC model includes variables for counts of payment HCCs for each of the model segments, with the first count variable included in a segment corresponding to the lowest positive and statistically significant payment HCC count in that segment. As a result, the six community segments include variables for counts of 5 through 10 or more payment HCCs, while the institutional segment includes one variable for a count of 10 or more payment HCCs.

2.6 CMS-HCC Model Segments

Predicting expenditures accurately for selected subgroups of Medicare beneficiaries is a fundamental goal of the risk adjustment model. This is why the CMS-HCC model differentiates between aged versus disabled, community residing versus long term institutional (i.e., nursing home), Medicare-Medicaid dual statuses (full benefit dual, partial benefit dual, and non-dual), and continuing enrollees versus new Medicare enrollees. Depending on the size and characteristics of the beneficiary subgroup, the cost predicted by the model will vary more or less around the actual average cost of the group. This is a result of the model's goal of predicting well on average for subgroups of beneficiaries, particularly those defined by a model segment. Some smaller subgroups that are defined by characteristics outside of the model, or whose health status is significantly different from the average, may be over or under predicted.

2.6.1 Institutional and Community Full Benefit Dual, Partial Benefit Dual, or Non-dual Model Segments

Medicare beneficiaries differ along characteristics that are important for risk adjustment. The risk adjustment model is divided into segments (see **Table 2-4**) to account for differences in

cost associated with these characteristics. One such characteristic is community versus institutional residence. About 2.6 percent of Medicare beneficiaries in the 2018-2019 model sample are long term residents in institutions, primarily nursing facilities (**Table 2-4**). Institutionalized beneficiaries are allowed to enroll, or remain enrolled, in MA plans. Another characteristic is Medicare-Medicaid dual eligibility. About 18 percent of Medicare FFS beneficiaries in the 2018-2019 model sample are dual eligible (**Table 2-4**). This group includes individuals who enrolled in Medicare Part A and/or Part B and receive Medicaid benefits and/or assistance with Medicare premiums. A third characteristic is the reason for entitlement to Medicare. About 14.6 percent of Medicare FFS beneficiaries in the 2018-2019 model sample are entitled to Medicare because they have a qualifying disability (**Table 2-4**).[28]

Table 2-4
2018-2019 Model Sample Counts

Population Segment	Number	Percentage
Community		
Non-dual aged	21,546,966	73.47%
Non-dual disabled	1,756,602	5.99%
Partial benefit dual aged	835,591	2.85%
Partial benefit dual disabled	699,747	2.39%
Full benefit dual aged	1,911,183	6.52%
Full benefit dual disabled	1,826,784	6.23%
Institutional	750,772	2.56%
Total Medicare FFS beneficiaries	29,327,645	

Table 2-4 Notes: Aged/disabled continuing enrollees are defined by (i) payment year criteria: at least one month of Part A, Part B, non-HMO, non-ESRD, non-MSP, non-Hospice, original reason for entitlement either age or disability, US residence, no Kidney Transplant Status (assigned using base year diagnosis codes); (ii) base year criteria: Part A and Part B enrollment for all 12 months, no months of HMO or ESRD, original reason for entitlement either age or disability, US residence, no Kidney Transplant Status (assigned using base year diagnosis codes). At least 1 month of institutional status in payment year is also required for institutional beneficiaries.
SOURCE: RTI International.

Separate CMS-HCC model segments for aged or disabled community and institutional residents have existed since the implementation of the first CMS-HCC risk adjustment model. Community and institutional enrollees have different cost patterns. Among the aged or disabled population, institutional residents are about twice as expensive as community residents, $22,916 in mean annual expenditures compared to $10,718 (2019 FFS expenditure data). In general, the costs of beneficiaries in facilities tend to be higher than the costs of beneficiaries not in facilities because they often have more medical conditions, and/or higher severity of their conditions. To recognize the medical characteristics of the institutional population, the institutional segment includes additional disease-disabled status interactions that are not present in community segments. For example, the disabled-skin ulcer interaction is unique to the institutional segment to reflect the higher incremental expenditures of the conditions among the institutional

[28] It should be noted that both aged and disabled beneficiaries can be clinically disabled. The definition used here for aged and disabled is a Medicare enrollment definition, i.e., whether a beneficiary's current reason for Medicare entitlement is due to age (beneficiaries age 65+) or due to disability (beneficiaries age 0-64).

population entitled by disability. In the 2024 CMS-HCC model (V28) finalized for CY 2024, both community and institutional segments include 115 payment HCCs.

Separate CMS-HCC community segments based on aged/disabled status and dual status have existed since the implementation of the CMS-HCC risk adjustment model in CY 2017 (the 2017 CMS-HCC model (segmented V22)). The six community segments are:

- Non-Dual Aged,
- Non-Dual Disabled,
- Full Benefit Dual Aged,
- Full Benefit Dual Disabled,
- Partial Benefit Dual Aged, and
- Partial Benefit Dual Disabled.

Separate model segments for these populations were created to improve accuracy of payments to MA plans, which were increasingly specializing in dual eligible beneficiaries. Dual eligibility status is measured in the payment year, which is consistent with MA plans experiencing enrollment of dual eligible beneficiaries throughout the payment year.

2.6.2 Aged and Disabled New Enrollees

The CMS-HCC model is a prospective model (year 1 [base year] diagnoses are used to predict the year 2 [payment year] expenditures) and requires a complete 12-month base year diagnostic profile. For purposes of calibrating the model, beneficiaries without 12 months of Part A and Part B base year Medicare enrollment, but at least one month of payment year enrollment, are defined for risk adjustment purposes as "new enrollees." This new enrollee definition includes new entrants to the Medicare program as well as beneficiaries without a full year of prior diagnosis information.

New entrants to the Medicare program: The majority of new enrollees are newly eligible for Medicare by age, having reached the qualifying age of 65. New enrollees may be under age 65 if they become eligible for Medicare by disability or ESRD status. They may be over age 65 if they delay Medicare enrollment.

Other beneficiaries without 12 months of Part B: Not all new enrollees for purposes of the risk adjustment model are new entrants to the Medicare program. Some are those who do not enroll in Part B, so they do not have a full year of prior diagnosis information. For example, a beneficiary might be entitled by age to Part A (hospital insurance) at age 65, but might not enroll in Part B, or enroll and pay the Part B (supplementary medical insurance) premium at an older age.[29]

Because new enrollees do not have a full year of diagnostic information, CMS developed a demographic model to predict expenditures for new enrollees. New enrollee scores are the same for both community and institutional beneficiaries. The new enrollee segment of the CMS-HCC risk adjustment model is used to calculate risk scores for beneficiaries enrolling in MA plans who do not have 12 months of Part B data collection year for risk score calculation. The same demographic factors from the CMS-HCC model—age, sex, Medicaid, and originally

[29] This distinction between Part A and Part B enrollment applies to the FFS calibration sample. Enrollment in Medicare Advantage requires both Part A and Part B coverage.

disabled—are used to predict expenditures in the new enrollee model. Both community and institutional residents are included in the sample. The age-sex breakouts for the new enrollee model include individual factors for ages 65, 66, 67, 68, and 69, rather than the five-year grouping that occurs in the continuing enrollee models, to allow the cost weights for these ages (where most new enrollees are concentrated) to be as accurate as possible. As with the continuing enrollee models, Medicaid status for the new enrollee model is measured in the payment year, rather than the base year, because CMS does not look at data prior to a beneficiary's entitlement to Medicare and, since most new enrollees are new to Medicare, we look to the payment year for Medicaid status.

2.6.3 New Enrollees in Chronic Condition Special Needs Plans

Under the Medicare Modernization Act of 2003 (MMA), Congress created a new type of MA plan focused on coordinating care for beneficiaries with special needs, called a Special Needs Plan (SNP). These plans provide targeted care to individuals with special needs, identified by Congress as those who: (1) are institutionalized (nursing home or nursing home certifiable); (2) are dually eligible for both Medicaid and Medicare; and/or (3) have severe or disabling chronic conditions. Further legislation, the Medicare Improvements for Patients and Providers Act (MIPPA) of 2008, restricted enrollment in Chronic Condition SNPs (C-SNPs) and mandated that CMS convene a panel of clinical advisors to determine the SNP-specific chronic conditions that meet the definition of severe or disabling. That panel identified 15 SNP-specific chronic conditions, shown in **Table 2-5**.[30]

As was discussed previously, enrollees who are new to Medicare lack the full base year diagnosis data needed for the CMS-HCC model to predict their expenditures in the next year and therefore are risk adjusted using a demographic only new enrollee model. New enrollees who enroll in a C-SNP are likely to have more diseases than the average Medicare new enrollee, or at least one of the targeted chronic condition diseases, and thus pose a greater risk of higher expenditures to these C-SNPs. To account for these differences, CMS implemented in 2011 a C-SNP New Enrollee model. The risk adjustment model factors in the C-SNP New Enrollee model segment are calibrated by taking the predicted risk scores of continuing enrollees enrolled in C-SNPs and adjusting the model factors of the new enrollee demographic variables – 108 mutually exclusive age-sex categories, Medicaid status, and originally disabled status – for the average risk faced by C-SNPs. Only continuing enrollees were used in the sample because they had risk scores calculated with model factors that reflected their morbidity. Risk adjustment model factors in the C-SNP new enrollee model are obtained by dividing coefficient estimates by the national average predicted expenditures used for all the aged/disabled MA models. Risk scores are used to adjust MA capitation payments for new enrollees in C-SNP plans.

[30] Centers for Medicare & Medicaid Services (CMS). "Chronic Condition Special Needs Plans (C-SNPs)." CMS.gov Centers for Medicare & Medicaid Services, 10 Aug. 2016, www.cms.gov/Medicare/Health-Plans/SpecialNeedsPlans/C-SNPs.html.

Table 2-5
Chronic Conditions Covered by Special Needs Plans

1. Chronic alcohol and other drug dependence
2. Autoimmune disorders, limited to: Polyarteritis nodosa, Polymyalgia rheumatica, Polymyositis, Rheumatoid arthritis, and Systemic lupus erythematosus
3. Cancer, excluding pre-cancer conditions or in situ status
4. Cardiovascular disorders, limited to: Cardiac arrhythmias, Coronary artery disease, Peripheral vascular disease, and Chronic venous thromboembolic disorder
5. Chronic heart failure
6. Dementia
7. Diabetes mellitus
8. End-stage liver disease
9. End-stage renal disease requiring dialysis
10. Severe hematologic disorders, limited to: Aplastic anemia, Hemophilia, Immune thrombocytopenic purpura, Myelodysplastic syndrome, Sickle-cell disease (excluding sickle-cell trait)
11. HIV/AIDS
12. Chronic lung disorders, limited to: Asthma, Chronic bronchitis, Emphysema, Pulmonary fibrosis, and Pulmonary hypertension
13. Chronic and disabling mental health conditions, limited to: Bipolar disorders, Major depressive disorders, Paranoid disorder, Schizophrenia, and Schizoaffective disorder
14. Neurologic disorders, limited to: Amyotrophic lateral sclerosis (ALS), Epilepsy, Extensive paralysis (i.e., hemiplegia, quadriplegia, paraplegia, monoplegia), Huntington's disease, Multiple sclerosis, Parkinson's disease, Polyneuropathy, Spinal stenosis, and Stroke-related neurologic deficit
15. Stroke

SOURCE: Centers for Medicare & Medicaid Services. Available at https://www.cms.gov/Medicare/Health-Plans/SpecialNeedsPlans/C-SNPs.html.

2.7 End Stage Renal Disease (ESRD) Models

People with ESRD (permanent kidney failure requiring dialysis or kidney transplant) are eligible for Medicare regardless of their age. Although the ESRD population is small—approximately 1 percent of all Medicare enrollees—these Medicare beneficiaries have extensive health needs and high medical expenditures that distinguish them from those who are eligible for Medicare by age or disabled status. For example, continuing enrollees on dialysis have mean annual medical expenditures of $89,882 (2019 FFS expenditure data). It has also been shown that the incremental costs of other medical conditions for this population are quite different from those in the non-dialysis population. For this reason, separate risk adjustment models are applied to the ESRD population.

ESRD beneficiaries are categorized into three groups based on treatment status: dialysis, transplant (initial 3 months), and functioning graft (from 4 months post-graft). Brief descriptions of each group and the models associated with them are given below. Previously, persons in dialysis status could not join an MA plan, except under certain circumstances, such as when it was a C-SNP specific to ESRD. Beneficiaries who were already enrolled in an MA plan when they developed ESRD could remain in their plan. But with the implementation of the 21st Century Cures Act, starting in 2021, ESRD patients have the option to enroll in MA plans of their choosing. Risk adjusting payment by ESRD treatment status avoids problematic incentives in specialty MA plans for ESRD beneficiaries. Without adequate risk adjustment, plans might

enroll lower cost functioning graft patients and avoid higher-cost dialysis patients or those likely to have a transplant.

There are separate ESRD models for the dialysis, transplant, and functioning graft populations—the dialysis and functioning graft models are HCC based; the kidney transplant factors are based on average costs of ESRD beneficiaries who have had a kidney transplant and are applied over three months to cover the high costs for the transplant and the immediate post-transplant services. Beneficiaries are assigned to a model based on the ESRD designation for each month of the payment year.

For CY 2023, CMS implemented a revised ESRD risk adjustment model.[31] As discussed in Sections 2.7.1, 2.7.2, and 2.7.3, the revised model includes several updates, primarily an update in the modeling sample years and an update to the clinical classification of HCCs used in the 2020 CMS-HCC model (V24). The revisions included in the 2023 ESRD model are described below.

2.7.1 ESRD Dialysis Models

There are two ESRD dialysis model segments: continuing enrollee and new enrollee. The dialysis continuing enrollee model segment is based on the 2020 CMS-HCC model classification (V24) and is calibrated on the population of ESRD continuing enrollees with qualifying dialysis months. It includes demographic variables (age-sex categories, full benefit dual status, partial benefit dual status, institutional status, originally disabled status, and originally ESRD status) and variables to predict the incremental costs of comorbidities (HCCs, disease interactions, and disease-non-aged interactions).[32]

The 2023 dialysis new enrollee model segment has four mutually exclusive assignments with age-sex breakouts (Non-dual or Partial Benefit Dual & Not Originally Disabled; Full Benefit Dual & Not Originally Disabled; Non-dual or Partial Benefit Dual & Originally Disabled; and Full Benefit Dual & Originally Disabled). Similar to the new enrollee models described earlier in this report, the new enrollee dialysis model uses only demographic variables to predict costs for beneficiaries on dialysis who do not have a full year of diagnostic information needed to apply the full risk adjustment model. Because the new enrollee dialysis population is too small to reliably estimate predicted costs for a large number of demographic categories, the modeling sample contains a mix of ESRD new enrollees and ESRD continuing enrollees who have been on dialysis for no more than 36 months in the most recent four years and with no history of kidney transplant (and are thus thought to be closer in costs to new enrollees). The demographic model contains 80 mutually exclusive demographic variables that encompass age-sex categories, dual eligibility status, and originally disabled status.

Because the population of new enrollees receiving dialysis is too small to reliably estimate a model, the model sample also includes continuing enrollees who have been on dialysis

[31] Announcement of Calendar Year (CY) 2023 Medicare Advantage (MA) Capitation Rates and Part C and Part D Payment Policies

[32] The originally disabled variables predict cost differences for beneficiaries who are currently age 65 or older and originally entered Medicare before age 65 due to a condition other than ESRD. The originally ESRD variables predict cost differences for beneficiaries who are currently age 65 or older and originally entered Medicare before age 65 due to ESRD and not disabled status. The disease-non-aged interactions predict incremental cost differences of diseases for the non-aged (age < 65) subpopulation.

for 3 years or less to increase its sample size. Because the costs for continuing enrollees are higher than for new enrollees, the 2019 ESRD risk adjustment model for dialysis new enrollees over predicted dialysis new enrollee expenditures by about 15 percent. To address that over prediction CMS applied an actuarial adjustment, dividing new enrollee demographic factors in the 2020 ESRD Dialysis model by 1.149. As reported in the December 2021 Report to Congress,[33] the overall sample predictive ratio (i.e., the ratio of the average predicted cost to the average actual cost) of the 2020 ESRD risk adjustment model for dialysis new enrollees is 1.000 after actuarial adjustment, representing perfect prediction of the average.

The 2023 ESRD risk adjustment model for dialysis new enrollees removed the actuarial adjustment for the dialysis new enrollee segment and instead adjusted the data for continuing enrollee expenditures included in the model so that they are more similar to those of true new enrollees. After analyzing differences in costs between new and continuing enrollees by age, sex, and reason for Medicare entitlement we found distinct differences between those entitled to Medicare due to age versus those entitled to Medicare because of a disability or health condition. Multipliers of 0.827 for non-aged enrollees and 0.900 for aged enrollees were applied to the continuing enrollee expenditures before modeling. This effectively adjusts each demographic age/sex coefficient separately, taking into account the proportion of continuing enrollees in that category. Unlike the actuarial adjustment used in the 2020 ESRD model for dialysis new enrollees, the adjustment used for the 2023 ESRD model accounts for the distribution of continuing enrollees by age, sex, or reason for entitlement. The overall sample predictive ratio is 0.971 under the 2023 ESRD model for dialysis new enrollees.

2.7.2 Kidney Transplant

The kidney transplant factors are based on average costs of ESRD beneficiaries (in 2015 for the 2020 ESRD model and 2019 for the 2023 ESRD model) who have had a kidney transplant. The kidney transplant factor for month 1 estimates the cost of the entire transplant stay (not just the first month of a longer stay). The kidney transplant factor for months 2 and 3 estimates the costs for each of the two months following discharge, which are higher on average than later months (4 months post-graft and beyond). CMS makes payment by determining the month of transplant and paying the three lump sum monthly amounts over the three-month period starting with the transplant month.

2.7.3 ESRD Functioning Graft Models with Post-Graft Factors

There are six functioning graft model segments in the 2023 ESRD model, which predict costs for ESRD beneficiaries who have a functioning graft and whose time since kidney transplant is 4 months or more: community continuing enrollee (non-dual or partial benefit dual, aged), community continuing enrollee (full benefit dual, aged), community continuing enrollee (non-dual or partial benefit dual, non-aged), community continuing enrollee (full benefit dual, non-aged), institutional continuing enrollee, and new enrollee. The combined sample size of the functioning graft continuing enrollee population, approximately 100,000, is too small on which to reliably estimate a full regression model. Instead, the four community continuing enrollee functioning graft segments start with values for most risk factors (demographic variables, HCCs, disease interactions, and disease-non-aged interactions) from a 2020 CMS-HCC model (V24)

[33] Report to Congress: Risk Adjustment in Medicare Advantage, December 2021

estimated on non-ESRD aged-disabled community populations. The model is then modified by estimating risk adjustment model post-graft factors to capture the extra costs of being in a post-graft period. The 2023 ESRD functioning graft model accounts for differences in cost patterns for dual eligible beneficiaries by breaking out the previous single functioning graft community model into four separate model segments (listed above) with relative factors that are independently developed for each segment, reflecting the specific relative costs for that subgroup. In the two community continuing enrollee segments where non-dual and partial benefit dual beneficiaries are combined, a partial benefit dual factor is estimated within each segment to differentiate their costs from non-dual beneficiaries.

The model also estimates eight post-graft factors to capture the differing predicted costs of post-graft ESRD beneficiaries based on age, dual status, and time since transplant. All eight post-graft factors are estimated on the four community functioning graft segments, and then used for the institutional continuing enrollee and new enrollee segments. The 2020 ESRD functioning graft model had four post-graft factors, with no further breakouts based on dual status.

2023 ESRD functioning graft model post-graft factors:

- Non-dual/Partial Benefit Dual, Age 65+, duration since transplant of 4–9 months
- Full Benefit Dual, Age 65+, duration since transplant of 4–9 months
- Non-dual/Partial Benefit Dual, Age < 65, duration since transplant of 4–9 months
- Full Benefit Dual, Age < 65, duration since transplant of 4–9 months
- Non-dual/Partial Benefit Dual, Age 65+, duration since transplant of 10+ months
- Full Benefit Dual, Age 65+, duration since transplant of 10+ months
- Non-dual/Partial Benefit Dual, Age < 65, duration since transplant of 10+ months
- Full Benefit Dual, Age < 65, duration since transplant of 10+ months

Similarly, the functioning graft institutional continuing enrollee model segment uses most factors from the 2020 CMS-HCC model (V24) estimated on the non-ESRD aged-disabled institutional population—demographic variables, HCCs, disease interactions, and disease non-aged interactions.

It also includes the eight post-graft factors to capture additional post-transplant costs (carried forward from the four community continuing enrollee functioning graft segments), two partial benefit dual factors (carried forward from two of the community continuing enrollee functioning graft segments). Two institutional status factors (aged and non-aged) are estimated on this segment.

The sample size of true functioning graft new enrollees is also too small to independently estimate a demographics-only regression model or the functioning graft factors. Therefore, the functioning graft new enrollee model segment starts with the factors from a CMS-HCC model estimated on the non-ESRD aged-disabled new enrollee population—108 mutually exclusive demographic variables that encompass age-sex categories, dual eligibility status, and originally disabled status. It then adds to each non-ESRD base factor the same eight post-graft factors from the functioning graft community continuing enrollee model segments to capture additional costs

of functioning graft new enrollees.[34] The 2023 ESRD new enrollee functioning graft model has actuarial adjustments applied to a beneficiary's summed risk score, based on months since transplant, to account for cost differences.

In the December 2021 Report to Congress,[35] the overall sample predictive ratio under the 2020 ESRD risk adjustment model for functioning graft new enrollees was 1.000, representing perfect prediction of the average after actuarial adjustment. To address previous under prediction in the 2019 ESRD model CMS applied one actuarial adjustment to the functioning graft new enrollee segment in the 2020 ESRD model. Specifically, CMS adjusted the coefficients in the functioning graft new enrollee segment by the applicable predictive ratio to set the entire segment predictive ratio to 1.0 – all coefficients in the functioning graft new enrollee segment of the model were divided by 0.806. For the 2023 ESRD model, we examined the under prediction of functioning graft new enrollees for beneficiaries in 4–9 months post-transplant status versus 10+ months post-transplant status. The 10+ months sample has higher under prediction than the 4–9 months sample. To address this differential underprediction between the two subpopulations, CMS applies separate adjustments to the 4–9 months sample (by dividing all relative factors by 0.905) and the 10+ months sample (by dividing all relative factors by 0.698). The overall sample predictive ratio under the 2023 ESRD model for functioning graft new enrollees is 1.000, representing perfect prediction.

Similarly, in the December 2021 Report to Congress, the overall sample predictive ratio under the 2020 ESRD risk adjustment model for functioning graft institutional continuing enrollees was 1.000, representing perfect prediction of the average after actuarial adjustment. An actuarial adjustment was applied to the 2020 ESRD model for the functioning graft institutional segment to achieve perfect prediction. As with the functioning graft new enrollee segment, coefficients in the functioning graft institutional segment were adjusted by the applicable predictive ratio such that all coefficients in the functioning graft institutional segment were divided by 0.836. The aged and non-aged institutional status factors added to the 2023 ESRD model during model estimation capture the differential costs of the functioning graft institutional population and eliminate the need for an actuarial adjustment for the institutional segment of the model. The overall sample predictive ratio under the 2023 ESRD model for functioning graft institutional continuing enrollees is 1.000, representing perfect prediction.

2.7.4 ESRD Model Statistics

Table 2-6 presents the explanatory power as measured by R^2 for segments of the most recent ESRD models. The subset of ESRD model segments included are those that were estimated on the ESRD subpopulations, for which there are R^2 statistics. The ESRD models finalized for 2020 and 2023, the focus of this evaluation, used the 2020 ESRD CMS-HCC model (V21) calibrated on 2014 diagnosis and 2015 expenditure data, and the 2023 ESRD CMS-HCC model (V24) calibrated on 2018 and 2019 diagnosis and expenditure data, respectively. The 2023 ESRD model roughly maintained the explanatory power of individual variation in beneficiaries' expenditures in each of the models.

[34] For additional information see Levy, J.M., Robst, J., and Ingber, M.J.: Risk-Adjustment System for the Medicare Capitated ESRD Program. Health Care Financing Review 27(4):53-69, Summer 2006. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4194965/

[35] Report to Congress: Risk Adjustment in Medicare Advantage, December, 2021

As noted previously, although CMS uses predictive ratios (the ratio of predicted expenditures to actual expenditures) as the standard metric to evaluate the accuracy of CMS-HCC risk adjustment models, the R^2 is provided as a statistical measure of the variance in individual expenditures that can be predicted by the model. Sections 3 and 5 provide further detail on the ESRD model predictive ratios, which measure the ability of the models to accurately predict expenditures for large subgroups, consistent with the primary goal for the ESRD risk adjustment models.

Table 2-6
ESRD risk adjustment model R^2 statistics[1]

Risk adjustment model	Payment years[2]	R^2
2007 ESRD CMS-HCC Models (2003 calibration)	2007-2011	
Dialysis Continuing Enrollee		0.0796
Dialysis New Enrollee		0.0168
Functioning Graft Community Continuing Enrollee		0.0680
2012 ESRD CMS-HCC Models (Version 21, 2007 calibration)	2012-2018	
Dialysis Continuing Enrollee		0.1134
Dialysis New Enrollee		0.0212
Functioning Graft Community Continuing Enrollee		0.0872
2019 ESRD CMS-HCC Models (Version 21, 2015 calibration)	2019-2021	
Dialysis Continuing Enrollee		0.1385
Dialysis New Enrollee		0.0264
Functioning Graft Community Continuing Enrollee		0.1039
2020 ESRD CMS-HCC Models (Version 21, 2015 calibration)	2020-2022	
Dialysis Continuing Enrollee		0.1385
Dialysis New Enrollee		0.0264
Functioning Graft Community Continuing Enrollee		0.1039
2023 ESRD CMS-HCC Models (Version 24, 2019 calibration)	2023-2024	
Dialysis Continuing Enrollee		0.1262
Dialysis New Enrollee		0.0226
Functioning Graft Community Continuing Enrollee, Non-dual/Partial Benefit Dual, Aged		0.0833
Functioning Graft Community Continuing Enrollee, Full Benefit Dual, Aged		0.1012

(continued)

Table 2-6 ESRD risk adjustment model R^2 statistics[1] (continued)

Risk adjustment model	Payment years[2]	R^2
Functioning Graft Community Continuing Enrollee, Non-dual/Partial Benefit D, Non-aged		0.0823
Functioning Graft Community Continuing Enrollee, Full Benefit Dual, Non-aged		0.0963

Table 2-6 Notes:
[1.] The R^2 statistic refers to the proportion of variation in individual expenditures explained by the model.
[2.] Payment years listed are for non-PACE organizations.
SOURCE: RTI analysis of Medicare claims and enrollment data—2002-2003, 2006-2007, 2014-2015, and 2018-2019 full 100% ESRD samples.

2.8 Frailty Adjustment to the CMS-HCC Models for Fully Integrated Dual Eligible (FIDE) Special Needs Plans (SNPs)

Section 1894(d)(2) of the Act requires CMS to take into account the frailty of the PACE population when making payments to PACE organizations. Section 1853(a)(1)(B)(iv) allows CMS to make an additional payment adjustment that takes into account the frailty of Fully Integrated Dual Eligible (FIDE) Special Needs Plans (SNPs) if the FIDE SNP has similar average levels of frailty to the PACE program. The purpose of frailty adjustment is to predict the Medicare expenditures of community beneficiaries with functional impairments that are unexplained by the demographic and diagnosis information in the risk adjustment model alone. CMS has applied a frailty adjustment to payments for enrollees in PACE organizations since 2004, as required by Section 1894(d)(2) of the Act and started applying a frailty adjustment to qualifying FIDE SNPs in 2012.[36]

For frailty adjustment, functional status is used to measure frailty, defined by difficulty in performing activities of daily living (ADLs): bathing, dressing, eating, getting in or out of chairs, walking, and using the toilet. To estimate the frailty factors, which are used to determine the frailty adjustment, CMS regresses residual expenditures (actual Medicare expenditures minus expenditures predicted by the CMS-HCC model) on counts of ADLs in the previous year. Because ADLs are not available from Medicare administrative claims data, CMS uses ADL counts from the Consumer Assessment of Health Plans Survey (CAHPS) data to calibrate the frailty factors. The CMS-HCC frailty factors use a scale based on the number of ADL difficulties, which are categorized into 5-6, 3-4, 1-2, and 0 difficulties. Prior to CY 2022, there were two sets of ADL categories based on Medicaid status (Medicaid and Non-Medicaid). For CY 2022, CMS finalized frailty factors associated with the 2020 CMS-HCC model for FIDE SNPs that have three sets of ADL categories based on Medicaid status (Full Medicaid, Partial Medicaid, and Non-Medicaid) using the 2014 CAHPS.[37] For CY 2024, CMS updated the frailty

[36] Kautter, J., and Pope, G.C.: CMS Frailty Adjustment Model. Health Care Financing Review 26(2):1-19, Winter 2004-2005 Available at https://www.cms.gov/research-statistics-data-and-systems/research/healthcarefinancingreview/downloads/04-05winterpg1.pdf

[37] Announcement of Calendar Year (CY) 2022 Medicare Advantage (MA) Capitation Rates and Part C and Part D Payment Policies

factors to align with the 2024 CMS-HCC model using the 2018 CAHPS.[38] Frailty factors are obtained by dividing the coefficient estimate for each ADL count/Medicaid status category by the weighted mean annualized expenditure for the entire CAHPS sample. The majority of frailty factors are negative for the lowest count category, 0 ADLs, because the CMS-HCC model over predicts for this subset. The remaining frailty factors are positive and increase as the level of frailty increases, as measured by ADL counts.

In payment, the frailty adjustment applies to aged or disabled community-residing beneficiaries aged 55 or older enrolled in qualifying FIDE SNPs. To be considered for a frailty adjustment, FIDE SNPs must participate in either the Health Outcomes Survey-Modified (HOS-M) or the Health Outcomes Survey (HOS) for the collection of ADL data, which are used to measure the plan's level of frailty. For qualifying FIDE SNPs, the frailty adjustment is made at the Plan Benefit Package level and is based on the proportion of beneficiaries in each ADL count category (0 ADLs, 1-2 ADLs, 3-4 ADLs, and 5-6 ADLs), stratified by dual status (full benefit dual, partial benefit dual, and non-Medicaid). Under Section 1853(a)(1)(B)(iv) of the Act, only FIDE SNPs with "similar average levels of frailty… as the PACE program" can receive frailty adjusted payments. Compared to MA plans, PACE organizations typically have a greater proportion of enrollees with non-zero ADL counts, with an expected net effect of a positive factor and an overall increase in monthly capitation payments.

[38] Announcement of Calendar Year (CY) 2024 Medicare Advantage (MA) Capitation Rates and Part C and Part D Payment Policies

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Section 3.
MODEL EVALUATION

This section presents a quantitative evaluation of the CMS-HCC aged-disabled and ESRD risk adjustment models. Risk adjustment models are typically evaluated with two key statistics: predictive ratios and the R^2. The predictive ratio is the ratio of predicted expenditures to actual expenditures for a group or large subgroup and measures the ability of the model to predict average expenditures over the entire group or subgroups, whereas the R^2 measures the extent to which the model can explain differences in expenditures between individuals. Given the CMS-HCC model's goal of predicting expenditures over large subgroups – it is not intended to predict accurately for individuals or small subgroups of beneficiaries – CMS uses predictive ratios as the primary measure of accuracy for the CMS-HCC models. The R^2 is less relevant in assessing the predictive accuracy of the model because it measures the model performance based on how well the model explains variation in spending across individuals (rather than groups).

Though not a primary factor when determining the model's specification, the R^2 (the individual explanatory power of the model) can be assessed in conjunction with predictive ratios because models that explain little variation in expenditures between individuals may still accurately predict the expenditures for groups or subgroups of beneficiaries. For example, a simple risk adjustment model may accurately predict (i.e., predictive ratio close to 1.0) the average expenditure for a large group of beneficiaries because the prediction errors will average out across the group. However, the model may fail to differentiate between high and low individual expenditures within the group. This is the case with the demographic risk adjustment model implemented in the original capitated payment methodology, the AAPCC, where the predictive ratios can be equal or close to 1.0 for subgroups of beneficiaries defined by age and sex, which are the main building blocks of the AAPCC system. However, the AAPCC model R^2 is very low, indicating there remains significant unexplained variation that is correlated with risk factors observable to MA organizations, hence creating considerable scope for risk selection. Each segment of the CMS-HCC model, which has a considerably greater R^2 than the demographic model used for new enrollees (described in Section 2.2), may have predictive ratios that are not equal to 1.0; however, this model is superior in its ability to distinguish high and low expenditure individuals and thus opportunities for risk selection by MA organizations are more limited. As such, the R^2 is provided for the current and historical CMS-HCC and ESRD models in Section 2.2 (**Table 2-1**) and Section 2.7.4 (**Table 2-6**), respectively, as a statistical measure of the individual variance that can be predicted by the model. However, a primary goal of risk adjustment is achieving predictive ratios close to 1.0 to accurately predict expenditures over groups or large subgroups.

The subgroups for which predictive ratios are computed should be meaningful for evaluating payments (e.g., related to types of adverse or favorable selection of enrollees into health plans). This report presents predictive ratios for subgroups within the model's sample defined by predicted medical expenditures, individual HCCs and disease groups, counts of chronic conditions, and counts of payment HCCs. Sections 3.2, 3.4, and 3.5 discuss predictive ratios and analyses for the CMS-HCC aged-disabled, ESRD dialysis, and ESRD functioning graft models, respectively. Tables of specific predictive ratios are presented in Section 5, with accompanying discussions of relevant methodological and analytical explanations of the results in this section.

3.1 Methodology

3.1.1 Calculating Predictive Ratios

A predictive ratio for any subgroup is the predicted expenditures for members of a group for the period they are in the group, divided by the actual expenditures for those members. As described in Section 2, predicted and actual expenditures for a beneficiary may vary if a person's Medicaid coverage or health status (e.g., able to reside in the community vs. living in a long term care institution) changes during the year: for example, a beneficiary may spend all of the year as a non-dual eligible, or may be dual eligible (either full benefit or partial benefit dual) for part of the year. A predictive ratio may be calculated for beneficiaries over the whole year, or for time spent in particular model segments (summarized in **Table 2-1**). Each model segment is estimated using only months each beneficiary spends in the segment. To calculate a full year predictive ratio for a beneficiary in more than one segment in a year, the total actual and predicted expenditures in each segment must be summed.

For a beneficiary, total actual expenditures are the sum of expenditures over the months a beneficiary is in each segment. Calculating total predicted expenditures is somewhat more complicated because the predicted expenditures from each segment are annualized; thus, total predicted expenditures is the sum across segments of the predicted expenditures in each segment, multiplied by the fraction of the year the beneficiary was in each segment. For example, for a continuing enrollee beneficiary with 10 months in the community with partial benefit dual status, 1 month in the community with full benefit dual status, and 1 month in long term institutionalized status, total predicted expenditures would be the sum of 10/12 of the partial benefit dual predicted expenditures, 1/12 of the full benefit dual predicted expenditures, and 1/12 of the long term institutionalized predicted expenditures. If the beneficiary died after the first 10 months of the year, the predictive ratio would be the ratio of 10/12 of the total predicted expenditures to the actual expenditures for those 10 months.

We provide two tables to illustrate. **Table 5-1**, Predictive ratios by deciles of predicted risk for all aged-disabled enrollees, presents predictive ratios for aged-disabled beneficiaries overall, including all periods beneficiaries spent in all segments. **Table 5-4**, Predictive ratios by deciles of predicted risk for aged-disabled community continuing enrollees, provides predictive ratios for the periods that continuing enrollee beneficiaries are in the community. Predicted and actual expenditures for the months continuing enrollee beneficiaries spend in institutional status are omitted from this table to focus on the very large proportion of months Medicare pays for enrollees residing in the community.

3.1.2 Defining Chronic Conditions

The 21st Century Cures Act directs that this report should include predictive ratios for groups of beneficiaries defined by the number of chronic conditions they may have. To assess the performance of the risk adjustment models for beneficiaries with chronic conditions, we must identify beneficiaries' chronic conditions. Definitions of chronic conditions vary widely. Some recurrent themes include prolonged course of illness (duration at least three months or longer, and usually twelve months or longer), functional limitations and ongoing medical care, and the

absence of a cure for the condition.[39] The U.S. Department of Health and Human Services (HHS) defines chronic conditions as "conditions that last a year or more and require ongoing medical attention and/or limit activities of daily living"; chronic conditions include both physical conditions, such as arthritis, cancer, and HIV infection, as well as mental health and cognitive disorders, such as ongoing depression, substance addiction, and dementia.[40] Goodman et al. summarize the World Health Organization's definition, which characterizes chronic conditions as having "uncertain etiology, multiple risk factors, a long latency period, a prolonged course of illness, noncontagious origin, functional impairment or disability, and incurability". The National Center for Health Statistics defines as chronic "[…] conditions that are not cured once acquired (such as heart disease, diabetes, and birth defects in the original response categories, and amputee and old age in the ad hoc categories)" or conditions "[…] present for 3 months or longer."[41]

The lack of a unanimous definition for "chronic condition" required empirical analyses and clinical judgment to determine which conditions in the CMS-HCC model's hierarchical condition categories (HCCs) to count as chronic. With the three methods outlined below, each unique condition and condition category–a grouping of clinically similar diagnosis codes–was classified as chronic if all methods were satisfied (otherwise input from clinicians was used to make final determinations).

1. First, we weighted each diagnosis code in each HCC by the number of beneficiaries in our model sample with that diagnosis code. We then identified which diagnoses were chronic with the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP) Chronic Condition Indicator Refined (CCIR) for ICD-10-CM.[42] CCIR categorizes each diagnosis code as either chronic or non-chronic. In some cases, many diagnoses codes map to a single HCC and, while diagnoses within an HCC are clinically similar, not all diagnoses in an HCC are considered chronic by AHRQ's CCIR. For each included HCC, the count of unique beneficiary-chronic diagnosis code combinations was divided by the total count of unique beneficiary diagnosis code combinations within an HCC based on the Medicare 2018 community sample. When the resulting percentage was larger than 51%, the condition category was classified as chronic.
2. The second empirical method relied on the duration of a condition to determine its chronicity. The number of individuals with a condition category in two consecutive years (Medicare 2018–2019 sample) was divided by the number of individuals with the condition category in the base year (2018). Condition categories were categorized as chronic when more than 51% of beneficiaries with the HCC were coded in 2018 and 2019.
3. The third empirical method compared the multiple regression model coefficient for the condition category using a prospective model to the coefficient using a concurrent model.

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[39] Goodman, R.A., et al., Defining and Measuring Chronic Conditions: Imperatives for Research, Policy, Program, and Practice. Preventing Chronic Disease, 2013. 10: p. E66.

[40] HHS, Multiple chronic conditions — a strategic framework: optimum health and quality of life for individuals with multiple chronic conditions. 2010, US Department of Health and Human Services: Washington (DC).

[41] National Center for Health Statistics. Health, United States, 2010: With Special Feature on Death and Dying. Hyattsville, MD. 2011.

[42] AHRQ. Chronic Condition Indicator Refined (CCIR) for ICD-10-CM. 03/08/2024, available at https://hcup-us.ahrq.gov/toolssoftware/chronic_icd10/chronic_icd10.jsp

Prospective models use diagnoses collected in a base year (2018) (and demographics collected in the following year [2019]) to predict medical expenditures in the following year (2019). They tend to emphasize the influence of chronic conditions on costs, whereas concurrent models use diagnoses and expenditures from the same year (2018) and tend to emphasize the costs of acute health events. If the ratio of prospective to concurrent multiple regression coefficients was larger than 0.8, a condition category was considered chronic.

In the event of disagreement in the categorization of a condition among these empirical methods, CMS sought the input of clinicians to make the final determination.

Using this approach with the V28 full classification, we determined that 159 of all 266 HCCs, including 97 of the 115 payment HCCs, represented chronic conditions. Sixty-nine percent of beneficiaries in the model sample were determined to have four or more chronic conditions and thirty-seven percent of beneficiaries in the model sample were determined to have seven or more chronic conditions.

Previous HCC versions followed the same methodologies for determining chronic conditions and there are no changes to those previous methodologies since the last Report to Congress.

3.1.3 Beneficiary Cost

The 21st Century Cures Act also requires that CMS present predictive ratios for beneficiaries with very low and very high expenditures.[43] In the 2020 and 2024 CMS-HCC aged-disabled model samples, the ten percent of beneficiaries with the highest expenditures account for around sixty percent of the total expenditures, and many of these beneficiaries have one or more chronic conditions.

In the 2020 CMS-HCC model, when beneficiaries in FFS Medicare without ESRD (i.e., the aged-disabled sample) are grouped by actual expenditures, beneficiaries in the lowest decile have average annual expenditures of $20 and beneficiaries in the highest decile have average annual expenditures of $64,547. The expenditures for beneficiaries in the first through eighth deciles (80 percent of the population) are over predicted, with the lowest deciles over predicted by a substantial amount. The ninth and tenth deciles are under predicted, with the tenth decile under predicted by a substantial amount.

Similarly, in the 2024 CMS-HCC model for the non-dual aged, when grouped by actual expenditures, the average actual expenditures for beneficiaries in the lowest decile have average annual expenditures of $43 and beneficiaries in the highest decile have an average annual expenditure of $67,768. This prediction pattern is almost inevitable when sorting by actual expenditures. It occurs because the model, which forecasts expenditures based on prior year's risk adjustment model factors, cannot account for all the random health events that result in either high or low expenditures in a given year.

However, given the objective of the risk adjustment model, interpreting predictive ratios arranged by actual expenditures at the individual level is not a meaningful approach to determining the model's effectiveness. We instead interpret predictive ratios arranged by deciles

[43] As discussed in the Preface, our analysis is based on beneficiaries enrolled in the FFS Medicare program.

of predicted expenditures. Modeling of future medical spending can never exactly predict expenditures at an individual level, and sorting by predicted expenditures essentially tests to see if all beneficiaries with high predicted expenditures have high actual expenditures and all those with low predicted expenditures have low actual expenditures. Insurance models are developed using information known prior to the insurance period, and future medical events have both predictable and random components. An insurance model captures the predictable component and seeks to balance the over and under prediction errors so the average actual expenditure for a group equals the average predicted expenditures; for a given group, average predicted expenditures should be close to average actual expenditures. MA organizations are licensed risk bearing entities that pool many individuals' random adverse and favorable expenditures and are expected to manage some degree of unpredictable risk.

3.2 Aged-Disabled[44] CMS-HCC Model Predictive Ratios

This section evaluates and compares the predictive accuracy of two aged-disabled CMS-HCC risk adjustment models for different population groups through a battery of predictive ratios. The two aged-disabled CMS-HCC models are the following:

- The 2020 CMS-HCC model (V24), and
- The 2024 CMS-HCC model (V28).

The 2020 CMS-HCC model was calibrated using 2014 diagnoses and 2015 demographic information to predict 2015 expenditures. The 2024 CMS-HCC model was calibrated using 2018 diagnoses and 2019 demographic information to predict 2019 expenditures. Predictive ratios are calculated on the respective data years used for calibration (2015 and 2019), so the sample, therefore, differs between the 2020 and 2024 CMS-HCC model results. HCCs were created with diagnoses filtered using the CPT/HCPCS filtering method, the same method CMS applies when calculating MA risk scores from diagnoses submitted to the encounter data system (EDS). The 2020 and 2024 CMS-HCC models include a count of conditions as required by the 21st Century Cures Act. The 2024 CMS-HCC model uses the revised V28 HCC classification, designed to account for changes from ICD-9-CM to ICD-10-CM diagnosis codes and to reflect more recent patterns of healthcare use and spending. The V28 classification limits the sensitivity of the model to variation in coding to maintain the integrity of the condition categories in the model and their ability to accurately predict costs.

Predictive ratios are provided for the following subpopulations:

- All aged-disabled enrollees (including community, institutional, and new enrollees),
- Aged enrollees (including community, institutional, and new enrollees),
- Disabled enrollees (including community, institutional, and new enrollees),
- Aged and disabled community continuing enrollees,
- Aged and disabled institutional continuing enrollees,
- Aged and disabled new enrollees,
- Aged community continuing enrollees,

[44] It should be noted that both aged and disabled beneficiaries can be clinically disabled. The definition used here for aged and disabled is a Medicare enrollment definition, i.e., whether a beneficiary's current reason for Medicare entitlement is due to age (beneficiaries age 65+) or due to disability (beneficiaries age 0-64).

- Disabled community continuing enrollees, and
- The continuing enrollee community sub-segments:
  - Non-Dual Aged,
  - Non-Dual Disabled,
  - Partial Benefit Dual Aged,
  - Partial Benefit Dual Disabled,
  - Full Benefit Dual Aged, and
  - Full Benefit Dual Disabled.

Five main types of predictive ratios are presented, one in each subsection. Subsection 3.2.1 includes predictive ratios by deciles of predicted medical expenditures. Subsection 3.2.2 discusses predictive ratios for all individual eligible HCCs[45] (including payment and nonpayment HCCs) and body systems (groupings of HCCs by affected areas of the body). Subsection 3.2.3 addresses predictive ratios by counts of chronic HCCs. Subsection 3.2.4—the final aged-disabled models subsection—examines predictive ratios by count of payment HCCs. In each table, sample sizes for each subgroup, along with mean actual and predicted expenditures, are shown with the predictive ratios. Across all aged-disabled models and for most of their predictive ratio tables, the entire sample predictive ratio is equal to 1.0, indicating that the expenditures predicted by the models are, on average, accurate for the calibration sample; predictive ratio tables that feature a subpopulation of model segments, such as enrollees with 0 chronic conditions (**Table 5-15**), may have a predictive ratio above or below 1.0. In each subsection, we highlight under prediction and over prediction trends and selected population groups with particularly accurate or inaccurate prediction, and we compare the predictive accuracy between the 2020 and 2024 CMS-HCC models.

Improvement in the CMS-HCC models is determined by whether predicted expenditures are closer to actual expenditures for beneficiaries in each decile of predicted risk. Perfect prediction is a predictive ratio of 1.0. Typically, a predictive ratio between 0.90 and 1.10 represents reasonable predictive accuracy. By this measure, in most cases, the 2020 CMS-HCC model and the 2024 CMS-HCC model show accurate prediction.

3.2.1 Predictive Ratios by Deciles of Predicted Risk

Tables 5-1 through 5-14 present predictive ratios by decile of predicted expenditure. Predictive ratios are provided for ten equally sized groups of beneficiaries based on their predicted expenditure. These predictive ratios are a test of the model's accuracy in predicting relative risk. They show the extent to which groups of beneficiaries predicted to have certain levels of expenditures actually have those expenditure levels on average. The sample is broken down by deciles and the top 5%, 1%, and 0.1% of predicted expenditures.

[45] Seventeen V24 nonpayment HCCs, three V28 payment HCCs, and twenty-three V28 nonpayment HCCs are ineligible because they have missing data, have a count of 0, or do not represent diseases or conditions (e.g., procedures, durable medical equipment, symptoms, treatments, history, external causes).

Table 5-1 shows predictive ratios based on the full aged-disabled enrollee population, composed of the community and institutional continuing enrollee and new enrollee subpopulations. In the 2020 and 2024 CMS-HCC models, the lowest deciles have some under prediction and the top deciles have slight over prediction. Decile breakouts show deviations from 1.0 between –0.027 (indicating 2.7 percent under prediction) and 0.005 (indicating 0.5 percent over prediction) for the 2020 CMS-HCC model. Results are similar for the 2024 CMS-HCC model, with deviations from 1.0 between -0.028 (indicating 2.8 percent under prediction) and 0.014 (indicating 1.4 percent over prediction). Under prediction for the lowest predicted groups is related to the structure of the model. The lowest predicted groups are healthier; most beneficiaries in these groups have no HCCs included in the model. Predicted expenditures for beneficiaries without conditions that map to HCCs in the model are determined by the CMS-HCC model's demographic factors only, and the values for these demographic factors are the same for beneficiaries with and without HCCs included in the model. We note that these predictive ratios fall within the range that we consider well predicted (0.90 to 1.10). The difference in dollars of the under prediction in the low deciles is relatively small, as it is a percentage of a relatively small expenditure level. We observe that predictive accuracy is similar between the 2020 and 2024 CMS-HCC model, with better prediction by the 2024 CMS-HCC models in the second and third deciles and better prediction by the 2020 CMS-HCC models in the fourth and seventh deciles. Changes in results on predictive accuracy between the 2020 CMS-HCC model and the 2024 CMS-HCC model may be due to differences in the data year for the beneficiary sample and in HCC classification under each model.

Table 5-2 displays predictive ratios for aged enrollees, including community and institutional continuing enrollees and new enrollees. Both models predict accurately across the deciles. The 2020 CMS-HCC model has a range in prediction from 3.6 percent under prediction to 0.5 percent over prediction, and the 2024 CMS-HCC model has a range in prediction from 3.5 percent under prediction to 1.9 percent over prediction. The 2024 CMS-HCC model slightly improves predictive accuracy compared to the 2020 CMS-HCC model in deciles 1-3, 5, and 10.

Table 5-3 presents predictive ratios for disabled enrollees, including community and institutional continuing enrollees and new enrollees. The 2020 CMS-HCC model has a larger range in prediction (4.8 percent under prediction to 2.4 percent over prediction) than the 2024 CMS-HCC model (3.5 percent under prediction to 1.0 percent over prediction). The 2024 CMS-HCC model improves predictive accuracy across six of the ten deciles and the top 5% and 0.1%.

Tables 5-4, 5-5, and 5-6 provide predictive ratios for aged-disabled community continuing enrollees, aged-disabled institutional continuing enrollees, and aged-disabled new enrollees, respectively. In the 2020 CMS-HCC model, expenditures for aged-disabled community and institutional enrollees are generally under predicted in lower deciles and in the top 5%, 1%, and 0.1% (under prediction ranges from 0.2 percent to 14.2 percent across both segments), and over predicted in higher deciles (0.2 percent to 2.6 percent across both segments). Compared to the 2020 CMS-HCC model, in the 2024 CMS-HCC model for aged-disabled community continuing enrollees (**Table 5-4**), improvements in predictive accuracy are observed in five of the ten deciles and in the top 5% and 0.1%. In the 2024 CMS-HCC model for aged-disabled institutional continuing enrollees (**Table 5-5**), a similar pattern as described for the 2020 CMS-HCC model is observed, where the lower deciles and the top 5%, 1%, and 0.1% are under predicted, and the higher deciles are over predicted. For new enrollees (**Table 5-6**), there is no consistent pattern in under or over prediction across deciles and model years. Overall, deviations

from 1.0 are small and are similar: the largest under predictions are 2.3 percent and 2.2 percent, while the largest over predictions are 2.8 percent and 2.9 percent, respectively, in the 2020 and 2024 CMS-HCC models. Note that only demographic factors are included as risk markers in the new enrollee model, so differences in results are due to changes in the data years between the 2020 CMS-HCC model and 2024 CMS-HCC model.

Tables 5-7 and 5-8 present predictive ratios for aged community continuing enrollees and disabled community continuing enrollees. For aged community continuing enrollees (**Table 5-7**), as compared to the 2020 CMS-HCC model, the 2024 CMS-HCC model improves or maintains predictive accuracy in six out of ten deciles and in the top 5% and 0.1%. For disabled community continuing enrollees (**Table 5-8**), the 2024 CMS-HCC model improves or maintains predictive accuracy across seven out of ten deciles and in the top 5% and 0.1% as compared to the 2020 CMS-HCC model.

Tables 5-9 and 5-10 examine full benefit dual aged and full benefit dual disabled enrollees. For full benefit dual aged enrollees (**Table 5-9**), the 2020 CMS-HCC and the 2024 CMS-HCC models generally show some under prediction (0.6 percent to 8.5 percent in 2020; 0.3 percent to 8.1 percent in 2024) for beneficiaries in lower deciles and in the top 1% and 0.1%. Most upper deciles are over predicted in both the 2020 and 2024 models (0.1 percent to 0.6 percent in 2020; 0.2 percent to 2.9 percent in 2024). For full benefit dual disabled enrollees (**Table 5-10**), some lower and mid-range deciles are under predicted in both the 2020 and 2024 CMS-HCC models (0.1 percent to 12.7 percent in 2020; 0.4 percent to 9.6 percent in 2024). Compared to the 2020 CMS-HCC model, we observe improved or maintained predictive accuracy in the 2024 CMS-HCC model across many deciles and percentiles.

Tables 5-11 and 5-12 show predictive ratios for partial benefit dual aged and partial benefit dual disabled enrollees. In both tables, most lower- and mid-range deciles are under predicted for the 2020 CMS-HCC model. The 2024 CMS-HCC model shows less under prediction, with improvements in predictive accuracy in five out of ten deciles for partial benefit dual aged enrollees (**Table 5-11**) and six out of ten deciles for partial benefit dual disabled enrollees (**Table 5-12**).

Tables 5-13 and 5-14 provide predictive ratios for non-dual aged and non-dual disabled enrollees. For non-dual aged enrollees (**Table 5-13**), some under prediction is shown for enrollees in lower deciles and in the top 1% and 0.1% (under prediction ranges from 0.4 percent to 4.1 percent in 2020, and from 0.4 percent to 3.3 percent in 2024). The 2024 CMS-HCC model improves or maintains predictive accuracy for four out of ten deciles and in the top 5%, 1%, and 0.1%. In both the 2020 and 2024 CMS-HCC models, for non-dual disabled enrollees (**Table 5-14**), under prediction is observed in lower and mid-range deciles and in the top percentiles (0.1 percent to 4.8 percent in 2020; 0.2 percent to 6.8 percent in 2024). Compared to the 2020 CMS-HCC model, predictive accuracy is improved or maintained in the 2024 CMS-HCC model in nine out of ten deciles.

Tables 5-15 through 5-19 report predictive ratios by deciles of predicted expenditures for all aged and disabled enrollees grouped by 0, 1–3, 4–6, 7–9, and 10+ counts of chronic conditions. Predictive ratios for the entire sample are more accurate for enrollees with more chronic conditions, compared to enrollees with 0 or few chronic conditions. Over prediction occurs across all deciles for beneficiaries with 0 chronic conditions (**Table 5-15**; 16.9 percent to 54.5 percent over prediction in 2020; 18.3 percent to 68.9 percent over prediction in 2024). Over

prediction is attenuated among beneficiaries with 1–3 chronic conditions (3.5 percent to 15.5 percent over prediction in 2020; 3.4 percent to 23.4 percent over prediction in 2024). In contrast, for beneficiaries with 4–6 and 7–9 chronic conditions (**Tables 5-17 and 5-18),** in both the 2020 and 2024 CMS-HCC models, under prediction is observed in lower deciles. For beneficiaries with 10+ chronic conditions (**Table 5-19**), under prediction is observed in all deciles and in the top percentiles except in the top 0.1% in the 2024 CMS-HCC model.

3.2.2 Predictive Ratios for All HCCs

Tables 5-20a and 5-20b present predictive ratios by individual eligible HCCs[46] for all aged and disabled community and institutional continuing enrollees with columns indicating whether a particular HCC is in the payment model, is categorized as a chronic condition, or both. The tables provide an evaluation of the 2020 and 2024 CMS-HCC models' predictive accuracy for groups of aged-disabled beneficiaries with each of the 204 HCCs in the 2020 CMS-HCC full classification and 266 HCCs in the 2024 CMS-HCC full classification.

Most payment HCCs show predictive ratios close to 1.0 in both the 2020 and 2024 CMS-HCC models. In the 2020 CMS-HCC model, only beneficiaries with HCC 134 Dialysis Status have noticeably under predicted expenditures (predictive ratio=0.843, indicating almost 16 percent under prediction). In this case, under prediction is caused by a constraint setting HCC 134 equal to HCC 135 Acute Renal Failure. In the 2024 CMS-HCC model, there is under prediction for beneficiaries with HCC 36 Diabetes with Severe Acute Complications (predictive ratio=0.850; constrained equal to HCC 37 and HCC 38 in the diabetes hierarchy) and HCC 224 Acute on Chronic Heart Failure (predictive ratio=0.863; constrained equal to HCC 225 and HCC 226 in the heart failure hierarchy).[47] Most nonpayment HCCs also show some under prediction. Substantial under prediction of HCCs usually results from small sample size issues. For example, 2020 HCC 150/2024 HCC 362 Ectopic and Molar Pregnancy has severe under prediction in the 2020 and 2024 CMS-HCC models; this condition is fairly rare in the Medicare population (only 951 and 526 beneficiaries in the 2020 and 2024 CMS-HCC models, respectively). With such a small sample, predictive ratios can be affected by outliers and random variations in expenditures. However, most non-payment HCCs have predictive ratios above 0.85. Only a few HCCs are over predicted (for example, 2020 HCC 166 Severe Head Injury, 2024 HCC 38 Diabetes with Glycemic, Unspecified, or No Complications, and 2024 HCC 226 Heart Failure, Except End-Stage and Acute). Over prediction in 2020 HCC 166 results from a constraint that addresses a hierarchy violation. Similarly, over prediction in 2024 HCCs 38 and 226 result from the aforementioned constraints across these disease hierarchies.

3.2.3 Predictive Ratios by Body Systems or Disease Groups

Table 5-21 provides predictive ratios by body systems/disease groupings for all aged and disabled continuing enrollees. Body systems are defined based on individual HCCs: for example, the Gastrointestinal group includes HCC 77 Intestine Transplant Status/Complications, HCC 78 Intestinal Obstruction/Perforation, HCC 79 Chronic Pancreatitis, HCC 80 Crohn's Disease

[46] Eligible HCCs are those that comprise disease- or condition-specific diagnoses. HCCs comprising symptoms, utilization, history, procedures, durable medical equipment, or external causes are excluded. Additionally, some conditions are rare or not applicable to the Medicare population (such as Extremely Immature Newborns) and their HCC predictive ratio information is also not included.

[47] Refer to the 2024 Rate Announcement for information regarding these constraints.

(Regional Enteritis), and HCC 81 Ulcerative Colitis in the 2024 CMS-HCC model. Body systems included in **Table 5-21** are based on payment HCCs. There are 26 body systems/disease groupings for the 2020 CMS-HCC model and 25 body systems/disease groupings for the 2024 CMS-HCC model, due to the exclusion of Complications of Medical Care HCCs from the payment model in the V28 classification.

Both the 2020 and 2024 CMS-HCC models show near perfect predictive accuracy of expenditures by body systems/disease groupings. Most of the 26 body systems/disease groups have predictive ratios at or very near 1.0. For both the 2020 and 2024 CMS-HCC models, the predictive ratios for both the Cognitive and Injury disease groups show the largest deviation from 1.0. The Cognitive disease group has a predictive ratio of 1.006 in the 2020 CMS-HCC model and 1.007 in the 2024 CMS-HCC model, indicating 0.6% and 0.7% over prediction, respectively. The Injury disease group has a predictive ratio of 0.994 in the 2020 CMS-HCC model and 0.993 in the 2024 CMS-HCC model, indicating 0.6% and 0.7% under prediction, respectively.

3.2.4 Predictive Ratios by Count of Chronic Conditions

The additive structure of the CMS-HCC models implies a greater disease burden as the count of HCCs increases. Most (approximately 80 percent) of payment HCCs in both the 2020 and 2024 CMS-HCC models are considered chronic. **Tables 5-22 through 5-26** display predictive ratios for aged, disabled, full benefit dual, partial benefit dual, and non-dual beneficiaries by count of chronic conditions grouped by 0, 1–3, 4–6, 7–9, and 10+ chronic conditions. The counts of chronic conditions in these tables are based on the full classification of HCCs (see **Tables 5-20a and 5-20b**; the full set of HCCs that are "chronic eligible" are those with a 'Y' in the Chronic column in these tables). They include chronic non-payment HCCs (51 HCCs in the 2020 CMS-HCC model; 60 HCCs in the 2024 CMS-HCC model) and chronic payment HCCs (67 in the 2020 CMS-HCC model; 97 in the 2024 CMS-HCC model). The higher count of chronic conditions in the 2024 CMS-HCC model is related to the increased number of total HCCs in the V28 classification. Therefore, beneficiary groups by count of chronic condition differ between the 2020 and 2024 CMS-HCC models due to changes in the HCCs definition as well as in the sample data years.

Except for the full benefit dual group, which is fairly well predicted, the 2020 and 2024 CMS-HCC models show noticeable over prediction among beneficiaries with 0 chronic HCCs for most subgroups (e.g., predictive ratios are 1.460 and 1.603 for the non-dual sample in the 2020 and 2024 CMS-HCC models, respectively). For individuals without chronic HCCs, predicted expenditures may be solely based on demographic factors (unless beneficiaries have non-chronic payment HCCs). Demographic factors estimated from payment CMS-HCC models tend to over predict expenditures, as beneficiaries without any payment or non-payment chronic HCCs may incur very low or even $0 in actual expenditures. Predictive accuracy improves among beneficiaries with more than 1 chronic HCC compared to those with 0 chronic HCCs. Predictive ratios for beneficiaries with 1–3 and 4–6 HCCs show slight over prediction, whereas predictive ratios for beneficiaries with 7–9 and 10+ HCCs show slight under prediction. Predictive accuracy shows similar patterns in the 2020 and 2024 CMS-HCC models.

Tables 5-27 through 5-35 include predictive ratios by counts of chronic HCCs (0, 1–3, 4–6, 7–9, and 10+) among individuals with the following conditions defined based on individual or grouped HCCs that are payment in the respective model. Therefore, some condition

definitions differ between the 2020 and 2024 CMS-HCC models due to changes in the HCC classification.

- Diabetes
- HIV/AIDS
- Substance use disorder
- Mental health conditions
- Chronic obstructive pulmonary disease (COPD)
- Congestive heart failure (CHF)
- Vascular disorders
- Cancer
- Chronic kidney disease (CKD)

We observe some over prediction for most disease groups in subgroups with fewer chronic HCCs. Over prediction decreases as the number of chronic HCCs increases. For example, prediction is fairly accurate for beneficiaries with 7–9 chronic HCCs. For beneficiaries with 10+ chronic HCCs, under prediction is seen (e.g., expenditures for beneficiaries with HIV/AIDS with 10+ chronic HCCs are 14.1 percent and 11.4 percent under predicted in the 2020 and 2024 CMS-HCC models, respectively). These patterns are similar across the 2020 and 2024 CMS-HCC models, both of which include condition count variables. Variation in results between the 2020 and 2024 CMS-HCC models may be due to changes in the HCC classification and resulting differences in definitions of chronic conditions and of condition categories, as well as changes in the sample data years. The disease group for HIV/AIDS shows more accurate prediction for certain chronic condition count categories under the 2024 CMS-HCC model (e.g., for the 2020 and 2024 CMS-HCC models, respectively, predictive ratios are 1.277 and 1.185 for beneficiaries with 1–3 chronic conditions, and 0.859 and 0.886 for beneficiaries with 10+ chronic conditions). Note, for certain other disease groups, the removal of HCCs from the 2024 CMS-HCC payment model in order to lessen the model's sensitivity to conditions that are more subject to coding variation may contribute to more accurate prediction under the 2020 CMS-HCC model.

3.2.5 Predictive Ratios by Count of Payment Conditions

Tables 5-36 through 5-40 report predictive ratios by count of payment conditions, respectively, in each of the 2020 and 2024 CMS-HCC models. Separate tables are presented for aged, disabled, full benefit dual, partial benefit dual, and non-dual enrollees. Predictive ratios of all five subpopulations are relatively close to 1.0 across the 2020 and 2024 CMS-HCC models. As seen in results by count of chronic conditions, predictive ratios follow similar trends in the 2020 and 2024 CMS-HCC model, with some variation due to changes in the HCC classification and sample data years. Specific examples are provided below for each subgroup of enrollees. In addition, as noted above, we also observe some under prediction among individuals with 0 payment HCCs. Beneficiaries in this group may have non-payment HCCs, which are not taken into account in the CMS-HCC payment models.

Among aged enrollees (**Table 5-36**), prediction is fairly close to 1.0 across the 2020 and 2024 CMS-HCC models. Similar to the 2020 CMS-HCC model, predictive accuracy improves in each payment HCC count category in the 2024 CMS-HCC model (ranging from 0.5 percent under predicted to 0.2 percent over predicted). In the 2024 CMS-HCC model, two subgroups (0 payment HCCs and 4-6 payment HCCs) are slightly under predicted (predictive ratios of 0.995 and 0.999, respectively).

For disabled enrollees (**Table 5-37**), prediction is fairly close to 1.0 in both the 2020 and 2024 CMS-HCC models. In the 2024 model, under prediction ranges from 0.2 percent to 2.3 percent. Similar to the 2020 CMS-HCC model, the only sub-group that is over predicted in the 2024 CMS-HCC model is 1-3 payment HCCs with a predictive ratio of 1.009.

Among full benefit dual enrollees (**Table 5-38**), predictive ratios are close to 1.0 across payment HCC count groups and models, and predictive accuracy is similar for each payment HCC count group in the 2024 CMS-HCC model, compared to the 2020 CMS-HCC model. In the 2020 CMS-HCC model, under prediction ranges from 0.1 percent to 2.2 percent, and only one payment HCC count group is over predicted (predictive ratio of 1.005 for beneficiaries with 1–3 payment HCCs). Similarly, in the 2024 CMS-HCC model, under prediction ranges from 0.5 percent to 2.6 percent and only one payment HCC count group is over predicted (predictive ratio of 1.008 for beneficiaries with 1–3 payment HCCs).

Among partial benefit dual enrollees (**Table 5-39**), predictive ratios are fairly close to 1.0 in both the 2020 and 2024 CMS-HCC models. In the 2024 CMS-HCC model, under prediction ranges from 0.2 percent to 0.7 percent, and only one payment HCC count group is over predicted (predictive ratio of 1.003 for beneficiaries with 1–3 payment HCCs).

Among non-dual enrollees (**Table 5-40**), predictive ratios are fairly close to 1.0 across payment HCC count groups and models. Compared to the 2020 CMS-HCC model, predictive accuracy is similar for each payment HCC count group in the 2024 CMS-HCC model. Near perfect prediction is observed in predictive ratios in the 2020 CMS-HCC model and 2024 CMS-HCC model, with the largest deviation from 1.0 being 0.3 percent under prediction in the 2024 CMS-HCC model.

3.3 ESRD Model Predictive Ratios

ESRD predictive ratios are calculated from a 2014–2015 sample for the 2020 ESRD model and a 2018-2019 sample for the 2023 ESRD model. The 2023 ESRD model includes two dialysis model segments (dialysis continuing enrollee and dialysis new enrollee), kidney transplant factors, and six functioning graft (post-transplant) model segments (aged community non-dual and partial benefit dual continuing enrollee, non-aged community non-dual and partial benefit continuing enrollee, aged community full benefit dual continuing enrollee, non-aged community full benefit dual continuing enrollee, institutional continuing enrollee, and new enrollee). As documented in the 2021 Report to Congress,[48] the 2020 ESRD models predicted well for the model segments that had greater sample sizes—dialysis continuing enrollee and functioning graft community continuing enrollee—on which the model or a subset of model variables were estimated. For segments with populations too small to reliably estimate predicted costs—dialysis new enrollee, functioning graft institutional continuing enrollee, and functioning graft new enrollee—adjustments were applied to their estimates for the 2020 ESRD models. The 2023 ESRD model included several updates compared to the 2020 ESRD model, as described in Section 2.7. For the dialysis new enrollee segment, an adjustment is no longer applied in the 2023 ESRD model, resulting in an overall 3 percent under prediction for true dialysis new enrollees as well as slight under prediction for combined samples that include true dialysis new enrollees.

[48] Report to Congress: Risk Adjustment in Medicare Advantage, December 2021

3.4 ESRD Dialysis Model Predictive Ratios

Section 3.4 discusses predictive ratios concerning the ESRD dialysis model. It is organized into five parts, each consisting of different predictive ratio calculation types; deciles of predicted risk, all individual HCCs, body system/disease groups, count of chronic conditions, and count of payment conditions.

3.4.1 Predictive Ratios by Deciles of Predicted Risk

Tables 5-41 through 5-50 display predictive ratios by deciles of 2015 and 2019 predicted expenditures. Separate predictive ratio tables were created for these dialysis subpopulations:

- all dialysis enrollees (continuing enrollees and new enrollees),
- aged (65 and older) dialysis enrollees (continuing enrollees and new enrollees),
- non-aged (< 65) dialysis enrollees (continuing enrollees and new enrollees),
- dialysis continuing enrollees,
- dialysis new enrollees,
- aged dialysis continuing enrollees,
- non-aged dialysis continuing enrollees,
- full benefit dual dialysis continuing enrollees,
- partial benefit dual dialysis continuing enrollees, and
- non-dual dialysis continuing enrollees.

Tables 5-41, 5-42, and 5-43 present predictive ratios for the combined continuing enrollee and new enrollee dialysis population, featuring the full sample and breakouts by aged or non-aged. In the 2020 ESRD dialysis model, this combined full sample is perfectly predicted because of the actuarial adjustment applied to the new enrollee subpopulation. In the 2023 ESRD dialysis model, an actuarial adjustment was not applied to the new enrollee segment, resulting in the slight underprediction seen for dialysis enrollees and non-aged dialysis enrollees.

Tables 5-44, 5-46, and 5-47 present predictive ratios for the continuing enrollee dialysis population, again featuring the full sample and breakouts by aged or non-aged. The dialysis continuing enrollee model is the only ESRD model with sufficient sample size (324,468 in the 2023 ESRD dialysis model) to estimate a full regression model on its population. The decile breakouts for this population show the model accurately predicts expenditures, with most deciles close to 1.0. In contrast, as described in Section 2.7.1, the population of true new enrollees receiving dialysis is too small to reliably estimate a model. Thus, the modeling sample also includes continuing enrollees who have been on dialysis for no more than 36 months in the most recent four years, and with no history of kidney transplant, to increase its sample size for modeling purposes. **Table 5-45** presents predictive ratios for the subset of dialysis new enrollees. The overall sample predictive ratio of the 2020 ESRD dialysis model for this subset of enrollees is 1.0. We know that dialysis new enrollees have lower costs on average than the average cost of continuing and new enrollees included in the modeling sample. To account for this, the 2023 ESRD dialysis new enrollee model segment adjusts continuing enrollees' costs before estimation so that these costs follow the patterns observed for new enrollee costs. In the 2023 ESRD dialysis model, the overall sample predictive ratio for the subset of dialysis new enrollees is 0.971, representing approximately 3 percent under prediction. The decile breakouts show under

prediction ranging from 1 to 5 percent, with over prediction of 1.6 percent for the top 0.1 percentile of predicted expenditures.

Tables 5-48, 5-49, and 5-50 present predictive ratios for the dialysis continuing enrollee sample by dual status (full benefit dual, partial benefit dual, non-dual). These predictive ratios indicate slight under prediction overall for the full benefit and non-dual subpopulations in both the 2020 and 2023 ESRD dialysis models. For the partial benefit dual subpopulation, the 2023 ESRD dialysis model shows nearly perfect prediction, while the 2020 ESRD dialysis model shows over prediction. The 2023 ESRD model for dialysis continuing enrollees includes expanded Medicaid interaction variables to separately identify level of dual status, where previously the Medicaid interaction variables only distinguished between Medicaid and non-Medicaid. The predictive ratios overall show improvement compared to the 2020 ESRD dialysis model.

3.4.2 Predictive Ratios for all HCCs

Tables 5-51a and 5-51b present predictive ratios for each of the HCCs in the full classification for all dialysis continuing enrollees, with columns indicating whether a particular HCC is in the payment model, is categorized as a chronic condition, or both. **Table 5-51a** presents these results for the 2020 ESRD dialysis model and **Table 5-51b** presents these results for the 2023 ESRD dialysis model. Overall, the model predicts expenditures well, with perfect prediction or predictive ratios close to 1.0 for most HCCs, even those not in the payment model. For the few HCCs with predictive ratios below 0.9, indicating under prediction greater than 10 percent, most have very small sample sizes, which makes it difficult to accurately predict their associated costs.

3.4.3 Predictive Ratios by Body Systems or Disease Groups

Table 5-52 shows predictive ratios for body systems or disease groups for all dialysis continuing enrollees. All predictive ratios for this sample are accurate, with under prediction or over prediction less than 2 percent under the 2020 ESRD dialysis model and less than 1 percent under the 2023 ESRD dialysis model. The disease groups consist of HCCs included in the model. The Kidney disease group is excluded in this set because it defines the dialysis population.

3.4.4 Predictive Ratios by Count of Chronic Conditions

Tables 5-53 through 5-60 provide predictive ratios by count of chronic conditions (0; 1–3; 4–6; 7–9; 10+) for the following dialysis continuing enrollee samples: all continuing enrollees, aged, non-aged, any Medicaid, non-Medicaid, full benefit dual, partial benefit dual, and non-dual. For all subpopulations, the largest populated breakout is “10 or more chronic conditions,” indicating the dialysis population has multiple chronic comorbidities in addition to their underlying renal disease. The counts include chronic conditions beyond those in the payment model, and the corresponding chronic and payment/non-payment HCCs are indicated in **Tables 5-51a and 5-51b**, for the 2020 and 2023 ESRD dialysis model, respectively. In general, the tables show over prediction for the small percentage of dialysis enrollees with 0 or few chronic conditions and fairly accurate predictions for beneficiaries with multiple chronic conditions, demonstrating that the dialysis continuing enrollee model performs well in accounting for these

costs. The overall samples for any Medicaid (**Table 5-56**) and non-Medicaid (**Table 5-57**) show slight under prediction and over prediction, respectively, of less than one percent under the 2023 ESRD dialysis model. This is likely due to the fact that the underlying model no longer follows this design for Medicaid interaction variables.

3.4.5 Predictive Ratios by Count of Payment Conditions

The final set of dialysis tables, **Tables 5-61 through 5-65**, provide predictive ratios by counts of payment conditions for the following dialysis continuing enrollee subpopulations: aged, non-aged, full benefit dual, partial benefit dual, and non-dual. The accuracy of these predictive ratios is quite good. In general, the range of over prediction or under prediction by count of payment conditions is smaller than for the set by count of chronic conditions, indicating better prediction.

3.5 ESRD Functioning Graft Model and Kidney Transplant Predictive Ratios

Section 3.5 discusses predictive ratios concerning the ESRD functioning graft model and kidney transplant factors. It is organized into seven parts, consisting of different predictive ratio calculation types: deciles of predicted risk, all individual HCCs, body system/disease groups, count of chronic conditions, count of payment conditions, post-graft factor, and kidney transplant factor.

These predictive ratios are calculated using predicted expenditures from the 2020 and 2023 ESRD functioning graft models, which include:

- six functioning graft segments which predict costs for post-graft months 4 and beyond:
  - community continuing enrollee, non-dual and partial benefit dual, aged,
  - community continuing enrollee non-dual and partial benefit dual, non-aged,
  - community continuing enrollee full benefit dual, aged,
  - community continuing enrollee, full benefit dual, non-aged,
  - institutional continuing enrollee, and
  - new enrollee.
- kidney transplant factors for the average costs of the entire transplant stay and the two months following a kidney transplant.

There are multiple factors related to small sample size that affect the predictive accuracy of the functioning graft models. The combined functioning graft sample size is only 104,383 in the 2023 ESRD functioning graft model, of which 93 percent are community continuing enrollees, less than 1 percent are institutional continuing enrollees, and 6 percent are new enrollees. None of these subpopulations are large enough to reliably estimate a full regression model. Instead, as was described in Section 2.7.3, the ESRD functioning graft continuing enrollee community and institutional segments use most of the risk adjustment model factors from a CMS-HCC model calibrated with the non-ESRD aged/disabled population. These risk adjustment model factors are supplemented with a few additional model factors specific to the functioning graft continuing enrollee sample, including eight post-graft factors that capture the

differing predicted costs of post-graft beneficiaries based on age, dual status, and time since kidney transplant. The 2023 ESRD functioning graft model divided the community continuing enrollee segment into four separate segments based on age and dual status, as shown above, and expanded the number of post-graft factors from four to eight. Because the community subpopulation dominates the functioning graft continuing enrollee modeling sample (and thus the post-graft factors represent its population), the community continuing enrollee predictive ratios are better overall than those of the institutional and new enrollee subpopulations. Adjustments were applied in the 2020 ESRD functioning graft model for the functioning graft institutional continuing enrollees and functioning graft new enrollees. The 2023 ESRD functioning graft model only includes adjustments for functioning graft new enrollees to allow for separate model factors for beneficiaries who are 4-9 months and 10+ months post-transplant.

The functioning graft model predictive ratios presented here have the same five category sets as those of the dialysis model and a sixth set of predictive ratios by post-graft factors. The section ends with a table of predictive ratios for the kidney transplant factors.

3.5.1 Predictive Ratios by Deciles of Predicted Risk

Tables 5-66 through 5-76 reflect predictive ratios by deciles of 2015 and 2019 predicted expenditures for the following functioning graft subpopulations:

- all functioning graft enrollees (community and institutional continuing enrollees and new enrollees),
- aged (65 and older) functioning graft enrollees (community and institutional continuing enrollees and new enrollees),
- non-aged (<65) functioning graft enrollees (community and institutional continuing enrollees and new enrollees),
- functioning graft community continuing enrollees,
- functioning graft institutional continuing enrollees,
- functioning graft new enrollees,
- aged non-dual or partial benefit dual functioning graft community continuing enrollees,
- aged full benefit dual functional graft community continuing enrollees,
- non-aged non-dual or partial benefit dual functioning graft community continuing enrollees,
- non-aged full benefit dual functioning graft community continuing enrollees,
- full benefit dual functioning graft continuing enrollees (community and institutional),
- partial benefit dual functioning graft continuing enrollees (community and institutional), and
- non-dual functioning graft continuing enrollees (community and institutional).

Tables 5-66, 5-67, and 5-68 present predictive ratios for the combined functioning graft population, featuring the full sample and breakouts by aged or non-aged. In the 2020 ESRD functioning graft model, this combined sample has near perfect prediction. In the 2023 ESRD functioning graft model, the combined sample has perfect prediction. **Tables 5-69, 5-70, and 5-71** present predictive ratios for each of the three functioning graft model samples: community continuing enrollee, institutional continuing enrollee, and new enrollee. **Tables 5-70 and 5-71** show perfect prediction overall for both the 2020 ESRD functioning graft model and 2023 ESRD

functioning graft model. At the decile level, the 2023 ESRD functioning graft model under predicts at the first, third, and tenth deciles for the community continuing enrollee, as well as the top percentiles, and otherwise over predicts (**Table 5-69**). The small sample sizes in **Tables 5-70 and 5-71** lead to more variable predictive ratios throughout the deciles.

Tables 5-72a, 5-72b, 5-73a, and 5-73b present predictive ratios for aged and non-aged breakouts of the functioning graft community continuing enrollee sample. The 2023 ESRD functioning graft model expanded the number of segments for the functioning graft community continuing enrollees from one segment to four separate segments, based on age and dual status. **Tables 5-72a and 5-72b** include the same results for the 2020 ESRD functioning graft model, for the aged functioning graft community continuing enrollees. Similarly, **Tables 5-73a and 5-73b** include the same results for the 2020 ESRD functioning graft model for the non-aged functioning graft community continuing enrollees. The aged subsets show variation, with slight over prediction at the lowest deciles and under prediction at the highest deciles. This indicates that the post-graft factors, which help capture costs of the functioning graft population overall, overestimate the costs of the healthiest enrollees who may have fewer post-graft complications or comorbidities. The over prediction at the lowest deciles and under prediction at the highest decile and in the top percentile breakouts may also be more greatly affected by outliers in the functioning graft sample due to a small sample size. The non-aged subsets show under prediction at the lowest and highest deciles, and fairly accurate prediction at the middle deciles. The variability for the non-aged subsets is likely related to the small sample size and possible differences between the underlying non-aged non-ESRD aged/disabled population (on which some of the model variables were calibrated) and the non-aged functioning graft enrollees.

The 2023 ESRD functioning graft model distinguishes Medicaid enrollees by type of dual status (full, partial, or non-dual). **Tables 5-74, 5-75, and 5-76** show predictive ratios for the combined continuing enrollee (community and institutional) functioning graft sample, with breakouts by dual status (full benefit, partial benefit, or non-dual). The predictive ratios for the 2023 ESRD functioning graft model show slight improvement overall for the full benefit dual and non-dual functioning graft segments.

3.5.2 Predictive Ratios for all HCCs

Tables 5-77a and 5-77b report the predictive ratios for all continuing enrollee functioning graft enrollees for all HCCs in the full classification, with columns indicating whether a particular HCC is in the payment model, is categorized as a chronic condition, or both. Although the overall samples have perfect predictive ratios (2020 ESRD functioning graft model is 1.000; 2023 ESRD functioning graft model is 1.000), we do not expect the functioning graft models to predict as accurately at the individual HCC level as the dialysis and Part C aged-disabled models do because most HCC estimates used in the functioning graft models were carried forward from the underlying Part C aged-disabled models. **Tables 5-77a and 5-77b** confirm this—with most HCCs over predicted or under predicted, including payment HCCs. Although sample sizes are too small to estimate HCC risk adjustment model factors specific to each of the functioning graft populations, the HCC model factors do distinguish beneficiaries with varying degrees of morbidity; the added post-graft factors capture, on average, costs for this population that are not attributed to the individual HCCs.

3.5.3 Predictive Ratios by Body Systems or Disease Groups

Table 5-78 presents predictive ratios for body systems or disease groups for all functioning graft continuing enrollees. In the 2023 ESRD functioning graft model, there are very slight increases in the predicted expenditures and the predictive ratios. The functioning graft models under predict for most disease groups. Again, the post-graft factors are designed to account for costs of disease groups not predicted fully by the HCCs.

3.5.4 Predictive Ratios by Count of Chronic Conditions

Tables 5-79 through 5-86 contain predictive ratios by count of chronic conditions (0; 1–3; 4–6; 7–9; 10+) in addition to the underlying renal disease for the following functioning graft continuing enrollee samples: all continuing enrollees, aged, non-aged, any Medicaid, non-Medicaid, full benefit dual, partial benefit dual, and non-dual. For all subpopulations, most functioning graft enrollees have 4 or more chronic conditions, and most predictive ratios monotonically decrease as the number of conditions increase. The high over prediction for the very small subset of enrollees with 0 chronic conditions in each subpopulation suggests that functioning graft patients with no recorded chronic comorbidities may have unique characteristics (see **Tables 5-77a and 5-77b** for specific HCCs). They are a very small proportion of the population. The overall sample predictive ratios for the 2023 ESRD functioning graft model in **Tables 5-82 and 5-83** indicate the model under predicts the Medicaid population by about 2 percent and over predicts the non-Medicaid population by about 1 percent, which are improvements compared to the 2020 ESRD functioning graft model.

3.5.5 Predictive Ratios by Count of Payment Conditions

Tables 5-87 through 5-91 provide predictive ratios by count of payment conditions for the following functioning graft continuing enrollee subpopulation: aged, non-aged, full benefit dual, partial benefit dual, and non-dual. **Tables 5-87 and 5-91** show over prediction for those with 0 payment conditions. The results consistently show under prediction for those with 10 or more conditions.

3.5.6 Predictive Ratios by Post-Graft Factor

Tables 5-92 through 5-94 exhibit predictive ratios by post-graft factor for the functioning graft community continuing enrollees, institutional continuing enrollees, and new enrollees, respectively. The 2023 ESRD functioning graft model expanded the number of post-graft factors from four to eight, these factors were used for the 2023 ESRD functioning graft model predictive ratios. **Table 5-92** indicates that the model for the functioning graft community continuing enrollees, who, as noted earlier, are 93 percent of the functioning graft population, provides a highly accurate estimate of predicted costs. The entire sample predictive ratio is 1.000 under the 2023 ESRD model, and the eight post-graft factor breakouts never deviate from 1.0 by more than 5.0 percent.

As expected, because the small sample size of institutional enrollees (n = 898) limits their impact within the modeling sample, the 2023 ESRD functioning graft model predictive ratios for this population indicate the post-graft factors are not fully capturing their additional post-transplant costs (**Table 5-93**). Four of the eight post-graft factors (non-aged, 4–9 months since transplant, non-dual and partial benefit dual; non-aged, 4-9 months since transplant, full benefit

dual; aged, 4-9 months since transplant, non-dual and partial benefit dual; and aged, 4-9 months since transplant, full benefit dual) do not have a large enough sample size to calculate a reliable predictive ratio (sample size below 30). Two of the remaining factors, with the smallest reliable sample sizes, show under prediction. The other two factors with sample sizes of over 200 beneficiaries show accurate prediction.

Table 5-94 illustrates that the post-graft factors in the 2023 ESRD functioning graft model have similar predictive results compared to the 2020 ESRD model for functioning graft new enrollees. The entire sample has a perfect predictive ratio of 1.0. Two of the eight post-graft factors in the 2023 ESRD functioning graft model are over predicted, two have perfect or near perfect prediction, and four are slightly under predicted.

3.5.7 Predictive Ratio by Kidney Transplant Factor

Table 5-95, the final table in this ESRD section, shows the predictive ratios by kidney transplant factor. The kidney transplant factors are based on average costs of ESRD beneficiaries who have had a kidney transplant. The kidney transplant factor for month 1 estimates the cost of the entire transplant stay. The predictive ratio for Kidney transplant month 1 shows perfect prediction (1.0) because month 1 is intended to capture costs of the entire transplant stay. The amount is paid by CMS to MA plans in one month as a lump sum. Although the costs for months 2 and 3 following transplant are estimated individually for each month, for payment simplicity, the average over the two months is paid for each. The averaged monthly amounts are weighted by enrollee population.[49] Thus, the predictive ratios for these individual months do not show perfect prediction. Month 2 has higher costs and month 3 has lower costs than the average over both months. The population on which the combined Kidney transplant months 2 and 3 predictive ratio is calculated (n = 10,093) is a subset of the populations used for the individual month calculations (n = 11,189 and 10,958, respectively). The combined population is slightly smaller than those of month 2 or month 3 because it contains individuals who had *both* month 2 and month 3 in the expenditure year (2019 for this evaluation). With this slightly different population, the predictive ratio for Kidney transplant months 2 and 3 shows accurate (1.021), but not perfect, prediction.

[49] Weighted average = ([month 2 count x month 2 costs] + [month 3 count x month 3 costs]) / [month 2 count + month 3 count]) = ([11,189 x $8,053.08] + [10,958 x $5,601.89]) / [11,189 + 10,958] = $6,840.27 per month

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Section 4.
ONGOING RESEARCH

As previously noted, by making payments to MA organizations that reflect the risk of beneficiaries enrolled in their MA plans, CMS appropriately pays plans that provide care for the most seriously ill beneficiaries and reduces the incentives for MA organizations to risk select only the healthiest beneficiaries. To achieve this, CMS predicts relative risk of enrollees utilizing a subset of - conditions that reliably predict costs in accordance with risk adjustment principles (refer to section 2.3 above). As we discuss throughout this report, the primary goal of the CMS-HCC models is to accurately predict cost across large groups, and we balance this goal with other policy considerations such as market stability, and whether risk scores calculated using the models are based on clinically meaningful condition categories, create appropriate incentives, and align with costs predicted by the model. Another long standing consideration when designing the risk adjustment model is that it is easily administered by CMS and plans – data used in developing and applying the model must be readily available, timely, and well understood.[50] CMS selected a regression methodology for the CMS-HCC models that is simpler, more widely understood than other methods, and utilizes cost effective, standardized data sources that are commonly used in CMS and plan operations.[51] Updates CMS has made to the risk adjustment models have improved their predictive ability over time to better account for current disease patterns, treatment methods and costs, and diagnosis and coding practices.

One such model update was made in 2024, as noted in previous sections, where CMS finalized an updated reclassified version of the CMS-HCC model. The 2024 CMS-HCC model is based on updated data years used for model calibration and a clinical reclassification of the HCCs based on ICD-10-CM codes. In addition, as part of the clinical reclassification, CMS conducted an assessment on conditions that are coded more frequently in MA relative to FFS. When conducting clinical updates to the model, CMS evaluates diagnoses where there is variation in coding in accordance with the long-standing risk adjustment principles. Conditions in the model where there is variation in their coding can lead to distortion of the marginal costs estimated by the model, reducing the ability of the HCCs in the model to predict stable costs and accurately predict those costs in alignment with the severity of the condition. In the 2024 CMS-HCC model CMS removed and constrained HCCs for certain conditions that are diagnosed and coded inconsistently across providers and plans, thereby decreasing the model sensitivity to coding variation. Diagnosis codes that are more subject to variation in coding are not necessarily or by definition an indication of inappropriate coding.

Stakeholders often suggest changes to the CMS-HCC model from a variety of policy preferences and perspectives. In recent years stakeholders have recommended a variety of approaches for updating the CMS-HCC risk adjustment model to address variation in MA coding patterns, in addition to using two years of diagnostic data, and using information other than HCCs to predict risk (e.g., incorporating beneficiary self-reported information and social drivers into the calibration). In addition, other stakeholders have made other suggestions, such as excluding diagnoses from unlinked chart review records, and excluding diagnoses from Health

[50] For example, see page 30 of the American Academy of Actuaries evaluation of the PIP-DCG model.

[51] The CMS-HCC models are calibrated using weighted least squares multiple regression, cost and diagnoses from FFS claims, and enrollment information collected by CMS and the Social Security Administration (SSA). FFS claims are collected either electronically in the X12 837 5010 format or on paper claim forms and are made accessible in CMS systems for a variety business uses.

Risk Assessments (HRAs). CMS regularly reviews and evaluates these proposals against risk adjustment principals as well as the agency's overarching strategic goals.

In this section we discuss three of the prominent proposals that are often suggested by stakeholders in comments to CMS, academic studies, and policy papers as improvements to the CMS-HCC model: an encounter data-based model, a model calibrated using two years of diagnostic data, and a model calibrated without costs or diagnoses from HRAs.

4.1 Using Medicare Advantage Encounter Data to Calibrate CMS-HCC Models

CMS has collected encounter data, which is a more comprehensive form of data than the legacy Risk Adjustment Processing System (RAPS) data, from Medicare Advantage (MA) organizations, as well as other organizations that are paid risk adjusted payments, since 2012. Per § 422.310(b), MA organizations are required to report all health care items and services provided to their enrollees using encounter data.[52] CMS collects encounter data using the X12 837 5010 format that is widely used in the healthcare industry, including for the submission of Traditional Medicare Fee-for-service (FFS) claims. Encounter data information submitted in this way is thus comparable to data submitted in other programs.

Among the established uses of encounter data, CMS uses risk adjustment eligible diagnoses submitted on encounter data records to calculate risk scores for use in MA payment (see Section 2.4.4 for an example of risk score calculation).[53] The CMS-HCC model risk scores are measures of relative risk used to calculate payments to MA organizations that ensure that plans that enroll relatively sicker beneficiaries receive higher payments, and plans that enroll relatively healthier beneficiaries receive lower payments. For each MA enrollee, CMS calculates their risk score based on 1) the enrollee's demographics and diagnoses, and 2) the CMS-HCC risk adjustment model for the specific payment year.

CMS began to use risk adjustment eligible diagnoses from encounter data submissions[54] in the calculation of risk scores used for MA risk adjusted capitation payments beginning with the 2015 payment year. The use of diagnoses from encounter data to calculate MA risk scores was phased in over a multi-year time period, with encounter data being the sole source of diagnoses for MA risk adjustment starting with payment for 2022. Over this multi-year phase in, CMS transitioned the source of MA diagnoses used to calculate MA risk scores from those submitted to the legacy RAPS to solely using MA diagnoses submitted on encounter data.[55] While CMS has made the full transition to using MA diagnoses from encounter data when calculating MA risk scores, the CMS-HCC risk adjustment model factors are calibrated on a FFS sample, and thus rely on expenditures and diagnoses from FFS claims to calculate the predicted costs associated with each of the risk adjustment model factors. Section 1853(a)(1)(C)(ii)(IV) of

[52] Data on outpatient prescription drugs is collected separately through the Part D program.

[53] See § 422.310(f)(i) "To determine the risk adjustment factors used to adjust payments, as required under §§ 422.304(a) and (c)."

[54] There are two types of data that MA organizations submit to the Encounter Data System (EDS): Encounter Data Records (EDRs) and Chart Review Records (CRRs). EDRs contain a complete description of service utilization, expenditures, and diagnostic data for an encounter, similar to a FFS claim. CRRs contain only diagnostic data. In this report, we refer to both of these data types as "encounter data," though it should be noted that only EDRs can provide service utilization and expenditure data, while diagnostic data is derived from both EDRs and CRRs. Some, but not all, CRRs are linked to EDRs.

[55] https://www.cms.gov/newsroom/fact-sheets/2022-medicare-advantage-advance-notice-part-i-risk-adjustment#:~:text=Using%20Encounter%20Data,calculating%20risk%20scores%20for%20payment.

the Act requires the coding adjustment to apply to risk scores until the Secretary implements risk adjustment using MA data. Based on this, stakeholders have suggested that calibrating the CMS-HCC model using an MA sample and the costs and diagnoses from MA encounter data would improve payment accuracy. The belief is that by fully aligning the diagnoses and costs used to calibrate the model with the diagnoses submitted for payment, thereby having relative factors in the model reflecting the diagnosis and cost patterns of MA rather than FFS, CMS would mitigate any impact that differences in diagnosis coding and cost patterns between FFS and MA may have on the risk scores used in MA payment. Additionally, Section 1853(a)(1)(C)(ii), lays out that the coding pattern adjustment, which is used to account for coding pattern differences between MA and FFS, should be applied to risk scores until the Secretary implements risk adjustment using MA diagnostic, cost, and use data. This means that once CMS uses an MA risk adjustment model calibrated using MA encounter data (MA diagnoses and costs), as per statute, CMS will no longer apply an MA coding pattern adjustment to risk scores.

As encounter data quality has continued to improve and given that an ever-increasing share of Medicare beneficiaries have enrolled in MA organizations (50 percent as of March 2024),[56] CMS is considering the possibility of calibrating the CMS-HCC risk adjustment model factors using an MA sample instead of a FFS sample. This would require determining the cost of items and services provided to MA enrollees, as well as using diagnoses from encounter data, to calibrate risk adjustment model factors. Specifically, calibrating an encounter data-based CMS-HCC model requires a sample of beneficiaries for whom the following can be measured for each beneficiary:

(a) Diagnostic information, as well as additional information needed to determine whether a diagnosis meets risk adjustment filtering rules (e.g. procedure codes and type of bill), over a full base calendar year (not applicable for new enrollee models);

(b) Total beneficiary costs for the months of enrollment in MA the following year.

In preparation for potentially using MA encounter data to calibrate the CMS-HCC risk adjustment model, CMS is assessing key facets of the encounter data and reviewing model parameters to assess how the use of encounter data may affect a risk adjustment model calibration. As part of this effort to develop an encounter data-based risk adjustment model, CMS is also exploring ways in which to engage stakeholders. For example, in the summer of 2023, CMS held discussions with various subject matter experts whose occupational backgrounds include experience researching MA and risk adjustment. The discussions were had in order to gather initial input on the benefits and challenges of calibrating the CMS-HCC model using MA encounter data, including topics such as the overall appropriateness of an encounter data-based model, plan-facing incentives and plan behavior, market implications, and considerations for how to determine the cost of items and services reported in encounter data.

The feedback CMS received from these discussions was generally in support of moving to an MA encounter data-based CMS-HCC risk adjustment model, with the understanding that there will be methodological challenges to overcome and a possibility for downstream market effects. The primary benefit of an MA encounter data-based model most often cited during these discussions was better alignment of MA risk-adjusted payments with MA costs, patterns of care, and enrollee characteristics. Many of these experts thought that the growing proportion of

[56] Medicare Enrollment Dashboard, accessed 7/11/2024.

Medicare enrollees covered under MA – now half – supported this transition. We anticipate additional discussions with other experts and stakeholders as we proceed in our work.

As we do with all revised and updated HCC-based risk adjustment models, as part of the development of any CMS-HCC model calibrated using MA diagnoses and costs for MA services, CMS is conducting model evaluations to assess model accuracy and to identify improvements of such a model. Below are some of the areas we are investigating regarding how to measure the key elements of an MA encounter data-based model calibration: the sample of beneficiaries, diagnoses, and costs.

4.1.1 Sample of Beneficiaries

CMS is reviewing sample selection criteria for use in developing an MA encounter data-based risk adjustment model. The sample selection criteria currently used to develop the CMS-HCC risk adjustment model is based on FFS data (see **Table 4-1**). Further research will be needed to determine if a risk adjustment model based on MA data provides opportunities to improve the model by using different criteria or whether the use of sample selection criteria that is parallel to the current approach remains best.

Table 4-1
Current CMS-HCC Risk Adjustment Model FFS Sample Criteria

Base Year (12 months in the base year with the following attributes)	Payment Year (Any month(s) in the payment year with the following attributes)
Enrolled in Medicare Parts A & B	Enrolled in Medicare Parts A & B
Alive	Alive
US residence	US residence
No End Stage Renal Disease status (ESRD)	No End Stage Renal Disease status (ESRD)
	No Medicare as a Secondary Payer status (MSP)
	Not in Hospice

Note: Hospice election results in the shifting of liability from MA to FFS and thus is an exclusion only applied to payment year months.

In selecting sample criteria for an encounter data-based CMS-HCC risk adjustment model for MA, CMS must consider a range of criteria, including where a beneficiary is enrolled in the prediction year, where a beneficiary is enrolled in the data collection year, and how long in each year, as well as which Medicare plan types to include, given that some organizations submit encounter data for plans that differ from typical MA plans in their benefit structure (e.g., PACE) or liability (e.g., MSAs, Cost plans).

CMS has examined MA sample sizes by model segment[57] with the considerations noted and determined they would be adequate for model calibration by segment and likely to continue to remain adequate.

[57] The same seven continuing enrollee model segments in the 2024 CMS-HCC model: two segments by age/disabled status for each dual eligibility (non-dual, full dual, and partial dual) and a separate segment for the long-term institutionalized population.

4.1.2 Beneficiary Diagnostic Information

Other criteria are related to where a beneficiary is enrolled in the base year from which we use diagnostic data, including plan type or in FFS. In addition, like the current CMS-HCC model, filtering criteria would be applied to identify risk adjustment eligible diagnoses.[58]

4.1.3 Beneficiary Costs

The CMS-HCC model currently predicts the annual cost of providing Medicare Parts A and B benefits in the Traditional Medicare FFS program. A cost is associated with each CMS-HCC risk adjustment model factor such that the sum of model factors assigned to a beneficiary is the total predicted cost of items and services provided to a beneficiary each year. CMS is exploring options for determining the cost of items and services reported in encounter data for the purpose of calibrating a risk adjustment model. In this effort, there are numerous considerations, such as the pros and cons of using a plan paid amount or a simulated, standardized amount calculated using FFS payment policies on items and services reported in encounter data. The plan paid amount is reported by MA organizations as the amount paid by the plan to the provider for the items and services reported on the encounter. A FFS simulated price would be an estimation of what would have been paid for the items and services on the encounter under FFS pricing rules.

By calibrating a CMS-HCC risk adjustment model using MA encounter data, MA enrollees' risk scores and the model factors would both be developed with MA data. This aligns the data used to calculate the costs associated with the risk adjustment model factors with the utilization, costs, and coding patterns of the population CMS pays MA organizations to provide Medicare benefits to. For this reason, payments to MA based on this model should be more accurate than a model calibrated based on FFS data. For example, it may be the case that a beneficiary in the Traditional Medicare FFS program with a particular condition in the model costs three times more than an average Medicare FFS beneficiary, while in the MA program a beneficiary with the same condition costs two times more than the average MA beneficiary. The opposite could also occur where the condition costs even more to treat in MA relative to the average (e.g., the beneficiary could cost four times more than the average MA beneficiary).

CMS plans to continue evaluating whether using MA data to calibrate the CMS-HCC risk adjustment models would lead to more appropriate payments to MA organizations, and how well it would continue to provide incentives for MA plans to enroll beneficiaries with an array of low-cost and high-cost conditions.

4.2 Using Two Years of Diagnostic Data to Calibrate CMS-HCC Models

Although already permitted under the broader authority in Section 1853(a)(1)(C), the 21st Century Cures Act gave express permission to the Secretary to use at least two years of diagnosis data when calibrating the risk adjustment model.

The current CMS-HCC model is prospective in that it uses one year of diagnosis data in a base year to predict costs in the following year. Some stakeholders advocate for a CMS-HCC model developed using two years of diagnostic data, contending that the additional year of

[58] https://www.hhs.gov/guidance/sites/default/files/hhs-guidance-documents/FinalEncounterDataDiagnosisFilteringLogic.pdf

diagnosis data would improve the accuracy of both FFS and MA diagnostic information, would reduce year-to-year variation in documentation, and lead to more accurate MA payments. MedPAC recommended using two years of diagnosis data to calibrate the model to "decrease the extent of coding differences that persist between the MA and FFS sectors of the Medicare program," resulting in decreased MA risk scores.[59] MedPAC stated that "using two years of diagnosis data allows the model to capture more medical conditions among the FFS population, so that the profile of conditions among the FFS population more closely matches the profile of conditions that would have been recorded for those beneficiaries had they been enrolled in MA."

There are a number of considerations for developing a two-year model, including:

- Data limitations. A main limitation to incorporating two years of diagnoses is the additional year of data required. Because fewer beneficiaries will have two years of data available than one year, a key consideration then becomes whether the additional year of data required for these beneficiaries when we calculate risk scores and monthly payments justifies any increase in the performance of the model.
- Delay in diagnosis-based risk scores. Currently, beneficiaries without 12 months of Part B enrollment in the base year are defined as new enrollees. This new enrollee definition includes new entrants to the Medicare program as well as beneficiaries without a full year of diagnosis information. Beneficiaries with less than 12 months Part B enrollment in the base year receive a risk score calculated with only demographic information. If a beneficiary must have a full two years of diagnostic data before they receive a continuing enrollee risk score, then a CMS-HCC model calibrated with two years of diagnostic information would require a beneficiary to have 24 months of Part B enrollment before they receive a diagnosis-based risk score, which are generally more accurate.
- Structural complexity and sample size issues. Furthermore, the current model is structured such that it includes separate segmentation to account for aged/disabled status, dual status, new or continuing enrollee status, and if the beneficiary resides in an institution or the community. As a result, the current model includes six community segments, an institutional segment, and a separate new enrollee segment. Therefore, if the model were to separately account for beneficiaries with less than two years, but more than 11 months, of Part B enrollment, new segments for these beneficiaries would be needed. The resulting model would likely require significantly more segments, resulting in concerns about complexity and not consistently meeting minimum sample size criteria for reliable relative cost estimates.
- Clinical implications. Clinically, CMS considered whether diagnoses reported in just one of the two years should be considered equivalent to diagnoses reported in both years. We especially question the face validity of certain acute HCCs (e.g. Acute Myocardial Infarction) if they are reported two years ago, but not in the more recent year. Including these conditions might introduce payment inaccuracy into the model. Extensive empirical analysis and clinical consultation would be required to evaluate which diagnoses meet risk adjustment principals when coded only two years ago.
- Statistical implications: it is possible that a diagnosis reported two years ago, but not in the more recent year, was a rule out diagnosis – i.e., being explored as a possible

[59] Refer to the June 2020 Report to Congress: Medicare and the Health Care Delivery System: https://www.medpac.gov/wp-content/uploads/import_data/scrape_files/docs/default-source/reports/jun20_ch4_reporttocongress_sec.pdf.

diagnosis, but reported before it was confirmed – or perhaps reported in error. The implication of using data from two years ago and assuming it carries the same weight as a diagnosis from the prior year is that it could introduce statistical error into the model, which can produce unstable or incorrect estimated costs.

CMS has explored including an additional year of FFS diagnosis data in the CMS-HCC model and has calibrated several analytic models to assess the effects. Our preliminary findings showed that the two-year model did not meaningfully improve the CMS-HCC model's predictive accuracy by decile of predicted risk, and the predictive ratios for groups of beneficiaries with between one and two years of diagnosis data were less accurate. CMS has not proposed to calibrate a CMS-HCC model for payment based on two years of diagnosis data because preliminary findings suggest requiring the additional year of data would not improve the model's predictive accuracy overall, but it would increase the time required for beneficiaries to receive a disease-based score, and would necessitate extensive research to evaluate the clinical meaningfulness of diagnoses coded two years prior to the payment year but not one. It additionally introduces more complexity to the model structure without offsetting improvements in accuracy.

4.3 Excluding Diagnoses and Cost from Health Risk Assessments

Over the years, CMS and external stakeholders have expressed concern that health risk assessments (HRAs) could be used as a vehicle for collecting risk adjustment diagnoses without follow-up care or treatment being provided to the beneficiary by the plan. Diagnosis codes are reported to CMS by MA organizations using the encounter data system. Diagnoses used for risk adjustment must meet specific criteria, including that the diagnosis is documented in the medical record. CMS allows MA organizations to use activities described as "health risk assessments," described in more detail below, as a source of diagnoses for MA beneficiaries used in the calculation of risk-adjusted payments. Stakeholders have asked CMS to restrict the use of diagnoses reported only on in-home HRAs for risk adjustment.

HRAs, used in both MA and Traditional Medicare (i.e., Medicare Parts A and B), are intended to be a tool for early identification of health risks to improve beneficiaries' health outcomes through care coordination. Physicians or other health care professionals conduct HRAs to collect information from beneficiaries about their health status, health risks, and daily activities. In the MA program, HRAs are generally either a part of annual wellness visits or are conducted during other visits in non-clinical settings. MA organizations often use these assessments to capture diagnoses that were recorded in a prior year, and to identify new diagnoses.

In recent years, HRA-type assessments, or visits that do not incorporate the use of a formal HRA but may have the same purpose of identifying diagnoses, have been conducted in the home. Diagnoses associated with HRA and HRA-type assessments submitted by MA organizations are eligible for use in risk adjustment when they are documented in the medical record and are associated with a risk-adjustment allowable procedure code. We recognize that there is increasing concern that these types of assessments, especially those conducted in the home, are primarily used to capture diagnoses in order to increase Medicare payments and may not be used for follow-up care. We also recognize that this practice is not used uniformly throughout the industry, leading to potential anti-competitive concerns. CMS intends to continue considering the relationship of HRAs to the care provided to beneficiaries, especially HRAs

conducted in the home. While home visits may be valuable in meeting beneficiaries' care and social needs and identifying early interventions, we recognize the concern that these visits may often be primarily for assessments that lead to collection of diagnoses that never result in early intervention, follow-up care, or care coordination, in the home or otherwise.

Any evaluation of stakeholder concerns and exploration of policy solutions around in-home HRAs needs to address the complexities of whether it is possible to identify diagnoses from home visits that are primarily used for coding assessments versus home visits where the primary purpose is treatment and, if so, how these differences can be identified. As there is no procedure code to identify HRAs that is uniformly used, any evaluation of HRAs would entail looking at procedure codes for other types of visits that cover a wide variety of services. Studies defining HRAs as encounter data records that contain a procedure code for an in-home annual wellness visit, an in-home initial preventive physical exam, or an evaluation and management (E&M) home visit cannot distinguish whether an HRA was included in the visit and, if so whether the visit was primarily for coding purposes or for the purpose of providing routine evaluation and management services including medical decision making, treatment planning, or other clinical consultation services. In addition to identifying diagnoses resulting from HRAs, a further complexity is regarding how to identify visits that do not include a formal HRA but may include an assessment that has the same purpose as a formal HRA and lead to identifying diagnoses without providing follow-up care.

Without a way to uniformly identify either HRAs or HRA-like assessments that are primarily used for coding, there are few options for excluding diagnoses that result from those activities. Potential options that stakeholders have suggested are to exclude all (or most) diagnoses from a home setting or that a diagnosis from a home setting be reported a second time within a certain period of time in order to be considered for risk adjustment. CMS believes that Medicare beneficiaries should have access to care that is appropriately provided in the home setting, and if we were to pursue the exclusion of diagnoses from home visits (or in-home HRAs), we would assess the extent to which excluding diagnosis codes associated with these visits may disincentivize the provision of home-based services. We would also consider the extent to which emerging health conditions that might not otherwise be identified, or identified as timely, are diagnosed through HRAs and consequently treated. As we further consider this important issue, we will need to carefully explore the purpose of the different types of visits made in the home, as well as the extent to which these types of home visits generate diagnoses for risk adjustment without leading to follow-up care or care coordination.

CMS appreciates the ongoing efforts and research conducted by stakeholders to evaluate the risk adjustment model and underlying data sources. We continue to consider comments and recommendations we receive in light of our risk adjustment principles, payment accuracy, and our goal to minimize selection and promote high quality care.

Section 5
TABLES OF PREDICTIVE RATIOS

Table 5-1
Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	30,863,674	$9,701.43	$9,701.43	1.000
First (lowest) decile	3,086,368	$2,885.57	$2,854.35	0.989
Second decile	3,086,368	$3,705.42	$3,645.08	0.984
Third decile	3,086,368	$4,513.32	$4,458.62	0.988
Fourth decile	3,086,368	$5,142.02	$5,117.51	0.995
Fifth decile	3,086,367	$6,252.50	$6,265.44	1.002
Sixth decile	3,086,367	$7,701.50	$7,661.08	0.995
Seventh decile	3,086,367	$9,456.85	$9,450.16	0.999
Eighth decile	3,086,367	$11,865.67	$11,893.95	1.002
Ninth decile	3,086,367	$16,133.73	$16,209.78	1.005
Tenth (highest) decile	3,086,367	$31,557.05	$31,670.94	1.004
Top 5%	1,543,183	$40,504.28	$40,512.61	1.000
Top 1%	308,636	$62,509.01	$62,342.51	0.997
Top 0.1%	30,863	$95,827.22	$93,229.56	0.973
2024 CMS-HCC Model				
Entire sample	30,826,031	$10,712.30	$10,712.30	1.000
First (lowest) decile	3,082,604	$3,301.99	$3,261.91	0.988
Second decile	3,082,603	$4,078.77	$4,059.89	0.995
Third decile	3,082,603	$5,066.13	$5,041.90	0.995
Fourth decile	3,082,603	$5,659.84	$5,737.53	1.014
Fifth decile	3,082,603	$6,753.79	$6,727.90	0.996
Sixth decile	3,082,603	$8,229.33	$8,173.76	0.993
Seventh decile	3,082,603	$10,296.87	$10,215.99	0.992
Eighth decile	3,082,603	$13,030.30	$12,971.61	0.995
Ninth decile	3,082,603	$17,675.73	$17,771.87	1.005
Tenth (highest) decile	3,082,603	$35,429.41	$35,574.90	1.004
Top 5%	1,541,301	$45,955.36	$45,990.56	1.001
Top 1%	308,260	$72,451.30	$71,683.02	0.989
Top 0.1%	30,826	$120,948.76	$117,538.25	0.972

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-2
Predictive ratios by deciles of predicted risk (sorted low to high): Aged enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	25,739,689	$9,658.46	$9,659.08	1.000
First (lowest) decile	2,573,969	$3,091.50	$3,008.61	0.973
Second decile	2,573,969	$3,803.88	$3,751.19	0.986
Third decile	2,573,969	$4,504.69	$4,528.33	1.005
Fourth decile	2,573,969	$5,142.02	$5,116.65	0.995
Fifth decile	2,573,969	$6,215.56	$6,237.54	1.004
Sixth decile	2,573,969	$7,651.68	$7,616.06	0.995
Seventh decile	2,573,969	$9,460.50	$9,447.48	0.999
Eighth decile	2,573,969	$11,950.94	$11,941.67	0.999
Ninth decile	2,573,969	$16,301.15	$16,347.03	1.003
Tenth (highest) decile	2,573,968	$30,812.43	$30,963.40	1.005
Top 5%	1,286,984	$39,074.75	$39,162.27	1.002
Top 1%	257,396	$59,240.76	$58,967.58	0.995
Top 0.1%	25,739	$89,528.10	$86,272.36	0.964
2024 CMS-HCC Model				
Entire sample	26,467,944	$10,645.57	$10,645.86	1.000
First (lowest) decile	2,646,795	$3,515.55	$3,465.73	0.986
Second decile	2,646,795	$4,172.95	$4,158.98	0.997
Third decile	2,646,795	$5,116.94	$5,129.77	1.003
Fourth decile	2,646,795	$5,645.12	$5,750.39	1.019
Fifth decile	2,646,794	$6,711.36	$6,696.19	0.998
Sixth decile	2,646,794	$8,179.42	$8,097.77	0.990
Seventh decile	2,646,794	$10,225.71	$10,120.22	0.990
Eighth decile	2,646,794	$12,989.58	$12,912.96	0.994
Ninth decile	2,646,794	$17,740.80	$17,831.12	1.005
Tenth (highest) decile	2,646,794	$34,614.68	$34,770.36	1.004
Top 5%	1,323,397	$44,450.86	$44,517.11	1.001
Top 1%	264,679	$68,157.90	$67,507.58	0.990
Top 0.1%	26,467	$102,563.06	$98,988.19	0.965

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-3
Predictive ratios by deciles of predicted risk (sorted low to high): Disabled enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	5,123,985	$9,919.12	$9,915.98	1.000
First (lowest) decile	512,399	$2,235.31	$2,289.66	1.024
Second decile	512,399	$3,172.12	$3,171.64	1.000
Third decile	512,399	$4,084.42	$3,890.03	0.952
Fourth decile	512,399	$5,243.59	$5,044.88	0.962
Fifth decile	512,399	$6,458.65	$6,405.49	0.992
Sixth decile	512,398	$7,913.87	$7,883.00	0.996
Seventh decile	512,398	$9,381.96	$9,447.03	1.007
Eighth decile	512,398	$11,590.84	$11,730.97	1.012
Ninth decile	512,398	$15,244.14	$15,491.34	1.016
Tenth (highest) decile	512,398	$35,097.16	$35,046.38	0.999
Top 5%	256,199	$47,188.84	$46,836.85	0.993
Top 1%	51,239	$74,874.25	$74,792.90	0.999
Top 0.1%	5,123	$112,267.50	$109,973.40	0.980
2024 CMS-HCC Model				
Entire sample	4,358,087	$11,128.26	$11,126.44	1.000
First (lowest) decile	435,809	$2,297.40	$2,217.95	0.965
Second decile	435,809	$3,444.93	$3,469.38	1.007
Third decile	435,809	$4,477.96	$4,332.23	0.967
Fourth decile	435,809	$5,732.76	$5,586.16	0.974
Fifth decile	435,809	$6,966.04	$6,977.67	1.002
Sixth decile	435,809	$8,595.95	$8,636.35	1.005
Seventh decile	435,809	$10,777.29	$10,767.95	0.999
Eighth decile	435,808	$13,252.85	$13,290.29	1.003
Ninth decile	435,808	$17,253.31	$17,432.00	1.010
Tenth (highest) decile	435,808	$40,283.27	$40,367.37	1.002
Top 5%	217,904	$54,602.74	$54,451.91	0.997
Top 1%	43,580	$94,288.72	$92,594.00	0.982
Top 0.1%	4,358	$201,091.63	$197,548.41	0.982

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-4
Predictive ratios by deciles of predicted risk (sorted low to high): Aged-disabled community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	27,574,242	$9,719.21	$9,719.21	1.000
First (lowest) decile	2,757,425	$2,890.31	$2,831.91	0.980
Second decile	2,757,425	$3,572.40	$3,521.56	0.986
Third decile	2,757,424	$4,290.42	$4,208.85	0.981
Fourth decile	2,757,424	$5,244.04	$5,155.97	0.983
Fifth decile	2,757,424	$6,309.31	$6,335.15	1.004
Sixth decile	2,757,424	$7,688.24	$7,673.62	0.998
Seventh decile	2,757,424	$9,439.83	$9,492.44	1.006
Eighth decile	2,757,424	$11,992.14	$12,058.15	1.006
Ninth decile	2,757,424	$16,465.57	$16,562.04	1.006
Tenth (highest) decile	2,757,424	$32,135.27	$32,201.32	1.002
Top 5%	1,378,712	$41,252.12	$41,174.22	0.998
Top 1%	275,742	$63,835.88	$63,402.58	0.993
Top 0.1%	27,574	$99,171.67	$95,221.04	0.960
2024 CMS-HCC Model				
Entire sample	27,702,798	$10,718.35	$10,718.35	1.000
First (lowest) decile	2,770,280	$3,313.15	$3,240.10	0.978
Second decile	2,770,280	$4,036.39	$3,973.17	0.984
Third decile	2,770,280	$4,716.77	$4,743.12	1.006
Fourth decile	2,770,280	$5,645.64	$5,635.58	0.998
Fifth decile	2,770,280	$6,812.79	$6,817.81	1.001
Sixth decile	2,770,280	$8,275.80	$8,233.49	0.995
Seventh decile	2,770,280	$10,272.52	$10,224.69	0.995
Eighth decile	2,770,280	$13,098.24	$13,083.19	0.999
Ninth decile	2,770,279	$17,986.21	$18,112.78	1.007
Tenth (highest) decile	2,770,279	$36,027.14	$36,136.30	1.003
Top 5%	1,385,139	$46,780.13	$46,742.55	0.999
Top 1%	277,027	$73,880.98	$72,902.13	0.987
Top 0.1%	27,702	$125,873.31	$121,875.25	0.968

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-5
Predictive ratios by deciles of predicted risk (sorted low to high): Aged-disabled institutional continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	906,802	$19,465.55	$19,465.55	1.000
First (lowest) decile	90,681	$8,687.63	$7,451.69	0.858
Second decile	90,681	$10,406.93	$9,983.01	0.959
Third decile	90,680	$11,858.63	$11,803.34	0.995
Fourth decile	90,680	$13,478.54	$13,475.66	1.000
Fifth decile	90,680	$14,961.00	$15,294.68	1.022
Sixth decile	90,680	$17,026.46	$17,424.23	1.023
Seventh decile	90,680	$19,631.99	$20,140.21	1.026
Eighth decile	90,680	$23,513.21	$23,986.39	1.020
Ninth decile	90,680	$29,912.89	$30,348.31	1.015
Tenth (highest) decile	90,680	$48,771.44	$48,253.67	0.989
Top 5%	45,340	$58,504.74	$57,544.87	0.984
Top 1%	9,068	$81,506.42	$78,847.70	0.967
Top 0.1%	906	$109,195.68	$104,208.42	0.954
2024 CMS-HCC Model				
Entire sample	750,772	$22,916.24	$22,916.24	1.000
First (lowest) decile	75,078	$10,212.15	$8,416.21	0.824
Second decile	75,078	$12,436.78	$11,586.27	0.932
Third decile	75,077	$14,193.30	$13,864.80	0.977
Fourth decile	75,077	$15,786.08	$15,958.85	1.011
Fifth decile	75,077	$17,652.42	$18,165.50	1.029
Sixth decile	75,077	$19,984.79	$20,686.90	1.035
Seventh decile	75,077	$23,169.65	$23,810.00	1.028
Eighth decile	75,077	$27,449.68	$28,215.49	1.028
Ninth decile	75,077	$35,006.10	$35,500.34	1.014
Tenth (highest) decile	75,077	$56,377.56	$55,927.45	0.992
Top 5%	37,538	$67,655.07	$66,162.17	0.978
Top 1%	7,507	$95,673.53	$87,823.73	0.918
Top 0.1%	750	$131,557.84	$112,973.30	0.859

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-6
Predictive ratios by deciles of predicted risk (sorted low to high): Aged-disabled new enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	2,631,327	$6,746.77	$6,746.77	1.000
First (lowest) decile	263,133	$4,925.13	$4,811.89	0.977
Second decile	263,133	$4,840.70	$4,847.25	1.001
Third decile	263,133	$4,864.90	$4,861.23	0.999
Fourth decile	263,133	$4,917.58	$4,870.54	0.990
Fifth decile	263,133	$4,755.21	$4,887.61	1.028
Sixth decile	263,133	$5,317.76	$5,340.17	1.004
Seventh decile	263,133	$6,835.96	$6,840.93	1.001
Eighth decile	263,132	$8,785.06	$8,778.08	0.999
Ninth decile	263,132	$10,101.01	$10,113.77	1.001
Tenth (highest) decile	263,132	$12,806.41	$12,807.86	1.000
Top 5%	131,566	$13,668.54	$13,632.82	0.997
Top 1%	26,313	$15,577.22	$15,568.61	0.999
Top 0.1%	2,631	$20,439.44	$20,281.59	0.992
2024 CMS-HCC Model				
Entire sample	2,577,049	$7,639.62	$7,639.62	1.000
First (lowest) decile	257,705	$5,608.74	$5,498.57	0.980
Second decile	257,705	$5,581.54	$5,534.87	0.992
Third decile	257,705	$5407.23	$5,565.86	1.029
Fourth decile	257,705	$6,020.80	$5,887.02	0.978
Fifth decile	257,705	$5,812.37	$5,895.66	1.014
Sixth decile	257,705	$6,026.37	$6,087.64	1.010
Seventh decile	257,705	$7,316.33	$7,229.93	0.988
Eighth decile	257,705	$9,692.50	$9,778.35	1.009
Ninth decile	257,705	$11,808.48	$11,815.39	1.001
Tenth (highest) decile	257,704	$14,584.37	$14,586.18	1.000
Top 5%	128,852	$15,557.29	$15,523.04	0.998
Top 1%	25,770	$17,295.20	$17,252.31	0.998
Top 0.1%	2,577	$22,406.95	$22,416.66	1.000

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-7
Predictive ratios by deciles of predicted risk (sorted low to high): Aged community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	23,075,236	$9,735.05	$9,735.05	1.000
First (lowest) decile	2,307,524	$3,022.24	$2,959.46	0.979
Second decile	2,307,524	$3,708.23	$3,634.02	0.980
Third decile	2,307,524	$4,369.20	$4,326.99	0.990
Fourth decile	2,307,524	$5,346.53	$5,288.03	0.989
Fifth decile	2,307,524	$6,426.87	$6,451.35	1.004
Sixth decile	2,307,524	$7,816.62	$7,808.99	0.999
Seventh decile	2,307,523	$9,581.56	$9,636.73	1.006
Eighth decile	2,307,523	$12,157.84	$12,196.30	1.003
Ninth decile	2,307,523	$16,591.82	$16,660.37	1.004
Tenth (highest) decile	2,307,523	$31,367.34	$31,440.29	1.002
Top 5%	1,153,761	$39,793.36	$39,760.96	0.999
Top 1%	230,752	$60,579.29	$59,937.20	0.989
Top 0.1%	23,075	$92,559.57	$87,970.49	0.950
2024 CMS-HCC Model				
Entire sample	23,830,645	$10,718.92	$10,718.92	1.000
First (lowest) decile	2,383,065	$3,485.88	$3,441.46	0.987
Second decile	2,383,065	$4,136.65	$4,069.53	0.984
Third decile	2,383,065	$4,799.34	$4,867.89	1.014
Fourth decile	2,383,065	$5,739.16	$5,707.36	0.994
Fifth decile	2,383,065	$6,873.64	$6,902.37	1.004
Sixth decile	2,383,064	$8,389.89	$8,325.41	0.992
Seventh decile	2,383,064	$10,381.71	$10,328.67	0.995
Eighth decile	2,383,064	$13,218.96	$13,180.61	0.997
Ninth decile	2,383,064	$18,056.97	$18,167.92	1.006
Tenth (highest) decile	2,383,064	$35,231.64	$35,337.55	1.003
Top 5%	1,191,532	$45,303.35	$45,281.06	1.000
Top 1%	238,306	$69,397.76	$68,556.47	0.988
Top 0.1%	23,830	$105,226.45	$101,063.70	0.960

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-8
Predictive ratios by deciles of predicted risk (sorted low to high): Disabled community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	4,499,006	$9,637.30	$9,637.30	1.000
First (lowest) decile	449,901	$2,130.59	$2,222.64	1.043
Second decile	449,901	$3,060.08	$3,053.25	0.998
Third decile	449,901	$3,803.60	$3,636.00	0.956
Fourth decile	449,901	$4,790.85	$4,512.60	0.942
Fifth decile	449,901	$5,822.89	$5,687.81	0.977
Sixth decile	449,901	$7,016.61	$6,970.09	0.993
Seventh decile	449,900	$8,650.59	$8,701.18	1.006
Eighth decile	449,900	$11,095.29	$11,287.15	1.017
Ninth decile	449,900	$15,714.55	$15,989.67	1.018
Tenth (highest) decile	449,900	$35,878.76	$35,910.99	1.001
Top 5%	224,950	$48,114.07	$47,855.05	0.995
Top 1%	44,990	$76,738.44	$76,306.55	0.994
Top 0.1%	4,499	$118,104.71	$112,649.56	0.954
2024 CMS-HCC Model				
Entire sample	3,872,153	$10,714.79	$10,714.79	1.000
First (lowest) decile	387,216	$2,219.18	$2,124.35	0.957
Second decile	387,216	$3,336.55	$3,342.26	1.002
Third decile	387,216	$4,283.69	$4,066.16	0.949
Fourth decile	387,215	$5,162.06	$5,064.64	0.981
Fifth decile	387,215	$6,387.83	$6,271.07	0.982
Sixth decile	387,215	$7,659.93	$7,684.18	1.003
Seventh decile	387,215	$9,495.98	$9,566.29	1.007
Eighth decile	387,215	$12,351.79	$12,441.38	1.007
Ninth decile	387,215	$17,505.93	$17,729.20	1.013
Tenth (highest) decile	387,215	$40,838.09	$40,965.06	1.003
Top 5%	193,607	$55,348.69	$55,261.77	0.998
Top 1%	38,721	$97,223.93	$95,243.85	0.980
Top 0.1%	3,872	$215,196.71	$210,913.23	0.980

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-9
Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual aged enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	1,984,583	$15,707.58	$15,707.58	1.000
First (lowest) decile	198,459	$4,887.58	$4,735.74	0.969
Second decile	198,459	$6,072.80	$6,109.97	1.006
Third decile	198,459	$7,709.10	$7,617.04	0.988
Fourth decile	198,458	$9,350.44	$9,295.78	0.994
Fifth decile	198,458	$11,102.71	$11,173.08	1.006
Sixth decile	198,458	$13,442.94	$13,447.48	1.000
Seventh decile	198,458	$16,364.12	$16,428.13	1.004
Eighth decile	198,458	$20,630.64	$20,686.30	1.003
Ninth decile	198,458	$27,902.71	$27,953.45	1.002
Tenth (highest) decile	198,458	$48,262.29	$48,298.65	1.001
Top 5%	99,229	$59,086.36	$59,305.87	1.004
Top 1%	19,845	$85,907.39	$84,021.41	0.978
Top 0.1%	1,984	$127,271.11	$116,431.41	0.915
2024 CMS-HCC Model				
Entire sample	1,911,183	$16,937.06	$16,937.06	1.000
First (lowest) decile	191,119	$5,229.86	$5,209.53	0.996
Second decile	191,119	$6,503.10	$6,691.58	1.029
Third decile	191,119	$7,996.34	$8,114.22	1.015
Fourth decile	191,118	$9,922.41	$9,751.89	0.983
Fifth decile	191,118	$11,935.61	$11,767.29	0.986
Sixth decile	191,118	$14,222.89	$14,182.95	0.997
Seventh decile	191,118	$17,575.97	$17,440.97	0.992
Eighth decile	191,118	$22,059.65	$22,111.14	1.002
Ninth decile	191,118	$30,002.09	$30,050.81	1.002
Tenth (highest) decile	191,118	$52,504.70	$52,659.83	1.003
Top 5%	95,559	$64,745.70	$64,902.07	1.002
Top 1%	19,111	$95,269.90	$93,294.01	0.979
Top 0.1%	1,911	$147,006.76	$135,082.79	0.919

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-10
Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual disabled enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	2,031,028	$10,834.33	$10,834.33	1.000
First (lowest) decile	203,103	$2,236.53	$2,407.61	1.076
Second decile	203,103	$3,250.51	$3,304.07	1.016
Third decile	203,103	$4,517.23	$4,033.96	0.893
Fourth decile	203,103	$5,401.83	$5,079.18	0.940
Fifth decile	203,103	$6,448.19	$6,395.50	0.992
Sixth decile	203,103	$7,814.40	$7,805.80	0.999
Seventh decile	203,103	$9,678.04	$9,871.93	1.020
Eighth decile	203,103	$12,511.70	$12,755.36	1.019
Ninth decile	203,102	$18,140.14	$18,292.92	1.008
Tenth (highest) decile	203,102	$41,440.70	$41,506.14	1.002
Top 5%	101,551	$55,469.82	$55,240.10	0.996
Top 1%	20,310	$87,808.62	$86,437.05	0.984
Top 0.1%	2,031	$141,917.09	$123,864.40	0.873
2024 CMS-HCC Model				
Entire sample	1,826,784	$11,940.55	$11,940.55	1.000
First (lowest) decile	182,679	$2,373.27	$2,295.40	0.967
Second decile	182,679	$3,408.74	$3,589.94	1.053
Third decile	182,679	$5,043.07	$4,559.85	0.904
Fourth decile	182,679	$5,866.09	$5,690.08	0.970
Fifth decile	182,678	$7,018.61	$7,053.20	1.005
Sixth decile	182,678	$8,542.77	$8,583.63	1.005
Seventh decile	182,678	$10,599.94	$10,737.21	1.013
Eighth decile	182,678	$14,036.22	$13,983.51	0.996
Ninth decile	182,678	$19,857.48	$20,171.35	1.016
Tenth (highest) decile	182,678	$46,245.75	$46,345.76	1.002
Top 5%	91,339	$62,419.74	$62,131.38	0.995
Top 1%	18,267	$106,848.16	$105,052.83	0.983
Top 0.1%	1,826	$225,350.99	$226,895.08	1.007

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-11
Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual aged enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	896,980	$10,791.10	$10,791.10	1.000
First (lowest) decile	89,698	$3,529.56	$3,523.41	0.998
Second decile	89,698	$4,253.12	$4,245.61	0.998
Third decile	89,698	$5,080.94	$4,963.81	0.977
Fourth decile	89,698	$6,243.18	$6,162.97	0.987
Fifth decile	89,698	$7,494.66	$7,486.61	0.999
Sixth decile	89,698	$8,862.98	$8,896.72	1.004
Seventh decile	89,698	$10,854.80	$10,891.39	1.003
Eighth decile	89,698	$13,634.07	$13,716.64	1.006
Ninth decile	89,698	$18,501.93	$18,620.21	1.006
Tenth (highest) decile	89,698	$33,314.23	$33,266.72	0.999
Top 5%	44,849	$41,496.82	$41,247.30	0.994
Top 1%	8,969	$59,717.85	$59,686.69	0.999
Top 0.1%	896	$83,275.44	$81,730.89	0.981
2024 CMS-HCC Model				
Entire sample	835,591	$11,965.14	$11,965.14	1.000
First (lowest) decile	83,560	$3,973.15	$3,973.51	1.000
Second decile	83,559	$4,585.54	$4,690.18	1.023
Third decile	83,559	$5,597.56	$5,589.43	0.999
Fourth decile	83,559	$6,663.02	$6,668.43	1.001
Fifth decile	83,559	$8,189.74	$7,994.36	0.976
Sixth decile	83,559	$9,772.58	$9,607.45	0.983
Seventh decile	83,559	$11,680.14	$11,748.82	1.006
Eighth decile	83,559	$14,949.94	$14,956.76	1.000
Ninth decile	83,559	$20,236.81	$20,423.72	1.009
Tenth (highest) decile	83,559	$37,716.56	$37,725.19	1.000
Top 5%	41,779	$47,638.52	$47,625.96	1.000
Top 1%	8,355	$71,279.45	$70,235.06	0.985
Top 0.1%	835	$103,235.00	$101,296.78	0.981

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-12
Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual disabled enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	840,221	$9,851.89	$9,851.89	1.000
First (lowest) decile	84,023	$3,139.48	$2,934.23	0.935
Second decile	84,022	$3,610.94	$3,681.92	1.020
Third decile	84,022	$4,136.95	$4,088.91	0.988
Fourth decile	84,022	$5,255.47	$5,142.56	0.979
Fifth decile	84,022	$6,309.06	$6,196.63	0.982
Sixth decile	84,022	$7,321.30	$7,311.75	0.999
Seventh decile	84,022	$8,949.78	$9,049.35	1.011
Eighth decile	84,022	$11,253.53	$11,538.71	1.025
Ninth decile	84,022	$15,948.86	$16,106.83	1.010
Tenth (highest) decile	84,022	$34,459.04	$34,334.97	0.996
Top 5%	42,011	$45,586.95	$45,068.69	0.989
Top 1%	8,402	$69,059.99	$69,220.58	1.002
Top 0.1%	840	$92,482.38	$99,549.56	1.076
2024 CMS-HCC Model				
Entire sample	699,747	$11,027.51	$11,027.51	1.000
First (lowest) decile	69,975	$3,197.44	$3,160.76	0.989
Second decile	69,975	$4,525.63	$4,056.70	0.896
Third decile	69,975	$4,479.78	$4,683.43	1.045
Fourth decile	69,975	$5,868.96	$5,879.54	1.002
Fifth decile	69,975	$6,810.13	$6,781.49	0.996
Sixth decile	69,975	$8,040.98	$8,065.38	1.003
Seventh decile	69,975	$9,943.55	$9,931.29	0.999
Eighth decile	69,974	$12,705.97	$12,652.10	0.996
Ninth decile	69,974	$17,423.63	$17,799.82	1.022
Tenth (highest) decile	69,974	$39,454.66	$39,457.93	1.000
Top 5%	34,987	$53,065.46	$52,926.75	0.997
Top 1%	6,997	$92,442.55	$90,666.81	0.981
Top 0.1%	699	$223,852.09	$216,774.33	0.968

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-13
Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual aged enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	20,657,519	$9,203.56	$9,203.56	1.000
First (lowest) decile	2,065,752	$3,048.40	$2,951.38	0.968
Second decile	2,065,752	$3,603.98	$3,540.94	0.983
Third decile	2,065,752	$4,161.37	$4,143.25	0.996
Fourth decile	2,065,752	$5,050.88	$4,996.02	0.989
Fifth decile	2,065,752	$6,132.93	$6,152.26	1.003
Sixth decile	2,065,752	$7,395.43	$7,412.00	1.002
Seventh decile	2,065,752	$9,071.45	$9,112.69	1.005
Eighth decile	2,065,752	$11,461.93	$11,499.53	1.003
Ninth decile	2,065,752	$15,549.91	$15,604.16	1.003
Tenth (highest) decile	2,065,751	$29,233.05	$29,310.45	1.003
Top 5%	1,032,875	$37,113.68	$37,096.47	1.000
Top 1%	206,575	$56,497.89	$55,599.71	0.984
Top 0.1%	20,657	$83,646.00	$80,184.50	0.959
2024 CMS-HCC Model				
Entire sample	21,546,966	$10,206.05	$10,206.05	1.000
First (lowest) decile	2,154,697	$3,519.78	$3,439.91	0.977
Second decile	2,154,697	$4,070.80	$3,993.69	0.981
Third decile	2,154,697	$4,530.99	$4,648.68	1.026
Fourth decile	2,154,697	$5,494.24	$5,512.50	1.003
Fifth decile	2,154,697	$6,614.93	$6,583.48	0.995
Sixth decile	2,154,697	$7,962.17	$7,909.04	0.993
Seventh decile	2,154,696	$9,841.61	$9,806.77	0.996
Eighth decile	2,154,696	$12,543.35	$12,488.85	0.996
Ninth decile	2,154,696	$17,028.21	$17,132.27	1.006
Tenth (highest) decile	2,154,696	$33,209.84	$33,314.30	1.003
Top 5%	1,077,348	$42,749.71	$42,751.22	1.000
Top 1%	215,469	$65,855.68	$65,020.38	0.987
Top 0.1%	21,546	$97,595.22	$94,327.59	0.967

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-14
Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual disabled enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	2,089,311	$8,373.23	$8,373.23	1.000
First (lowest) decile	208,932	$1,814.85	$1,977.84	1.090
Second decile	208,931	$2,798.17	$2,682.81	0.959
Third decile	208,931	$3,230.81	$3,173.78	0.982
Fourth decile	208,931	$3,933.42	$3,862.61	0.982
Fifth decile	208,931	$5,170.59	$4,921.22	0.952
Sixth decile	208,931	$6,158.05	$6,139.26	0.997
Seventh decile	208,931	$7,826.48	$7,689.57	0.983
Eighth decile	208,931	$9,870.88	$9,946.54	1.008
Ninth decile	208,931	$13,721.82	$14,106.84	1.028
Tenth (highest) decile	208,931	$31,184.86	$31,229.45	1.001
Top 5%	104,465	$42,036.86	$41,657.58	0.991
Top 1%	20,893	$66,661.48	$66,572.15	0.999
Top 0.1%	2,089	$100,047.98	$97,942.92	0.979
2024 CMS-HCC Model				
Entire sample	1,756,602	$9,306.05	$9,306.05	1.000
First (lowest) decile	175,661	$1,925.44	$1,794.36	0.932
Second decile	175,661	$2,898.47	$2,868.19	0.990
Third decile	175,660	$3,641.22	$3,579.89	0.983
Fourth decile	175,660	$4,245.88	$4,292.23	1.011
Fifth decile	175,660	$5,620.29	$5,365.16	0.955
Sixth decile	175,660	$6,645.53	$6,625.12	0.997
Seventh decile	175,660	$8,420.41	$8,391.36	0.997
Eighth decile	175,660	$10,908.28	$10,931.86	1.002
Ninth decile	175,660	$15,160.88	$15,488.41	1.022
Tenth (highest) decile	175,660	$35,719.75	$35,861.06	1.004
Top 5%	87,830	$48,711.73	$48,636.24	0.998
Top 1%	17,566	$87,143.31	$85,477.22	0.981
Top 0.1%	1,756	$204,477.80	$196,272.72	0.960

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-15
Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 0 chronic conditions

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	2,697,830	$2,840.11	$3,886.17	1.368
First (lowest) decile	269,783	$1,600.56	$2,229.44	1.393
Second decile	269,783	$2,060.23	$2,884.57	1.400
Third decile	269,783	$1,902.56	$2,939.80	1.545
Fourth decile	269,783	$2,015.54	$3,043.55	1.510
Fifth decile	269,783	$2,402.32	$3,495.66	1.455
Sixth decile	269,783	$2,418.34	$3,666.44	1.516
Seventh decile	269,783	$2,926.25	$4,022.46	1.375
Eighth decile	269,783	$3,173.76	$4,411.63	1.390
Ninth decile	269,783	$3,976.90	$5,182.17	1.303
Tenth (highest) decile	269,783	$6,057.77	$7,115.68	1.175
Top 5%	134,891	$6,836.09	$7,991.66	1.169
Top 1%	26,978	$8,303.12	$9,927.61	1.196
Top 0.1%	2,697	$9,205.75	$12,806.59	1.391
2024 CMS-HCC Model				
Entire sample	2,601,882	$2,904.78	$4,348.08	1.497
First (lowest) decile	260,189	$1,712.69	$2,240.74	1.308
Second decile	260,189	$2,080.19	$3,412.26	1.640
Third decile	260,188	$2,132.17	$3,450.89	1.618
Fourth decile	260,188	$2,290.02	$3,507.75	1.532
Fifth decile	260,188	$2,621.09	$4,066.75	1.552
Sixth decile	260,188	$2,440.30	$4,121.70	1.689
Seventh decile	260,188	$3,128.15	$4,490.81	1.436
Eighth decile	260,188	$3,198.81	$5,090.93	1.592
Ninth decile	260,188	$3,895.11	$5,688.55	1.460
Tenth (highest) decile	260,188	$5,626.54	$7,480.03	1.329
Top 5%	130,094	$6,284.78	$8,267.72	1.316
Top 1%	26,018	$8,430.09	$9,975.95	1.183
Top 0.1%	2,601	$10,431.25	$13,185.17	1.264

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-16
Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 1–3 chronic conditions

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	7,074,549	$5,074.96	$5,573.11	1.098
First (lowest) decile	707,455	$2,924.67	$2,734.39	0.935
Second decile	707,455	$2,906.97	$3,029.50	1.042
Third decile	707,455	$3,235.37	$3,550.71	1.097
Fourth decile	707,455	$3,521.79	$3,770.55	1.071
Fifth decile	707,455	$3,913.68	$4,301.73	1.099
Sixth decile	707,455	$4,288.18	$4,890.52	1.140
Seventh decile	707,455	$4,923.91	$5,688.11	1.155
Eighth decile	707,455	$5,865.69	$6,700.23	1.142
Ninth decile	707,455	$7,435.73	$8,240.17	1.108
Tenth (highest) decile	707,454	$12,179.94	$13,320.14	1.094
Top 5%	353,727	$14,896.85	$16,296.59	1.094
Top 1%	70,745	$25,940.42	$26,857.10	1.035
Top 0.1%	7,074	$51,331.19	$43,048.11	0.839
2024 CMS-HCC Model				
Entire sample	6,203,214	$5,166.19	$6,049.80	1.171
First (lowest) decile	620,322	$3,002.69	$3,105.43	1.034
Second decile	620,322	$3,215.48	$3,445.88	1.072
Third decile	620,322	$3,525.60	$3,879.71	1.100
Fourth decile	620,322	$3,605.48	$4,118.25	1.142
Fifth decile	620,321	$3,982.56	$4,649.96	1.168
Sixth decile	620,321	$4,387.46	$5,282.70	1.204
Seventh decile	620,321	$4,830.20	$5,957.11	1.233
Eighth decile	620,321	$5,659.81	$6,985.43	1.234
Ninth decile	620,321	$7,325.26	$8,642.68	1.180
Tenth (highest) decile	620,321	$12,502.87	$14,889.81	1.191
Top 5%	310,160	$15,740.88	$18,754.32	1.191
Top 1%	62,032	$29,368.45	$34,030.48	1.159
Top 0.1%	6,203	$67,444.23	$71,410.56	1.059

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-17
Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 4–6 chronic conditions

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	9,581,219	$8,229.13	$8,363.95	1.016
First (lowest) decile	958,122	$4,430.11	$3,185.01	0.719
Second decile	958,122	$4,806.54	$3,984.49	0.829
Third decile	958,122	$5,287.93	$4,817.25	0.911
Fourth decile	958,122	$5,842.94	$5,732.83	0.981
Fifth decile	958,122	$6,426.77	$6,628.66	1.031
Sixth decile	958,122	$7,314.16	$7,607.44	1.040
Seventh decile	958,122	$8,284.75	$8,831.17	1.066
Eighth decile	958,122	$9,729.23	$10,423.21	1.071
Ninth decile	958,122	$11,970.53	$12,871.48	1.075
Tenth (highest) decile	958,121	$19,198.62	$20,719.07	1.079
Top 5%	479,060	$23,602.69	$25,381.58	1.075
Top 1%	95,812	$36,875.28	$38,017.71	1.031
Top 0.1%	9,581	$56,426.81	$55,908.63	0.991
2024 CMS-HCC Model				
Entire sample	8,969,132	$8,337.08	$8,750.17	1.050
First (lowest) decile	896,914	$4,782.73	$3,509.73	0.734
Second decile	896,914	$5,166.21	$4,254.20	0.823
Third decile	896,913	$5,457.72	$5,131.66	0.940
Fourth decile	896,913	$5,823.99	$5,811.01	0.998
Fifth decile	896,913	$6,430.57	$6,743.70	1.049
Sixth decile	896,913	$7,164.76	$7,673.64	1.071
Seventh decile	896,913	$8,114.26	$8,933.25	1.101
Eighth decile	896,913	$9,604.32	$10,642.91	1.108
Ninth decile	896,913	$11,826.79	$13,264.08	1.122
Tenth (highest) decile	896,913	$19,862.29	$22,608.28	1.138
Top 5%	448,456	$25,162.15	$28,435.89	1.130
Top 1%	89,691	$44,095.48	$47,637.43	1.080
Top 0.1%	8,969	$77,897.34	$80,332.15	1.031

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-18
Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 7–9 chronic conditions

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	5,670,564	$13,780.49	$13,296.57	0.965
First (lowest) decile	567,057	$7,129.79	$4,418.50	0.620
Second decile	567,057	$8,160.69	$6,493.37	0.796
Third decile	567,057	$9,170.26	$7,932.41	0.865
Fourth decile	567,057	$10,102.03	$9,327.95	0.923
Fifth decile	567,056	$11,191.03	$10,751.89	0.961
Sixth decile	567,056	$12,605.27	$12,360.91	0.981
Seventh decile	567,056	$14,264.09	$14,281.52	1.001
Eighth decile	567,056	$16,524.16	$16,797.83	1.017
Ninth decile	567,056	$19,961.19	$20,755.16	1.040
Tenth (highest) decile	567,056	$31,131.14	$32,648.48	1.049
Top 5%	283,528	$37,372.93	$39,079.34	1.046
Top 1%	56,705	$52,456.74	$54,447.36	1.038
Top 0.1%	5,670	$74,506.49	$76,199.78	1.023
2024 CMS-HCC Model				
Entire sample	6,127,501	$13,637.73	$13,149.83	0.964
First (lowest) decile	612,751	$7,519.24	$4,465.14	0.594
Second decile	612,750	$8,209.43	$6,164.18	0.751
Third decile	612,750	$8,954.58	$7,506.68	0.838
Fourth decile	612,750	$9,853.04	$8,838.68	0.897
Fifth decile	612,750	$11,004.44	$10,291.62	0.935
Sixth decile	612,750	$12,244.94	$11,912.41	0.973
Seventh decile	612,750	$13,883.24	$13,891.35	1.001
Eighth decile	612,750	$15,895.91	$16,480.50	1.037
Ninth decile	612,750	$19,240.13	$20,485.92	1.065
Tenth (highest) decile	612,750	$31,585.52	$33,887.44	1.073
Top 5%	306,375	$39,316.79	$41,714.42	1.061
Top 1%	61,275	$60,232.60	$61,627.88	1.023
Top 0.1%	6,127	$94,125.02	$96,667.95	1.027

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-19
Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 10+ chronic conditions

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	3,208,185	$25,989.17	$24,366.25	0.938
First (lowest) decile	320,819	$11,587.37	$7,875.20	0.680
Second decile	320,819	$14,230.76	$11,609.11	0.816
Third decile	320,819	$16,411.04	$14,311.18	0.872
Fourth decile	320,819	$18,661.38	$16,947.92	0.908
Fifth decile	320,819	$21,274.55	$19,760.74	0.929
Sixth decile	320,818	$24,059.68	$22,956.87	0.954
Seventh decile	320,818	$27,755.55	$26,852.96	0.967
Eighth decile	320,818	$32,999.31	$32,075.12	0.972
Ninth decile	320,818	$40,767.95	$40,129.95	0.984
Tenth (highest) decile	320,818	$60,699.74	$60,168.95	0.991
Top 5%	160,409	$70,884.42	$70,146.96	0.990
Top 1%	32,081	$94,931.12	$92,251.70	0.972
Top 0.1%	3,208	$131,103.55	$121,692.26	0.928
2024 CMS-HCC Model				
Entire sample	4,347,253	$26,434.45	$24,026.73	0.909
First (lowest) decile	434,726	$11,867.04	$7,056.27	0.595
Second decile	434,726	$14,279.66	$10,562.70	0.740
Third decile	434,726	$16,466.64	$13,280.30	0.806
Fourth decile	434,725	$18,650.12	$15,981.28	0.857
Fifth decile	434,725	$21,254.72	$18,858.72	0.887
Sixth decile	434,725	$24,114.85	$22,157.63	0.919
Seventh decile	434,725	$27,731.45	$26,211.22	0.945
Eighth decile	434,725	$32,913.58	$31,651.70	0.962
Ninth decile	434,725	$41,175.33	$40,271.84	0.978
Tenth (highest) decile	434,725	$64,206.60	$63,107.70	0.983
Top 5%	217,362	$75,853.24	$74,564.56	0.983
Top 1%	43,472	$103,660.16	$100,691.37	0.971
Top 0.1%	4,347	$147,671.74	$148,421.43	1.005

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all deciles using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because deciles defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-20a
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				28,232,347	$9,949.14	$9,949.14	1.000
HCC1	HIV/AIDS	Y	Y	100,346	$15,248.52	$15,248.52	1.000
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		595,422	$35,841.56	$35,841.56	1.000
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			40,179	$29,613.78	$27,090.61	0.915
HCC4	Viral and Late Effects Central Nervous System Infections			47,526	$19,155.98	$17,212.61	0.899
HCC5	Tuberculosis			14,968	$23,103.63	$20,351.25	0.881
HCC6	Opportunistic Infections	Y		80,137	$29,209.56	$29,209.56	1.000
HCC7	Other Infectious Diseases			5,992,048	$16,424.99	$15,424.48	0.939
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	279,327	$41,183.12	$41,183.12	1.000
HCC9	Lung and Other Severe Cancers	Y	Y	311,387	$25,603.56	$25,603.56	1.000
HCC10	Lymphoma and Other Cancers	Y	Y	391,747	$19,423.50	$19,423.50	1.000
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	583,094	$15,322.54	$15,322.54	1.000
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	1,700,875	$11,389.70	$11,389.70	1.000
HCC13	Other Respiratory and Heart Neoplasms			36,747	$15,818.83	$13,678.46	0.865
HCC14	Other Digestive and Urinary Neoplasms			1,386,589	$10,147.58	$9,726.04	0.958
HCC15	Other Neoplasms			2,131,151	$10,149.95	$9,540.85	0.940
HCC16	Benign Neoplasms of Skin, Breast, Eye			2,011,707	$8,902.99	$8,570.94	0.963
HCC17	Diabetes with Acute Complications	Y	Y	83,346	$27,081.68	$24,645.60	0.910
HCC18	Diabetes with Chronic Complications	Y	Y	2,785,407	$17,818.45	$17,889.23	1.004
HCC19	Diabetes without Complication	Y	Y	4,235,412	$11,565.87	$11,565.87	1.000
HCC20	Type I Diabetes Mellitus		Y	712,185	$21,096.89	$19,146.67	0.908
HCC21	Protein-Calorie Malnutrition	Y		392,429	$37,609.15	$37,609.15	1.000
HCC22	Morbid Obesity	Y	Y	1,005,414	$19,442.29	$19,442.29	1.000
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	716,383	$19,392.56	$19,392.56	1.000
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			3,066,255	$23,642.49	$21,741.09	0.920

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Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC25	Disorders of Lipoid Metabolism		Y	15,334,459	$11,284.50	$11,259.47	0.998
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	8,456,488	$13,344.34	$12,855.86	0.963
HCC27	End-Stage Liver Disease	Y	Y	94,747	$32,760.70	$32,755.51	1.000
HCC28	Cirrhosis of Liver	Y	Y	120,412	$22,136.71	$22,158.45	1.001
HCC29	Chronic Hepatitis	Y	Y	131,745	$16,975.69	$16,956.39	0.999
HCC30	Acute Liver Failure/Disease			33,724	$28,805.40	$29,056.17	1.009
HCC31	Other Hepatitis and Liver Disease		Y	414,696	$16,948.90	$15,335.51	0.905
HCC32	Gallbladder and Biliary Tract Disorders			302,054	$18,475.37	$17,694.15	0.958
HCC33	Intestinal Obstruction/Perforation	Y		395,204	$25,884.81	$25,884.81	1.000
HCC34	Chronic Pancreatitis	Y	Y	59,943	$24,875.90	$24,875.90	1.000
HCC35	Inflammatory Bowel Disease	Y	Y	246,140	$17,433.87	$17,433.87	1.000
HCC36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			1,737,455	$20,192.76	$18,302.83	0.906
HCC37	Appendicitis			32,607	$14,759.24	$15,956.43	1.081
HCC38	Other Gastrointestinal Disorders			10,688,403	$14,028.54	$13,196.02	0.941
HCC39	Bone/Joint/Muscle Infections/Necrosis	Y		245,502	$30,899.09	$30,899.09	1.000
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	Y	Y	1,581,836	$16,429.39	$16,429.39	1.000
HCC41	Disorders of the Vertebrae and Spinal Discs		Y	4,604,072	$14,461.27	$12,508.69	0.865
HCC42	Osteoarthritis of Hip or Knee		Y	2,988,229	$14,281.96	$11,857.49	0.830
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	3,655,876	$13,224.89	$12,654.62	0.957
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	24,975	$16,575.41	$14,386.13	0.868
HCC45	Other Musculoskeletal and Connective Tissue Disorders			16,390,878	$12,553.26	$11,820.82	0.942
HCC46	Severe Hematological Disorders	Y	Y	125,467	$38,121.69	$38,121.69	1.000
HCC47	Disorders of Immunity	Y	Y	310,254	$34,024.65	$34,024.65	1.000

(continued)

Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	1,080,878	$22,029.97	$22,029.97	1.000
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			3,908,675	$18,139.37	$16,402.44	0.904
HCC50	Delirium and Encephalopathy			750,505	$29,286.29	$26,718.33	0.912
HCC51	Dementia With Complications	Y	Y	470,051	$22,432.96	$21,194.59	0.945
HCC52	Dementia Without Complication	Y	Y	1,516,764	$19,006.55	$19,535.33	1.028
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	252,650	$16,656.86	$14,716.41	0.884
HCC54	Substance Use with Psychotic Complications	Y	Y	171,308	$26,292.02	$26,600.33	1.012
HCC55	Substance Use Disorder, Moderate/Severe, or Substance Use with Complications	Y	Y	460,436	$19,779.91	$19,728.87	0.997
HCC56	Substance Use Disorder, Mild, Except Alcohol and Cannabis	Y	Y	96,693	$19,723.28	$19,430.22	0.985
HCC57	Schizophrenia	Y	Y	511,487	$15,390.74	$15,422.25	1.002
HCC58	Reactive and Unspecified Psychosis	Y		410,214	$23,672.96	$23,678.71	1.000
HCC59	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	1,630,996	$14,810.53	$14,801.06	0.999
HCC60	Personality Disorders	Y	Y	29,177	$15,243.15	$15,170.25	0.995
HCC61	Depression		Y	2,479,274	$15,304.56	$13,689.42	0.894
HCC62	Anxiety Disorders		Y	424,004	$10,742.49	$10,254.21	0.955
HCC63	Other Psychiatric Disorders		Y	1,581,954	$12,360.85	$11,597.80	0.938
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	26,256	$13,954.02	$15,442.06	1.107
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	24,340	$12,250.29	$14,313.49	1.168
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	37,330	$9,347.49	$11,376.09	1.217

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Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	220,997	$9,265.22	$10,615.26	1.146
HCC68	Other Developmental Disorders		Y	46,731	$13,514.90	$13,216.49	0.978
HCC69	Attention Deficit Disorder		Y	135,837	$11,383.03	$10,686.23	0.939
HCC70	Quadriplegia	Y	Y	56,216	$36,596.24	$36,610.75	1.000
HCC71	Paraplegia	Y	Y	55,588	$32,072.92	$32,058.71	1.000
HCC72	Spinal Cord Disorders/Injuries	Y	Y	159,566	$21,036.71	$21,254.87	1.010
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	Y	Y	13,544	$27,599.39	$27,599.39	1.000
HCC74	Cerebral Palsy	Y	Y	88,620	$13,418.45	$13,842.71	1.032
HCC75	Myasthenia Gravis/Myoneural Disorders and Guillain-Barre Syndrome/Inflammatory and Toxic Neuropathy	Y	Y	215,174	$22,643.94	$22,643.94	1.000
HCC76	Muscular Dystrophy	Y	Y	16,522	$20,088.74	$20,091.16	1.000
HCC77	Multiple Sclerosis	Y	Y	148,801	$17,966.05	$17,954.90	0.999
HCC78	Parkinson's and Huntington's Diseases	Y	Y	406,610	$20,692.72	$20,692.72	1.000
HCC79	Seizure Disorders and Convulsions	Y	Y	836,228	$18,163.41	$18,163.41	1.000
HCC80	Coma, Brain Compression/Anoxic Damage	Y	Y	55,216	$34,362.18	$34,260.64	0.997
HCC81	Polyneuropathy, Mononeuropathy, and Other Neurological Conditions/Injuries		Y	4,473,236	$16,251.35	$14,761.37	0.908
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	59,768	$50,847.42	$50,867.53	1.000
HCC83	Respiratory Arrest	Y		7,325	$39,576.46	$39,517.09	0.998
HCC84	Cardio-Respiratory Failure and Shock	Y		740,900	$33,140.37	$33,139.34	1.000
HCC85	Congestive Heart Failure	Y	Y	3,111,271	$23,079.39	$23,079.39	1.000
HCC86	Acute Myocardial Infarction	Y	Y	273,381	$26,632.34	$26,797.58	1.006
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	439,734	$20,574.67	$20,487.84	0.996
HCC88	Angina Pectoris	Y	Y	514,055	$15,910.88	$15,901.72	0.999

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Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	4,616,202	$15,792.03	$14,573.84	0.923
HCC90	Heart Infection/Inflammation, Except Rheumatic			143,595	$26,377.58	$24,646.15	0.934
HCC91	Valvular and Rheumatic Heart Disease		Y	3,279,221	$17,717.11	$16,328.45	0.922
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	8,368	$19,041.55	$16,408.56	0.862
HCC93	Other Congenital Heart/Circulatory Disease		Y	68,888	$16,187.39	$15,377.47	0.950
HCC94	Hypertensive Heart Disease		Y	784,741	$12,207.19	$11,346.48	0.929
HCC95	Hypertension		Y	14,387,218	$9,903.56	$9,585.45	0.968
HCC96	Specified Heart Arrhythmias	Y	Y	3,733,504	$18,509.28	$18,509.28	1.000
HCC97	Other Heart Rhythm and Conduction Disorders		Y	1,335,456	$15,534.52	$14,166.61	0.912
HCC98	Other and Unspecified Heart Disease		Y	1,667,763	$19,024.24	$17,826.93	0.937
HCC99	Intracranial Hemorrhage	Y	Y	134,956	$23,867.18	$24,446.36	1.024
HCC100	Ischemic or Unspecified Stroke	Y	Y	891,848	$20,530.37	$20,444.38	0.996
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	1,286,957	$15,116.65	$14,114.37	0.934
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	203,465	$17,491.97	$16,048.16	0.917
HCC103	Hemiplegia/Hemiparesis	Y	Y	308,769	$25,258.84	$25,273.01	1.001
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	31,829	$21,855.26	$21,552.38	0.986
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	467,501	$19,826.44	$18,264.41	0.921
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	Y	Y	116,455	$39,652.13	$39,652.13	1.000
HCC107	Vascular Disease with Complications	Y		521,243	$23,731.12	$23,731.12	1.000
HCC108	Vascular Disease	Y	Y	3,453,434	$17,900.87	$17,900.87	1.000
HCC109	Other Circulatory Disease			2,013,836	$15,561.49	$14,012.49	0.900
HCC110	Cystic Fibrosis	Y	Y	4,365	$38,191.12	$38,191.12	1.000

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Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	3,592,677	$19,407.79	$19,407.79	1.000
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	228,989	$16,618.95	$16,618.95	1.000
HCC113	Asthma		Y	1,220,110	$11,342.69	$10,060.43	0.887
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		236,848	$40,055.96	$40,064.77	1.000
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		65,458	$26,586.61	$26,614.34	1.001
HCC116	Viral and Unspecified Pneumonia, Pleurisy			1,161,027	$24,347.47	$21,610.76	0.888
HCC117	Pleural Effusion/Pneumothorax			358,663	$33,450.39	$30,588.02	0.914
HCC118	Other Respiratory Disorders			5,041,594	$15,453.10	$14,392.78	0.931
HCC119	Legally Blind		Y	94,287	$20,577.07	$19,466.83	0.946
HCC120	Major Eye Infections/Inflammations			62,466	$15,347.00	$13,461.34	0.877
HCC121	Retinal Detachment			160,106	$11,792.28	$11,200.82	0.950
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	Y	Y	194,449	$18,524.75	$18,524.75	1.000
HCC123	Diabetic and Other Vascular Retinopathies		Y	1,351,356	$14,917.01	$14,086.31	0.944
HCC124	Exudative Macular Degeneration	Y	Y	526,720	$17,435.99	$17,435.99	1.000
HCC125	Other Retinal Disorders		Y	2,659,397	$11,020.59	$10,787.61	0.979
HCC126	Glaucoma		Y	3,709,096	$11,163.66	$10,967.90	0.982
HCC127	Cataract		Y	7,502,928	$10,067.78	$10,033.27	0.997
HCC128	Other Eye Disorders			9,236,346	$11,162.84	$10,890.01	0.976
HCC129	Significant Ear, Nose, and Throat Disorders			362,743	$14,958.14	$13,472.87	0.901
HCC130	Hearing Loss		Y	1,879,751	$13,340.58	$12,681.89	0.951
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			9,115,196	$11,729.95	$11,238.55	0.958
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End-Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status	Y	Y	20,011	$44,594.26	$37,590.77	0.843

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Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC135	Acute Renal Failure	Y		1,076,267	$31,174.52	$31,296.28	1.004
HCC136	Chronic Kidney Disease, Stage 5	Y	Y	82,796	$18,677.33	$19,070.28	1.021
HCC137	Chronic Kidney Disease, Severe (Stage 4)	Y	Y	191,770	$18,622.87	$18,456.12	0.991
HCC138	Chronic Kidney Disease, Moderate (Stage 3)	Y	Y	1,124,211	$14,582.37	$14,593.99	1.001
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1–2 or Unspecified)		Y	778,050	$15,390.28	$14,058.85	0.913
HCC140	Unspecified Renal Failure		Y	56,342	$15,898.69	$13,853.63	0.871
HCC141	Nephritis		Y	52,352	$15,120.14	$14,567.48	0.963
HCC142	Urinary Obstruction and Retention			1,865,270	$17,801.24	$16,027.68	0.900
HCC143	Urinary Incontinence		Y	1,914,672	$16,326.02	$14,381.23	0.881
HCC144	Urinary Tract Infection			3,421,599	$18,193.08	$16,357.80	0.899
HCC145	Other Urinary Tract Disorders			2,421,229	$17,815.78	$16,410.68	0.921
HCC146	Female Infertility		Y	3,745	$14,121.26	$12,097.96	0.857
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	575,300	$12,061.85	$11,160.49	0.925
HCC148	Other Female Genital Disorders		Y	1,484,866	$10,645.81	$10,060.45	0.945
HCC149	Male Genital Disorders		Y	3,342,279	$12,671.37	$12,153.66	0.959
HCC150	Ectopic and Molar Pregnancy			951	$12,852.12	$10,009.25	0.779
HCC151	Miscarriage/Terminated Pregnancy			3,609	$10,538.29	$9,108.69	0.864
HCC152	Completed Pregnancy With Major Complications			1,709	$17,555.99	$16,221.18	0.924
HCC153	Completed Pregnancy With Complications			9,895	$7,365.05	$8,102.60	1.100
HCC154	Completed Pregnancy With No or Minor Complications			4,358	$7,793.52	$7,637.04	0.980
HCC155	Uncompleted Pregnancy With Complications			3,630	$17,792.28	$11,749.86	0.660
HCC156	Uncompleted Pregnancy With No or Minor Complications			6,949	$13,244.34	$9,721.47	0.734
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	Y	Y	34,738	$57,916.21	$57,916.21	1.000

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Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	74,696	$42,079.44	$42,093.63	1.000
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss	Y	Y	73,846	$37,361.44	$37,347.35	1.000
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage		Y	181,075	$31,306.77	$26,087.09	0.833
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	639,852	$23,763.35	$23,763.35	1.000
HCC162	Severe Skin Burn or Condition	Y		4,241	$24,980.23	$25,114.73	1.005
HCC163	Moderate Skin Burn or Condition			8,627	$21,764.41	$19,547.16	0.898
HCC164	Cellulitis, Local Skin Infection			2,366,362	$18,585.24	$16,790.08	0.903
HCC165	Other Dermatological Disorders			10,373,365	$11,983.14	$11,494.66	0.959
HCC166	Severe Head Injury	Y		3,566	$23,253.29	$27,246.58	1.172
HCC167	Major Head Injury	Y		167,986	$20,437.31	$20,513.61	1.004
HCC168	Concussion or Unspecified Head Injury			536,052	$19,809.17	$16,480.55	0.832
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		323,965	$22,195.57	$22,085.74	0.995
HCC170	Hip Fracture/Dislocation	Y		337,196	$23,033.57	$23,050.25	1.001
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			363,936	$17,879.60	$15,674.83	0.877
HCC172	Internal Injuries			91,720	$27,938.52	$26,931.03	0.964
HCC173	Traumatic Amputations and Complications	Y		85,499	$29,941.10	$29,941.10	1.000
HCC174	Other Injuries			6,058,248	$14,633.21	$13,182.48	0.901
HCC175	Poisonings and Allergic and Inflammatory Reactions			866,107	$16,885.78	$15,280.98	0.905
HCC176	Complications of Specified Implanted Device or Graft	Y		428,333	$28,003.39	$28,003.39	1.000
HCC177	Other Complications of Medical Care			922,227	$24,222.78	$22,814.88	0.942
HCC178	Major Symptoms, Abnormalities			.	.	.	.
HCC179	Minor Symptoms, Signs, Findings			.	.	.	.

(continued)

Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	.	.	.	.
HCC181	Premature Newborns, Including Birthweight 1000–1499 Grams		Y	.	.	.	.
HCC182	Serious Perinatal Problem Affecting Newborn		Y	4,870	$21,954.06	$20,042.23	0.913
HCC183	Other Perinatal Problems Affecting Newborn			6,874	$17,809.41	$15,713.17	0.882
HCC184	Term or Post-Term Singleton Newborn, Normal or High Birthweight		Y	.	.	.	.
HCC185	Major Organ Transplant (procedure)		Y	.	.	.	.
HCC186	Major Organ Transplant or Replacement Status	Y	Y	53,861	$33,301.96	$33,301.96	1.000
HCC187	Other Organ Transplant Status/Replacement		Y	105,957	$18,004.64	$15,142.14	0.841
HCC188	Artificial Openings for Feeding or Elimination	Y	Y	233,699	$35,957.50	$35,957.50	1.000
HCC189	Amputation Status, Lower Limb/Amputation Complications	Y	Y	91,958	$29,821.67	$29,821.67	1.000
HCC190	Amputation Status, Upper Limb			11,655	$23,088.58	$21,715.88	0.941
HCC191	Post-Surgical States/Aftercare/Elective			.	.	.	.
HCC192	Radiation Therapy			.	.	.	.
HCC193	Chemotherapy			.	.	.	.
HCC194	Rehabilitation			.	.	.	.
HCC195	Screening/Observation/Special Exams			.	.	.	.
HCC196	History of Disease			.	.	.	.
HCC197	Supplemental Oxygen			.	.	.	.
HCC198	CPAP/IPPB/Nebulizers			.	.	.	.
HCC199	Patient Lifts, Power Operated Vehicles, Beds			.	.	.	.
HCC200	Wheelchairs, Commodes			.	.	.	.
HCC201	Walkers			.	.	.	.
HCC202	Drug Use, Uncomplicated, Except Cannabis			.	.	.	.

(continued)

Table 5-20a (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2020 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC203	Alcohol/Cannabis Use or Use Disorder, Mild or Uncomplicated; Non-Psychoactive Substance Abuse; Nicotine Dependence		Y	1,981,142	$14,231.31	$13,281.32	0.933
HCC204	External Causes of Morbidity, Except Self-Inflicted Injury			.	.	.	.

1. HCCs with missing data have a count of 0 or are not populated because they do not represent diseases or conditions (e.g., procedures, durable medical equipment, symptoms, treatments, history, external causes).
SOURCE: RTI International analysis of Medicare 2014–2015 (V24) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year.

Table 5-20b
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				28,248,982	$10,958.40	$10,958.40	1.000
HCC1	HIV/AIDS	Y	Y	95,147	$16,852.01	$16,852.01	1.000
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		724,204	$37,750.96	$37,750.96	1.000
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			34,304	$32,255.61	$29,100.18	0.902
HCC4	Viral Central Nervous System Infections			22,348	$23,913.38	$20,718.58	0.866
HCC5	Tuberculosis			11,606	$24,195.18	$22,299.15	0.922
HCC6	Opportunistic Infections	Y		93,514	$30,913.28	$30,913.28	1.000
HCC7	Coronavirus Disease 2019 (COVID-19)			.	.	.	.
HCC8	Coronavirus Disease, Except SARS [including COVID-19 prior to April 1, 2020]			3,263	$42,491.40	$34,541.02	0.813
HCC9	Other Infectious Diseases			6,169,862	$17,907.05	$16,309.99	0.911
HCC17	Cancer Metastatic to Lung, Liver, Brain, and Other Organs; Acute Myeloid Leukemia Except Promyelocytic	Y	Y	200,753	$59,213.22	$59,213.22	1.000
HCC18	Cancer Metastatic to Bone, Other and Unspecified Metastatic Cancer; Acute Leukemia Except Myeloid	Y	Y	166,455	$38,318.98	$38,318.98	1.000
HCC19	Myelodysplastic Syndromes, Multiple Myeloma, and Other Cancers	Y	Y	132,056	$37,323.64	$37,323.64	1.000
HCC20	Lung and Other Severe Cancers	Y	Y	349,343	$26,905.59	$26,905.59	1.000
HCC21	Lymphoma and Other Cancers	Y	Y	263,569	$19,950.64	$19,950.64	1.000
HCC22	Bladder, Colorectal, and Other Cancers	Y	Y	631,428	$16,778.85	$16,778.85	1.000
HCC23	Prostate, Breast, and Other Cancers and Tumors	Y	Y	1,823,307	$12,770.03	$12,770.03	1.000
HCC24	Other Respiratory and Heart Neoplasms			27,838	$16,522.39	$14,226.09	0.861
HCC25	Other Digestive and Urinary Neoplasms			1,547,412	$10,618.02	$10,053.51	0.947
HCC26	Other Neoplasms			2,574,262	$10,860.45	$10,041.09	0.925
HCC27	Benign Neoplasms of Skin, Breast, Eye			2,281,370	$9,404.78	$8,969.77	0.954
HCC35	Pancreas Transplant Status	Y	Y	345	$43,687.46	$43,229.82	0.990

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Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC36	Diabetes with Severe Acute Complications	Y	Y	117,226	$28,389.41	$24,129.89	0.850
HCC37	Diabetes with Chronic Complications	Y	Y	3,515,883	$19,330.38	$18,550.10	0.960
HCC38	Diabetes with Glycemic, Unspecified, or No Complications	Y	Y	3,436,400	$11,604.00	$12,523.89	1.079
HCC39	Type 1 Diabetes Mellitus, Add-on to HCCs 36-38		Y	431,328	$24,005.52	$20,620.54	0.859
HCC47	Protein-Calorie Malnutrition			461,055	$40,267.70	$34,451.92	0.856
HCC48	Morbid Obesity	Y	Y	1,707,331	$17,992.53	$17,992.53	1.000
HCC49	Specified Lysosomal Storage Disorders	Y	Y	1,817	$106,825.19	$106,825.19	1.000
HCC50	Amyloidosis, Porphyria, and Other Specified Metabolic Disorders	Y	Y	53,172	$28,021.10	$28,021.10	1.000
HCC51	Addison's and Cushing's Diseases, Acromegaly, and Other Specified Endocrine Disorders	Y	Y	23,576	$26,076.42	$26,076.42	1.000
HCC52	Disorders of Fluid/Electrolyte/Acid-Base Balance			3,257,404	$25,707.18	$22,829.35	0.888
HCC53	Disorders of Lipoid Metabolism		Y	16,387,880	$12,493.53	$12,322.48	0.986
HCC54	Other Endocrine/Metabolic/Nutritional Disorders		Y	10,101,792	$14,491.40	$13,791.54	0.952
HCC62	Liver Transplant Status/Complications	Y	Y	21,833	$22,321.61	$22,321.61	1.000
HCC63	Chronic Liver Failure/End-Stage Liver Disorders	Y	Y	109,139	$34,611.24	$34,611.24	1.000
HCC64	Cirrhosis of Liver	Y	Y	123,756	$25,224.94	$25,268.91	1.002
HCC65	Chronic Hepatitis	Y	Y	155,535	$18,608.66	$18,592.37	0.999
HCC66	Acute Liver Failure/Disease			19,931	$37,476.62	$37,882.90	1.011
HCC67	Other Hepatitis and Liver Disease		Y	610,705	$17,456.22	$15,843.05	0.908
HCC68	Cholangitis and Obstruction of Bile Duct Without Gallstones	Y		61,413	$25,364.19	$25,317.78	0.998
HCC69	Gallbladder and Other Biliary Tract Disorders, Except Cholangitis and Obstruction of Bile Duct			418,276	$19,332.48	$17,702.75	0.916
HCC77	Intestine Transplant Status/Complications	Y	Y	200	$89,030.63	$86,043.98	0.966
HCC78	Intestinal Obstruction/Perforation	Y		375,402	$28,651.58	$28,651.58	1.000
HCC79	Chronic Pancreatitis	Y	Y	67,194	$26,674.43	$26,674.43	1.000

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Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC80	Crohn's Disease (Regional Enteritis)	Y	Y	126,437	$21,421.71	$21,421.71	1.000
HCC81	Ulcerative Colitis	Y	Y	154,142	$17,306.41	$17,306.41	1.000
HCC82	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			1,831,616	$21,906.59	$19,335.34	0.883
HCC83	Appendicitis			34,251	$16,447.80	$17,016.15	1.035
HCC84	Other Gastrointestinal Disorders			11,518,137	$15,269.48	$14,189.13	0.929
HCC92	Bone/Joint/Muscle/Severe Soft Tissue Infections/Necrosis	Y		247,310	$34,720.10	$34,720.10	1.000
HCC93	Rheumatoid Arthritis and Other Specified Inflammatory Rheumatic Disorders	Y	Y	908,532	$20,168.14	$20,168.55	1.000
HCC94	Systemic Lupus Erythematosus and Other Specified Systemic Connective Tissue Disorders	Y	Y	197,856	$17,246.90	$17,245.04	1.000
HCC95	Disorders of the Vertebrae and Spinal Discs		Y	5,163,030	$15,928.19	$13,501.83	0.848
HCC96	Osteoarthritis of Hip or Knee		Y	3,511,527	$15,282.02	$12,635.46	0.827
HCC97	Osteoporosis and Other Bone/Cartilage Disorders		Y	4,246,847	$13,818.13	$13,035.46	0.943
HCC98	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	28,879	$17,491.93	$14,704.16	0.841
HCC99	Other Musculoskeletal and Connective Tissue Disorders			16,766,630	$13,755.54	$12,783.95	0.929
HCC107	Sickle Cell Anemia (Hb-SS) and Thalassemia Beta Zero	Y	Y	10,150	$35,130.85	$35,148.70	1.001
HCC108	Sickle Cell Disorders, Except Sickle Cell Anemia (Hb-SS) and Thalassemia Beta Zero; Beta Thalassemia Major	Y	Y	5,158	$18,869.64	$18,835.71	0.998
HCC109	Acquired Hemolytic, Aplastic, and Sideroblastic Anemias	Y	Y	147,713	$43,529.62	$43,529.62	1.000
HCC110	Iron, Other Deficiency, Chronic Disease, Drug-Induced, and Unspecified Anemias		Y	4,065,988	$22,239.70	$19,724.26	0.887

(continued)

Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC111	Hemophilia, Male	Y	Y	3,102	$175,537.61	$175,537.61	1.000
HCC112	Immune Thrombocytopenia and Specified Coagulation Defects and Hemorrhagic Conditions	Y	Y	109,438	$25,096.15	$25,096.15	1.000
HCC113	Thrombocytopenia, Purpura, Thrombophilia, and Other and Unspecified Hemorrhagic Conditions			1,102,425	$24,316.13	$21,946.70	0.903
HCC114	Common Variable and Combined Immunodeficiencies	Y	Y	21,976	$44,679.48	$44,681.54	1.000
HCC115	Specified Immunodeficiencies and White Blood Cell Disorders	Y	Y	33,264	$26,294.16	$26,292.78	1.000
HCC116	Neutropenia, White Blood Cell, Other, and Unspecified Blood/Immune Disorders			1,524,285	$25,972.19	$22,786.99	0.877
HCC124	Delirium and Encephalopathy			640,643	$36,587.16	$32,462.34	0.887
HCC125	Dementia, Severe	Y	Y	.	.	.	.
HCC126	Dementia, Moderate	Y	Y	.	.	.	.
HCC127	Dementia, Mild or Unspecified	Y	Y	1,726,311	$21,486.99	$21,643.18	1.007
HCC128	Nonpsychotic Organic Brain Syndromes/Conditions		Y	521,392	$18,558.83	$15,975.39	0.861
HCC135	Drug Use with Psychotic Complications	Y	Y	12,891	$28,047.47	$28,478.96	1.015
HCC136	Alcohol Use with Psychotic Complications	Y	Y	30,647	$29,868.43	$31,744.17	1.063
HCC137	Drug Use Disorder, Moderate/Severe, or Drug Use with Non-Psychotic Complications	Y	Y	486,978	$22,434.49	$22,340.82	0.996
HCC138	Drug Use Disorder, Mild, Uncomplicated, Except Cannabis	Y	Y	77,410	$22,089.10	$21,888.01	0.991
HCC139	Alcohol Use Disorder, Moderate/Severe, or Alcohol Use with Specified Non-Psychotic Complications	Y	Y	203,607	$20,191.77	$20,197.84	1.000

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Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC140	Drug Use, Uncomplicated, Except Cannabis			72,829	$20,110.13	$16,137.97	0.802
HCC141	Cannabis Use or Use Disorder, Mild or Uncomplicated, or Cannabis Use with Intoxication or Unspecified Complications		Y	74,154	$18,196.62	$15,681.51	0.862
HCC142	Alcohol Use Disorder, Mild, Uncomplicated, or Alcohol Use with Intoxication or Unspecified Complications		Y	192,202	$17,220.74	$14,993.29	0.871
HCC143	Nicotine Dependence; Non-Psychoactive Substance Abuse		Y	1,850,570	$15,564.50	$14,277.98	0.917
HCC151	Schizophrenia	Y	Y	496,094	$17,468.55	$17,474.86	1.000
HCC152	Psychosis, Except Schizophrenia	Y		260,890	$20,885.20	$20,961.55	1.004
HCC153	Personality Disorders; Anorexia/Bulimia Nervosa	Y	Y	82,781	$17,726.68	$17,467.97	0.985
HCC154	Bipolar Disorders without Psychosis	Y	Y	434,527	$15,001.22	$15,133.74	1.009
HCC155	Major Depression, Moderate or Severe, without Psychosis	Y	Y	948,489	$17,659.30	$17,597.79	0.997
HCC156	Depression, Mild, Unspecified, or in Remission		Y	3,111,884	$16,567.71	$14,715.46	0.888
HCC157	Anxiety Disorders		Y	854,273	$12,000.37	$11,439.66	0.953
HCC158	Other Mental or Behavioral Conditions			481,550	$14,253.70	$12,742.56	0.894
HCC159	Other and Unspecified Anxiety States			1,408,104	$13,129.40	$12,328.36	0.939
HCC167	Profound Intellectual Disability/Developmental Disorder		Y	27,705	$16,259.70	$17,191.17	1.057
HCC168	Severe Intellectual Disability/Developmental Disorder		Y	27,229	$13,428.16	$14,893.03	1.109
HCC169	Moderate Intellectual Disability/Developmental Disorder		Y	45,103	$10,690.45	$12,347.42	1.155
HCC170	Mild Intellectual Disability, Autism, Down Syndrome		Y	246,110	$9,978.51	$11,203.11	1.123

(continued)

Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC171	Other Developmental Disorders and Conditions with Onset Usually Occurring During Childhood and Adolescence		Y	98,897	$16,365.75	$15,102.93	0.923
HCC172	Attention Deficit Disorder		Y	148,898	$12,242.17	$11,468.58	0.937
HCC180	Quadriplegia	Y	Y	56,357	$43,747.99	$43,747.99	1.000
HCC181	Paraplegia	Y	Y	58,577	$34,616.83	$34,616.83	1.000
HCC182	Spinal Cord Disorders/Injuries	Y	Y	166,029	$21,825.06	$21,825.06	1.000
HCC190	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease, Spinal Muscular Atrophy	Y	Y	15,850	$36,458.21	$36,458.21	1.000
HCC191	Quadriplegic Cerebral Palsy	Y	Y	17,946	$23,114.80	$23,053.26	0.997
HCC192	Cerebral Palsy, Except Quadriplegic	Y	Y	82,369	$13,326.38	$13,512.15	1.014
HCC193	Chronic Inflammatory Demyelinating Polyneuritis and Multifocal Motor Neuropathy	Y	Y	22,094	$35,422.60	$35,422.60	1.000
HCC194	Guillain-Barre Syndrome		Y	12,277	$21,801.51	$19,194.39	0.880
HCC195	Myasthenia Gravis with (Acute) Exacerbation	Y	Y	8,726	$50,053.11	$50,053.11	1.000
HCC196	Myasthenia Gravis without (Acute) Exacerbation and Other Myoneural Disorders	Y	Y	49,172	$23,171.06	$23,171.06	1.000
HCC197	Muscular Dystrophy	Y	Y	17,049	$22,981.63	$22,981.63	1.000
HCC198	Multiple Sclerosis	Y	Y	155,336	$22,308.26	$22,308.26	1.000
HCC199	Parkinson and Other Degenerative Disease of Basal Ganglia	Y	Y	416,750	$22,850.80	$22,850.80	1.000
HCC200	Friedreich and Other Hereditary Ataxias; Huntington Disease	Y	Y	28,765	$19,559.21	$19,614.74	1.003
HCC201	Seizure Disorders and Convulsions	Y	Y	824,572	$20,232.84	$20,232.84	1.000
HCC202	Coma, Brain Compression/Anoxic Damage	Y	Y	84,381	$36,291.34	$36,291.34	1.000
HCC203	Polyneuropathy, Mononeuropathy, and Other Neurological Conditions/Injuries		Y	6,126,845	$17,616.34	$15,790.15	0.896
HCC211	Respirator Dependence/Tracheostomy Status/Complications	Y	Y	75,612	$51,289.34	$51,289.34	1.000

(continued)

Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC212	Respiratory Arrest	Y		5,201	$39,565.09	$38,822.63	0.981
HCC213	Cardio-Respiratory Failure and Shock	Y		907,720	$35,101.28	$35,105.46	1.000
HCC221	Heart Transplant Status/Complications	Y	Y	10,787	$32,935.52	$32,935.52	1.000
HCC222	End-Stage Heart Failure	Y	Y	6,484	$71,688.50	$68,604.26	0.957
HCC223	Heart Failure with Heart Assist Device/Artificial Heart	Y	Y	5,667	$57,639.57	$60,690.18	1.053
HCC224	Acute on Chronic Heart Failure	Y	Y	521,181	$39,653.09	$34,215.89	0.863
HCC225	Acute Heart Failure (Excludes Acute on Chronic)	Y	Y	156,792	$28,913.04	$28,724.92	0.993
HCC226	Heart Failure, Except End-Stage and Acute	Y	Y	2,243,680	$22,556.45	$23,732.40	1.052
HCC227	Cardiomyopathy/Myocarditis	Y	Y	303,977	$15,215.34	$15,215.34	1.000
HCC228	Acute Myocardial Infarction	Y	Y	459,263	$27,127.62	$27,163.95	1.001
HCC229	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	358,378	$22,929.84	$22,884.77	0.998
HCC230	Angina Pectoris		Y	793,781	$17,646.79	$15,888.89	0.900
HCC231	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	4,104,932	$17,176.06	$15,695.65	0.914
HCC232	Heart Infection/Inflammation, Except Rheumatic			174,247	$29,442.16	$26,516.99	0.901
HCC233	Valvular and Rheumatic Heart Disease		Y	3,463,935	$19,423.76	$17,564.83	0.904
HCC234	Major Congenital Cardiac/Circulatory Defect		Y	10,485	$19,800.65	$18,026.67	0.910
HCC235	Other Congenital Heart/Circulatory Disease		Y	82,075	$17,494.94	$16,272.17	0.930
HCC236	Hypertensive Heart Disease		Y	713,994	$14,456.00	$12,875.76	0.891
HCC237	Hypertension		Y	14,538,426	$10,886.93	$10,465.00	0.961
HCC238	Specified Heart Arrhythmias	Y	Y	3,758,550	$20,472.93	$20,472.93	1.000
HCC239	Other Heart Rhythm and Conduction Disorders		Y	1,402,124	$15,901.52	$14,154.87	0.890
HCC240	Other and Unspecified Heart Disease		Y	2,269,818	$19,735.06	$18,319.05	0.928
HCC248	Intracranial Hemorrhage	Y	Y	146,978	$26,205.10	$26,586.10	1.015

(continued)

Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC249	Ischemic or Unspecified Stroke	Y	Y	811,912	$22,625.20	$22,557.43	0.997
HCC250	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	1,349,143	$16,667.07	$14,829.36	0.890
HCC251	Cerebrovascular Atherosclerosis and Other Disease		Y	200,760	$18,954.50	$17,042.84	0.899
HCC252	Cerebral Aneurysm and Arteriovenous Malformation		Y	73,958	$18,096.69	$15,951.55	0.881
HCC253	Hemiplegia/Hemiparesis	Y	Y	394,627	$27,084.29	$27,103.14	1.001
HCC254	Monoplegia, Other Paralytic Syndromes	Y	Y	44,612	$23,254.43	$23,149.72	0.995
HCC255	Sequelae of Cerebrovascular Disease, Except Paralysis		Y	311,812	$21,560.38	$19,882.86	0.922
HCC263	Atherosclerosis of Arteries of the Extremities with Ulceration or Gangrene	Y	Y	135,826	$42,365.67	$42,365.67	1.000
HCC264	Vascular Disease with Complications	Y	Y	166,360	$24,919.76	$24,919.76	1.000
HCC265	Atherosclerosis of Arteries of the Extremities, with Intermittent Claudication		Y	289,692	$20,968.28	$16,688.69	0.796
HCC266	Vascular Disease		Y	3,480,343	$19,587.42	$17,599.94	0.899
HCC267	Deep Vein Thrombosis and Pulmonary Embolism	Y		676,795	$25,849.60	$25,849.60	1.000
HCC268	Other Circulatory Disease			2,301,731	$16,499.90	$15,023.60	0.911
HCC276	Lung Transplant Status/Complications	Y	Y	6,570	$49,104.00	$49,104.00	1.000
HCC277	Cystic Fibrosis	Y	Y	3,552	$44,087.44	$44,210.48	1.003
HCC278	Idiopathic Pulmonary Fibrosis and Lung Involvement in Systemic Sclerosis	Y	Y	43,422	$26,089.77	$27,550.26	1.056
HCC279	Severe Persistent Asthma	Y	Y	70,061	$25,542.28	$24,687.01	0.967
HCC280	Chronic Obstructive Pulmonary Disease, Interstitial Lung Disorders, and Other Chronic Lung Disorders	Y	Y	3,627,781	$20,975.12	$20,975.12	1.000
HCC281	Asthma, Except Severe Persistent		Y	1,416,982	$12,616.12	$11,127.16	0.882
HCC282	Aspiration and Specified Bacterial Pneumonias	Y		248,025	$42,420.37	$42,420.37	1.000

(continued)

Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC283	Empyema, Lung Abscess	Y		14,880	$32,062.84	$32,510.76	1.014
HCC284	Pneumonia, Except for Aspiration and Specified Bacterial			1,155,910	$26,320.02	$23,562.10	0.895
HCC285	Pleural Effusion/Pneumothorax			378,447	$37,558.09	$33,548.35	0.893
HCC286	Other Respiratory Disorders			5,900,145	$16,619.04	$15,433.53	0.929
HCC294	Corneal Transplant Status/Complications		Y	72,297	$14,053.51	$12,836.45	0.913
HCC295	Legally Blind		Y	69,172	$22,131.65	$20,755.20	0.938
HCC296	Major Eye Infections/Inflammations			62,938	$17,333.47	$14,802.26	0.854
HCC297	Retinal Detachment			158,292	$13,204.29	$12,589.91	0.953
HCC298	Severe Diabetic Eye Disease, Retinal Vein Occlusion, and Vitreous Hemorrhage	Y	Y	532,341	$19,321.76	$19,321.76	1.000
HCC299	Non-Proliferative Diabetic Retinopathy Without Macular Edema and Other Vascular Retinopathies		Y	1,172,850	$16,095.65	$14,799.85	0.919
HCC300	Exudative Macular Degeneration	Y	Y	524,201	$20,228.65	$20,228.65	1.000
HCC301	Other Retinal Disorders		Y	2,930,533	$11,769.47	$11,447.70	0.973
HCC302	Glaucoma		Y	3,870,561	$12,289.43	$11,967.34	0.974
HCC303	Cataract		Y	7,729,773	$11,073.50	$10,963.33	0.990
HCC304	Other Eye Disorders			10,252,856	$12,335.01	$11,938.28	0.968
HCC312	Significant Ear, Nose, and Throat Disorders			371,452	$16,737.88	$14,824.51	0.886
HCC313	Hearing Loss		Y	2,165,318	$14,743.27	$13,712.21	0.930
HCC314	Other Ear, Nose, Throat, and Mouth Disorders			9,819,528	$12,994.56	$12,301.37	0.947
HCC322	Kidney Transplant Status		Y	.	.	.	.
HCC323	End-Stage Renal Disease		Y	.	.	.	.
HCC324	Dialysis Status			30,635	$52,817.32	$44,039.91	0.834
HCC325	Acute Kidney Injury			1,260,352	$33,176.71	$29,524.10	0.890
HCC326	Chronic Kidney Disease, Stage 5	Y	Y	115,851	$37,292.16	$37,292.16	1.000
HCC327	Chronic Kidney Disease, Severe (Stage 4)	Y	Y	380,181	$27,674.96	$27,674.96	1.000

(continued)

Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC328	Chronic Kidney Disease, Moderate (Stage 3B)	Y	Y	.	.	.	.
HCC329	Chronic Kidney Disease, Moderate (Stage 3, Except 3B)	Y	Y	2,190,681	$18,751.97	$18,751.97	1.000
HCC330	Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)		Y	999,937	$18,787.42	$16,860.69	0.897
HCC331	Unspecified Kidney Failure		Y	31,706	$21,925.52	$18,801.94	0.858
HCC332	Nephritis		Y	245,167	$15,951.27	$14,955.81	0.938
HCC340	Urinary Obstruction and Retention			2,150,409	$19,410.63	$17,010.78	0.876
HCC341	Urinary Incontinence		Y	2,224,406	$17,922.98	$15,497.70	0.865
HCC342	Urinary Tract Infection			3,339,855	$20,051.97	$17,537.36	0.875
HCC343	Other Urinary Tract Disorders			2,484,075	$18,938.34	$16,911.82	0.893
HCC351	Female Infertility		Y	2,080	$13,662.86	$10,302.03	0.754
HCC352	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	599,057	$13,399.87	$12,073.48	0.901
HCC353	Other Female Genital Disorders		Y	1,378,972	$11,831.61	$10,946.56	0.925
HCC354	Male Genital Disorders		Y	3,751,143	$14,229.26	$13,352.41	0.938
HCC362	Ectopic and Molar Pregnancy			526	$17,774.98	$11,764.26	0.662
HCC363	Miscarriage with Complications			215	$15,886.50	$10,740.80	0.676
HCC364	Miscarriage with No or Minor Complications			2,373	$12,604.80	$9,313.83	0.739
HCC365	Terminated Pregnancy			261	$10,055.10	$10,156.36	1.010
HCC366	Pregnancy with Delivery with Major Complications			1,891	$19,639.45	$17,995.86	0.916
HCC367	Pregnancy with Delivery with Complications			5,912	$8,356.62	$9,048.71	1.083
HCC368	Pregnancy with Delivery with No or Minor Complications			3,983	$7,378.57	$8,040.84	1.090
HCC369	(Ongoing) Pregnancy without Delivery with Major Complications			664	$27,829.21	$19,258.24	0.692

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Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC370	(Ongoing) Pregnancy without Delivery with Complications			2,289	$17,586.29	$10,805.30	0.614
HCC371	(Ongoing) Pregnancy without Delivery with No or Minor Complications			4,314	$14,515.61	$10,076.87	0.694
HCC379	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	Y	Y	45,188	$60,905.02	$60,905.02	1.000
HCC380	Chronic Ulcer of Skin, Except Pressure, Through to Bone or Muscle	Y	Y	71,796	$43,472.55	$43,489.35	1.000
HCC381	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	114,855	$41,059.16	$41,047.83	1.000
HCC382	Pressure Ulcer of Skin with Partial Thickness Skin Loss	Y	Y	107,850	$35,588.26	$35,667.36	1.002
HCC383	Chronic Ulcer of Skin, Except Pressure, Not Specified as Through to Bone or Muscle	Y	Y	531,618	$25,745.44	$25,730.71	0.999
HCC384	Pressure Pre-Ulcer Skin Changes or Unspecified Stage			92,487	$29,473.52	$23,252.13	0.789
HCC385	Severe Skin Burn	Y		1,342	$32,494.36	$33,019.56	1.016
HCC386	Moderate Skin Burn or Condition			6,909	$25,591.67	$22,042.06	0.861
HCC387	Pemphigus, Pemphigoid, and Other Specified Autoimmune Skin Disorders	Y	Y	31,635	$22,919.12	$22,919.12	1.000
HCC388	Cellulitis, Local Skin Infection			2,222,867	$20,697.07	$18,268.66	0.883
HCC389	Other Dermatological Disorders			11,360,275	$13,136.90	$12,380.13	0.942
HCC397	Major Head Injury with Loss of Consciousness > 1 Hour	Y		2,826	$24,444.44	$25,734.41	1.053
HCC398	Major Head Injury with Loss of Consciousness < 1 Hour or Unspecified	Y		83,750	$24,812.30	$25,092.32	1.011
HCC399	Major Head Injury without Loss of Consciousness	Y		62,936	$23,309.33	$22,878.96	0.982
HCC400	Concussion or Unspecified Head Injury			583,183	$21,708.88	$17,751.54	0.818
HCC401	Vertebral Fractures without Spinal Cord Injury	Y		328,670	$25,955.62	$25,955.62	1.000

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Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC402	Hip Fracture/Dislocation	Y		279,856	$26,059.24	$26,059.24	1.000
HCC403	Major Fracture, Except of Skull, Vertebrae, or Hip			315,217	$20,083.52	$17,071.32	0.850
HCC404	Internal Injuries			64,716	$28,909.55	$27,570.16	0.954
HCC405	Traumatic Amputations and Complications	Y		7,371	$36,826.29	$38,789.48	1.053
HCC406	Other Injuries			5,595,390	$16,442.00	$14,572.12	0.886
HCC407	Injuries, Subsequent Encounter			2,070,554	$19,118.37	$17,069.66	0.893
HCC408	Injuries, Sequela			544,178	$21,875.28	$19,547.19	0.894
HCC409	Amputation Status, Lower Limb/Amputation Complications	Y	Y	75,556	$29,844.83	$29,653.98	0.994
HCC410	Amputation Status, Upper Limb		Y	8,577	$27,291.93	$24,860.26	0.911
HCC418	Poisonings and Allergic and Inflammatory Reactions			1,303,506	$25,529.84	$21,791.26	0.854
HCC419	Poisonings and Allergic and Inflammatory Reactions, Subsequent Encounter			148,024	$23,071.04	$19,636.04	0.851
HCC420	Poisonings and Allergic and Inflammatory Reactions, Sequela			60,017	$24,504.77	$20,735.94	0.846
HCC428	Mechanical Complications of Specified Implanted Device or Graft			324,430	$29,017.28	$23,081.45	0.795
HCC429	Infections as a Complication of Medical Care			218,138	$39,280.32	$32,976.79	0.840
HCC430	Complications of Medical Care, Except Mechanical and Infections			1,104,232	$24,621.86	$21,779.64	0.885
HCC431	Complications of Medical Care, Subsequent Encounter			208,165	$29,577.85	$24,482.99	0.828
HCC432	Complications of Medical Care, Sequela			57,948	$30,991.82	$25,314.20	0.817
HCC440	Major Symptoms, Abnormalities			.	.	.	.

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Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC441	Minor Symptoms, Signs, Findings			.	.	.	.
HCC449	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	.	.	.	.
HCC450	Immature Newborns, Including Birthweight 1000-1999 Grams		Y	.	.	.	.
HCC451	Premature Newborns, Including Birthweight 2000-2499 Grams, and Other Premature, Low Birthweight, Malnourished, or Multiple Birth Newborns		Y	.	.	.	.
HCC452	Term or Post-Term Singleton Newborn, Normal or High Birthweight		Y	.	.	.	.
HCC453	Disorders and Conditions of Newborns, Not Elsewhere Classified			4,036	$22,073.74	$20,021.62	0.907
HCC454	Stem Cell, Including Bone Marrow, Transplant Status/Complications	Y	Y	28,071	$46,126.45	$46,126.45	1.000
HCC455	Other Organ Transplant, Implant, or Graft Status/Complications		Y	381,532	$30,411.51	$24,727.15	0.813
HCC463	Artificial Openings for Feeding or Elimination	Y	Y	260,175	$38,873.34	$38,873.34	1.000
HCC464	Post-Surgical States/Aftercare/Elective			.	.	.	.
HCC465	Encounter for Anti-Neoplastic Radiation Therapy			.	.	.	.
HCC466	Encounter for Anti-Neoplastic Chemotherapy or Immunotherapy			.	.	.	.
HCC467	Long Term (Current) Drug Therapy			.	.	.	.
HCC468	Screening/Observation/Special Exams			.	.	.	.
HCC469	History of Disease			.	.	.	.
HCC470	Supplemental Oxygen			.	.	.	.
HCC471	CPAP/IPPB/Nebulizers			.	.	.	.
HCC472	Patient Lifts, Power Operated Vehicles, Beds			.	.	.	.
HCC473	Wheelchairs, Commodes			.	.	.	.

(continued)

Table 5-20b (continued)
Predictive ratios for all eligible HCCs: All aged-disabled enrollees
2024 CMS-HCC Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC474	Walkers, Other Reduced Mobility			.	.	.	.
HCC475	External Causes of Morbidity, Except Self-Inflicted Injury Initial Encounter			.	.	.	.
HCC476	Sequela, Not Elsewhere Classified			.	.	.	.
HCC484	Homelessness			.	.	.	.
HCC485	Inadequate Housing or Housing Instability			.	.	.	.
HCC486	Victim of Abuse, Exploitation, Neglect, or Maltreatment			.	.	.	.
HCC487	Problems Related to Living Alone			.	.	.	.
HCC488	Problems Related to Care Provider Dependency			.	.	.	.
HCC489	Other Social Determinants of Health			.	.	.	.

1. Three payment HCCs have missing data: HCC 125 Dementia, Severe; HCC 126 Dementia, Moderate; HCC 328 Chronic Kidney Disease, Moderate (Stage 3B). All constituent ICD-10-CM diagnosis codes in these HCCs are not active in the 2018-2019 sample as these codes first became valid in subsequent years.
2. Other nonpayment HCCs with missing data have a count of 0 or are not populated because they do not represent diseases or conditions (e.g., procedures, durable medical equipment, symptoms, treatments, history, external causes).
SOURCE: RTI International analysis of Medicare 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year.

Table 5-21
Predictive ratios by body systems/disease groups: All aged-disabled enrollees

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	28,232,347	$9,949.14	$9,949.14	1.000
Infection	754,729	$31,714.80	$31,810.80	1.003
Neoplasm	3,266,430	$16,569.40	$16,569.40	1.000
Diabetes	7,104,165	$14,168.47	$14,168.47	1.000
Metabolic	1,995,762	$21,457.06	$21,469.55	1.001
Liver	346,904	$22,883.31	$22,881.96	1.000
Gastrointestinal	670,868	$22,292.93	$22,311.30	1.001
Musculoskeletal	1,792,421	$18,000.60	$18,008.31	1.000
Blood	1,411,249	$24,311.55	$24,442.53	1.005
Cognitive	1,986,815	$19,786.03	$19,912.81	1.006
Substance Use	728,437	$21,280.50	$21,280.50	1.000
Psychiatric	2,581,874	$16,250.98	$16,251.25	1.000
Spinal	271,370	$26,415.19	$26,544.95	1.005
Neurological	1,645,393	$18,938.77	$18,930.79	1.000
Arrest	807,993	$34,486.88	$34,486.88	1.000
Heart	5,909,290	$18,497.37	$18,480.87	0.999
Cerebrovascular Disease	1,160,629	$20,950.39	$20,920.30	0.999
Vascular	4,091,132	$19,228.00	$19,228.00	1.000
Lung	3,958,742	$19,604.69	$19,613.97	1.000
Eye	708,657	$17,669.69	$17,648.08	0.999
Kidney	2,495,055	$22,103.42	$22,108.87	1.000
Skin	807,317	$27,385.02	$27,370.04	0.999
Injury	855,633	$22,485.34	$22,350.34	0.994
Complications	428,333	$28,003.39	$28,003.39	1.000
Transplant	53,861	$33,301.96	$33,301.96	1.000
Openings	233,699	$35,957.50	$35,957.50	1.000
Amputation	91,958	$29,821.67	$29,821.67	1.000

(continued)

Table 5-21 (continued)
Predictive ratios by body systems/disease groups: All aged-disabled enrollees

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2024 CMS-HCC Model				
Entire sample	28,248,982	10,958.40	10,958.40	1.000
Infection	887,594	34,113.45	34,237.30	1.004
Neoplasm	3,566,911	19,604.17	19,604.17	1.000
Diabetes	7,069,854	15,677.85	15,677.82	1.000
Metabolic	1,778,204	18,390.55	18,394.58	1.000
Liver	469,222	24,973.92	24,967.58	1.000
Gastrointestinal	687,409	24,200.60	24,247.67	1.002
Musculoskeletal	1,325,934	21,968.53	21,969.04	1.000
Blood	318,117	35,207.11	35,403.95	1.006
Cognitive	1,726,311	21,486.99	21,643.18	1.007
Substance Use	811,533	22,197.23	22,198.76	1.000
Psychiatric	2,222,781	17,459.65	17,459.65	1.000
Spinal	280,963	28,620.15	28,620.15	1.000
Neurological	1,576,637	21,254.77	21,239.50	0.999
Arrest	988,533	36,357.06	36,357.06	1.000
Heart	5,735,814	20,654.83	20,635.22	0.999
Cerebrovascular Disease	1,140,216	23,245.95	23,143.98	0.996
Vascular	942,074	27,288.04	27,263.59	0.999
Lung	3,874,579	21,607.26	21,619.11	1.001
Eye	1,021,091	19,651.74	19,568.24	0.996
Kidney	2,686,713	20,664.32	20,664.32	1.000
Skin	898,189	31,493.30	31,509.38	1.001
Injury	710,894	25,331.71	25,144.18	0.993
Transplant	28,071	46,126.45	46,126.45	1.000
Openings	260,175	38,873.34	38,873.34	1.000
Amputation	75,556	29,844.83	29,653.98	0.994

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year.

Table 5-22
Predictive ratios by count of chronic conditions: Aged enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	23,668,355	$9,959.32	$9,959.32	1.000
0 chronic eligible HCCs	2,095,466	$3,019.17	$4,161.12	1.378
1–3 chronic eligible HCCs	5,663,293	$5,086.83	$5,577.89	1.097
4–6 chronic eligible HCCs	8,194,931	$8,109.06	$8,253.88	1.018
7–9 chronic eligible HCCs	4,932,479	$13,525.75	$13,066.86	0.966
10+ chronic eligible HCCs	2,782,186	$25,208.07	$23,632.96	0.938
2024 CMS-HCC Model				
Entire sample	24,319,605	$10,944.38	$10,944.38	1.000
0 chronic eligible HCCs	2,088,363	$3,039.00	$4,646.28	1.529
1–3 chronic eligible HCCs	5,103,446	$5,135.13	$6,027.62	1.174
4–6 chronic eligible HCCs	7,826,232	$8,196.99	$8,612.81	1.051
7–9 chronic eligible HCCs	5,436,246	$13,401.57	$12,934.97	0.965
10+ chronic eligible HCCs	3,865,318	$25,765.87	$23,410.35	0.909

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-23
Predictive ratios by count of chronic conditions: Disabled enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	4,563,992	$9,896.02	$9,896.02	1.000
0 chronic eligible HCCs	602,364	$2,208.90	$2,916.94	1.321
1–3 chronic eligible HCCs	1,411,256	$5,026.61	$5,553.61	1.105
4–6 chronic eligible HCCs	1,386,288	$8,946.61	$9,021.68	1.008
7–9 chronic eligible HCCs	738,085	$15,489.54	$14,837.70	0.958
10+ chronic eligible HCCs	425,999	$31,021.85	$29,090.89	0.938
2024 CMS-HCC Model				
Entire sample	3,929,377	$11,047.23	$11,047.23	1.000
0 chronic eligible HCCs	513,519	$2,345.92	$3,106.39	1.324
1–3 chronic eligible HCCs	1,099,768	$5,314.51	$6,155.70	1.158
4–6 chronic eligible HCCs	1,142,900	$9,324.32	$9,718.16	1.042
7–9 chronic eligible HCCs	691,255	$15,543.66	$14,883.79	0.958
10+ chronic eligible HCCs	481,935	$31,872.38	$29,040.10	0.911

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-24
Predictive ratios by count of chronic conditions: Full benefit dual enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	4,015,611	$13,154.40	$13,154.40	1.000
0 chronic eligible HCCs	349,647	$4,077.39	$4,245.41	1.041
1–3 chronic eligible HCCs	1,017,264	$6,145.86	$6,673.24	1.086
4–6 chronic eligible HCCs	1,249,419	$10,451.47	$10,731.70	1.027
7–9 chronic eligible HCCs	810,911	$17,242.43	$17,003.08	0.986
10+ chronic eligible HCCs	588,370	$32,421.91	$31,018.27	0.957
2024 CMS-HCC Model				
Entire sample	3,737,967	$14,425.48	$14,425.48	1.000
0 chronic eligible HCCs	321,436	$4,194.74	$4,608.13	1.099
1–3 chronic eligible HCCs	833,126	$6,276.93	$7,194.42	1.146
4–6 chronic eligible HCCs	1,073,758	$10,481.58	$11,189.35	1.068
7–9 chronic eligible HCCs	788,086	$16,930.80	$16,710.60	0.987
10+ chronic eligible HCCs	721,561	$32,910.87	$30,680.35	0.932

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-25
Predictive ratios by count of chronic conditions: Partial benefit dual enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	1,737,201	$10,342.22	$10,342.22	1.000
0 chronic eligible HCCs	180,407	$3,221.22	$3,920.97	1.217
1–3 chronic eligible HCCs	449,316	$5,379.46	$5,928.36	1.102
4–6 chronic eligible HCCs	565,260	$8,752.10	$8,887.53	1.015
7–9 chronic eligible HCCs	340,566	$14,334.50	$13,895.54	0.969
10+ chronic eligible HCCs	201,652	$26,420.82	$24,841.39	0.940
2024 CMS-HCC Model				
Entire sample	1,535,338	$11,545.34	$11,545.34	1.000
0 chronic eligible HCCs	159,516	$3,467.90	$4,351.06	1.255
1–3 chronic eligible HCCs	343,947	$5,628.17	$6,562.30	1.166
4–6 chronic eligible HCCs	460,872	$8,969.58	$9,463.73	1.055
7–9 chronic eligible HCCs	325,397	$14,218.26	$13,825.92	0.972
10+ chronic eligible HCCs	245,606	$27,019.83	$24,626.68	0.911

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-26
Predictive ratios by count of chronic conditions: Non-dual enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	22,746,830	$9,133.84	$9,133.84	1.000
0 chronic eligible HCCs	2,269,856	$2,613.21	$3,815.62	1.460
1–3 chronic eligible HCCs	5,780,615	$4,823.10	$5,310.47	1.101
4–6 chronic eligible HCCs	7,843,224	$7,761.89	$7,854.40	1.012
7–9 chronic eligible HCCs	4,492,369	$12,995.21	$12,430.78	0.957
10+ chronic eligible HCCs	2,360,766	$24,078.39	$22,395.12	0.930
2024 CMS-HCC Model				
Entire sample	23,303,568	$10,145.09	$10,145.09	1.000
0 chronic eligible HCCs	2,225,338	$2,682.69	$4,301.22	1.603
1–3 chronic eligible HCCs	5,194,517	$4,937.70	$5,811.01	1.177
4–6 chronic eligible HCCs	7,542,651	$7,934.52	$8,287.72	1.045
7–9 chronic eligible HCCs	5,018,198	$12,976.24	$12,403.24	0.956
10+ chronic eligible HCCs	3,322,864	$24,677.05	$22,182.23	0.899

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-27
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with diabetes

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	7,104,165	$14,168.47	$14,168.47	1.000
1–3 chronic eligible HCCs	653,752	$5,572.23	$6,381.50	1.145
4–6 chronic eligible HCCs	2,496,601	$8,090.85	$8,794.61	1.087
7–9 chronic eligible HCCs	2,217,271	$13,708.87	$13,760.11	1.004
10+ chronic eligible HCCs	1,736,541	$27,410.56	$25,953.82	0.947
2024 CMS-HCC Model				
Entire sample	7,069,854	$15,677.85	$15,677.82	1.000
1–3 chronic eligible HCCs	463,673	$5,478.90	$7,237.37	1.321
4–6 chronic eligible HCCs	2,018,977	$7,913.78	$9,346.96	1.181
7–9 chronic eligible HCCs	2,242,524	$13,017.89	$13,411.18	1.030
10+ chronic eligible HCCs	2,344,680	$27,444.06	$25,394.88	0.925

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-28
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with HIV/AIDS

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	100,346	$15,248.52	$15,248.52	1.000
1–3 chronic eligible HCCs	25,726	$6,151.23	$7,853.45	1.277
4–6 chronic eligible HCCs	37,021	$10,612.40	$11,542.49	1.088
7–9 chronic eligible HCCs	22,147	$17,639.18	$17,799.24	1.009
10+ chronic eligible HCCs	15,452	$39,249.51	$33,699.62	0.859
2024 CMS-HCC Model				
Entire sample	95,147	$16,852.01	$16,852.01	1.000
1–3 chronic eligible HCCs	19,059	$7,003.34	$8,300.92	1.185
4–6 chronic eligible HCCs	32,115	$10,527.54	$12,067.88	1.146
7–9 chronic eligible HCCs	23,361	$17,038.73	$17,401.37	1.021
10+ chronic eligible HCCs	20,612	$36,227.63	$32,083.78	0.886

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-29
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with substance use disorder

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	728,437	$21,280.50	$21,280.50	1.000
1–3 chronic eligible HCCs	90,877	$8,033.67	$9,756.78	1.214
4–6 chronic eligible HCCs	203,327	$12,611.90	$13,453.27	1.067
7–9 chronic eligible HCCs	200,785	$19,526.67	$19,511.37	0.999
10+ chronic eligible HCCs	233,448	$36,168.07	$34,709.39	0.960
2024 CMS-HCC Model				
Entire sample	811,533	$22,197.23	$22,198.76	1.000
1–3 chronic eligible HCCs	87,133	$8,183.53	$10,455.02	1.278
4–6 chronic eligible HCCs	202,332	$12,422.32	$13,848.23	1.115
7–9 chronic eligible HCCs	217,911	$18,521.89	$18,956.89	1.023
10+ chronic eligible HCCs	304,157	$35,833.71	$33,855.86	0.945

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-30
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with mental health conditions

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	2,581,874	$16,250.98	$16,251.25	1.000
0 chronic eligible HCCs	4,187	$4,455.58	$6,296.67	1.413
1–3 chronic eligible HCCs	478,647	$5,925.07	$7,267.65	1.227
4–6 chronic eligible HCCs	795,609	$10,316.51	$11,009.85	1.067
7–9 chronic eligible HCCs	673,157	$16,923.34	$16,629.55	0.983
10+ chronic eligible HCCs	630,274	$31,905.77	$30,203.42	0.947
2024 CMS-HCC Model				
Entire sample	2,222,781	$17,459.65	$17,459.65	1.000
0 chronic eligible HCCs	7,253	$4,403.29	$6,689.49	1.519
1–3 chronic eligible HCCs	354,224	$6,297.67	$8,163.86	1.296
4–6 chronic eligible HCCs	626,663	$10,359.40	$11,623.63	1.122
7–9 chronic eligible HCCs	582,252	$16,331.68	$16,384.53	1.003
10+ chronic eligible HCCs	652,389	$32,185.86	$29,770.38	0.925

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-31
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with chronic obstructive pulmonary disease (COPD)

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	3,826,031	$19,259.78	$19,259.78	1.000
1–3 chronic eligible HCCs	305,771	$8,085.86	$9,011.79	1.115
4–6 chronic eligible HCCs	1,052,464	$11,403.58	$12,157.71	1.066
7–9 chronic eligible HCCs	1,209,125	$17,204.93	$17,483.01	1.016
10+ chronic eligible HCCs	1,258,671	$31,167.56	$29,981.46	0.962
2024 CMS-HCC Model				
Entire sample	3,674,755	$21,055.65	$21,072.40	1.001
1–3 chronic eligible HCCs	234,130	$8,263.41	$9,979.81	1.208
4–6 chronic eligible HCCs	839,327	$11,586.47	$13,030.69	1.125
7–9 chronic eligible HCCs	1,099,035	$17,012.93	$17,653.66	1.038
10+ chronic eligible HCCs	1,502,263	$31,815.48	$30,236.78	0.950

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-32
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with congestive heart failure (CHF)

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	3,111,271	$23,079.39	$23,079.39	1.000
1–3 chronic eligible HCCs	130,102	$10,109.59	$10,808.25	1.069
4–6 chronic eligible HCCs	688,269	$13,482.04	$14,526.72	1.077
7–9 chronic eligible HCCs	1,031,750	$19,334.28	$19,903.27	1.029
10+ chronic eligible HCCs	1,261,150	$33,260.46	$32,092.69	0.965
2024 CMS-HCC Model				
Entire sample	3,248,568	$24,868.01	$24,868.01	1.000
1–3 chronic eligible HCCs	95,318	$9,777.86	$11,408.25	1.167
4–6 chronic eligible HCCs	552,221	$13,067.23	$14,967.76	1.145
7–9 chronic eligible HCCs	966,337	$18,594.17	$19,767.83	1.063
10+ chronic eligible HCCs	1,634,692	$33,893.49	$32,388.40	0.956

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-33
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with vascular disorders

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	4,091,132	$19,228.00	$19,228.00	1.000
0 chronic eligible HCCs	2,155	$7,004.92	$8,180.00	1.168
1–3 chronic eligible HCCs	216,448	$8,755.63	$9,923.05	1.133
4–6 chronic eligible HCCs	992,870	$11,307.45	$12,323.82	1.090
7–9 chronic eligible HCCs	1,379,679	$16,146.16	$16,555.75	1.025
10+ chronic eligible HCCs	1,499,980	$29,255.48	$27,982.46	0.956
2024 CMS-HCC Model				
Entire sample	942,074	$27,288.04	$27,263.59	0.999
0 chronic eligible HCCs	2,872	$4,474.74	$7,904.58	1.766
1–3 chronic eligible HCCs	56,784	$9,208.28	$11,802.89	1.282
4–6 chronic eligible HCCs	178,912	$13,936.16	$15,925.29	1.143
7–9 chronic eligible HCCs	254,400	$20,747.31	$21,610.27	1.042
10+ chronic eligible HCCs	449,106	$39,501.16	$37,708.47	0.955

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-34
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with cancer

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	3,266,430	$16,569.40	$16,569.40	1.000
1–3 chronic eligible HCCs	389,658	$8,720.01	$9,433.07	1.082
4–6 chronic eligible HCCs	1,086,166	$11,179.02	$11,664.99	1.043
7–9 chronic eligible HCCs	1,003,161	$16,424.05	$16,310.27	0.993
10+ chronic eligible HCCs	787,445	$28,853.25	$27,912.57	0.967
2024 CMS-HCC Model				
Entire sample	3,566,911	$19,604.17	$19,604.17	1.000
1–3 chronic eligible HCCs	327,416	$9,882.76	$11,713.35	1.185
4–6 chronic eligible HCCs	1,017,216	$12,518.88	$13,668.93	1.092
7–9 chronic eligible HCCs	1,097,605	$17,740.23	$17,882.24	1.008
10+ chronic eligible HCCs	1,124,674	$31,301.66	$29,488.75	0.942

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-35
Predictive ratios by count of chronic conditions: All aged-disabled enrollees with chronic kidney disease (CKD)

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	1,398,777	$15,350.17	$15,359.59	1.001
1–3 chronic eligible HCCs	57,722	$6,560.65	$7,120.78	1.085
4–6 chronic eligible HCCs	383,089	$9,029.41	$9,696.00	1.074
7–9 chronic eligible HCCs	505,889	$13,822.60	$14,016.42	1.014
10+ chronic eligible HCCs	452,077	$23,844.90	$22,989.95	0.964
2024 CMS-HCC Model				
Entire sample	2,686,713	$20,664.32	$20,664.32	1.000
1–3 chronic eligible HCCs	69,938	$6,229.32	$8,342.06	1.339
4–6 chronic eligible HCCs	503,378	$9,086.33	$11,052.05	1.216
7–9 chronic eligible HCCs	835,081	$14,614.58	$15,680.61	1.073
10+ chronic eligible HCCs	1,278,316	$30,528.89	$28,847.19	0.945

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-36
Predictive ratios by count of payment conditions: Aged enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	23,668,355	$9,959.32	$9,959.32	1.000
0 payment HCCs	8,107,039	$4,147.78	$4,138.45	0.998
1–3 payment HCCs	11,946,456	$9,553.34	$9,550.52	1.000
4–6 payment HCCs	2,715,094	$21,298.57	$21,326.56	1.001
7–9 payment HCCs	677,057	$35,409.76	$35,465.32	1.002
10+ payment HCCs	222,709	$55,373.41	$55,401.21	1.001
2024 CMS-HCC Model				
Entire sample	24,319,605	$10,944.38	$10,944.38	1.000
0 payment HCCs	8,958,442	$4,650.26	$4,626.89	0.995
1–3 payment HCCs	12,305,153	$11,212.11	$11,233.17	1.002
4–6 payment HCCs	2,430,826	$25,741.57	$25,715.29	0.999
7–9 payment HCCs	506,398	$43,774.49	$43,796.87	1.001
10+ payment HCCs	118,786	$68,123.72	$68,164.21	1.001

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-37
Predictive ratios by count of payment conditions: Disabled enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	4,563,992	$9,896.02	$9,896.02	1.000
0 payment HCCs	1,329,617	$3,060.45	$3,047.48	0.996
1–3 payment HCCs	2,505,906	$8,413.21	$8,439.25	1.003
4–6 payment HCCs	536,119	$21,231.09	$21,210.15	0.999
7–9 payment HCCs	134,109	$40,091.93	$39,890.74	0.995
10+ payment HCCs	58,241	$67,583.04	$67,364.10	0.997
2024 CMS-HCC Model				
Entire sample	3,929,377	$11,047.23	$11,047.23	1.000
0 payment HCCs	1,171,115	$3,376.20	$3,298.67	0.977
1–3 payment HCCs	2,191,817	$9,829.18	$9,917.13	1.009
4–6 payment HCCs	438,797	$25,705.45	$25,512.39	0.992
7–9 payment HCCs	97,602	$49,991.05	$49,825.29	0.997
10+ payment HCCs	30,046	$82,564.04	$82,414.61	0.998

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-38
Predictive ratios by count of payment conditions: Full benefit dual enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	4,015,611	$13,154.40	$13,154.40	1.000
0 payment HCCs	942,110	$4,554.92	$4,454.30	0.978
1–3 payment HCCs	2,203,307	$10,328.61	$10,375.46	1.005
4–6 payment HCCs	617,131	$24,344.65	$24,330.07	0.999
7–9 payment HCCs	178,860	$43,161.22	$43,161.22	1.000
10+ payment HCCs	74,203	$71,357.58	$71,357.58	1.000
2024 CMS-HCC Model				
Entire sample	3,737,967	$14,425.48	$14,425.48	1.000
0 payment HCCs	916,385	$5,005.27	$4,872.83	0.974
1–3 payment HCCs	2,099,969	$11,904.59	$11,994.61	1.008
4–6 payment HCCs	541,840	$29,032.75	$28,899.95	0.995
7–9 payment HCCs	138,706	$52,440.96	$52,440.96	1.000
10+ payment HCCs	41,067	$85,422.11	$85,422.11	1.000

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-39
Predictive ratios by count of payment conditions: Partial benefit dual enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	1,737,201	$10,342.22	$10,342.22	1.000
0 payment HCCs	466,467	$4,034.77	$4,019.60	0.996
1–3 payment HCCs	960,857	$8,916.88	$8,920.09	1.000
4–6 payment HCCs	232,559	$20,498.73	$20,516.83	1.001
7–9 payment HCCs	57,531	$36,254.59	$36,254.59	1.000
10+ payment HCCs	19,787	$58,858.11	$58,858.11	1.000
2024 CMS-HCC Model				
Entire sample	1,535,338	$11,545.34	$11,545.34	1.000
0 payment HCCs	422,168	$4,493.76	$4,462.01	0.993
1–3 payment HCCs	864,238	$10,333.34	$10,359.70	1.003
4–6 payment HCCs	197,615	$24,170.83	$24,121.28	0.998
7–9 payment HCCs	41,419	$44,685.37	$44,685.37	1.000
10+ payment HCCs	9,898	$72,920.96	$72,920.96	1.000

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-40
Predictive ratios by count of payment conditions: Non-dual enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	22,746,830	$9,133.84	$9,133.84	1.000
0 payment HCCs	8,252,920	$3,920.72	$3,927.12	1.002
1–3 payment HCCs	11,497,244	$9,147.86	$9,143.06	0.999
4–6 payment HCCs	2,305,850	$20,867.79	$20,868.50	1.000
7–9 payment HCCs	529,608	$35,333.25	$35,333.25	1.000
10+ payment HCCs	161,208	$55,706.97	$55,706.97	1.000
2024 CMS-HCC Model				
Entire sample	23,303,568	$10,145.09	$10,145.09	1.000
0 payment HCCs	9,019,475	$4,446.11	$4,432.24	0.997
1–3 payment HCCs	11,741,212	$10,814.04	$10,838.62	1.002
4–6 payment HCCs	2,070,013	$25,255.95	$25,173.03	0.997
7–9 payment HCCs	390,929	$43,724.62	$43,724.62	1.000
10+ payment HCCs	81,939	$68,544.53	$68,544.53	1.000

SOURCE: RTI International analysis of Medicare 2014–2015 (V24) and 2018-2019 (V28) 100% sample claims and enrollment data.
Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual expenditures across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual expenditures for the entire sample in the table because groupings defined based on counts of beneficiaries do not account for partial enrollment.

Table 5-41
Predictive ratios by deciles of predicted risk (sorted low to high): All dialysis enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	373,176	$80,912.08	$80,913.46	1.000
First (lowest) decile	37,318	$46,300.23	$47,123.31	1.018
Second decile	37,318	$56,604.34	$56,048.47	0.990
Third decile	37,318	$63,194.82	$62,636.57	0.991
Fourth decile	37,318	$68,115.88	$67,843.47	0.996
Fifth decile	37,318	$73,022.80	$73,223.00	1.003
Sixth decile	37,318	$78,674.58	$78,781.55	1.001
Seventh decile	37,317	$86,657.21	$86,617.38	1.000
Eighth decile	37,317	$95,117.70	$95,885.89	1.008
Ninth decile	37,317	$109,408.68	$109,463.69	1.001
Tenth (highest) decile	37,317	$140,691.98	$140,121.07	0.996
Top 5%	18,658	$155,408.01	$154,933.37	0.997
Top 1%	3,731	$184,534.83	$185,415.90	1.005
Top 0.1%	373	$207,709.56	$222,306.23	1.070
2023 CMS-HCC Model				
Entire sample	378,103	$88,529.46	$88,264.30	0.997
First (lowest) decile	37,811	$54,027.64	$54,553.90	1.010
Second decile	37,811	$64,149.19	$62,509.69	0.974
Third decile	37,811	$68,980.62	$67,946.73	0.985
Fourth decile	37,810	$75,051.01	$73,834.86	0.984
Fifth decile	37,810	$78,793.62	$78,629.90	0.998
Sixth decile	37,810	$84,683.63	$84,934.89	1.003
Seventh decile	37,810	$93,127.16	$93,422.84	1.003
Eighth decile	37,810	$102,131.75	$103,284.93	1.011
Ninth decile	37,810	$118,181.05	$118,334.97	1.001
Tenth (highest) decile	37,810	$152,166.24	$151,022.93	0.992
Top 5%	18,905	$166,919.03	$166,462.94	0.997
Top 1%	3,781	$195,279.13	$198,020.49	1.014
Top 0.1%	378	$211,466.70	$234,448.54	1.109

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-42
Predictive ratios by deciles of predicted risk (sorted low to high): Aged dialysis enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 CMS-HCC Model				
Entire sample	178,003	$86,650.90	$86,574.22	0.999
First (lowest) decile	17,801	$53,118.71	$52,691.20	0.992
Second decile	17,801	$65,163.18	$62,088.80	0.953
Third decile	17,801	$70,418.38	$68,566.49	0.974
Fourth decile	17,800	$75,077.92	$74,231.85	0.989
Fifth decile	17,800	$80,614.41	$79,982.41	0.992
Sixth decile	17,800	$86,207.90	$86,321.77	1.001
Seventh decile	17,800	$92,569.52	$93,254.36	1.007
Eighth decile	17,800	$100,781.62	$102,111.81	1.013
Ninth decile	17,800	$112,707.44	$114,992.97	1.020
Tenth (highest) decile	17,800	$140,905.04	$143,178.19	1.016
Top 5%	8,900	$154,404.21	$156,929.44	1.016
Top 1%	1,780	$183,618.09	$185,277.71	1.009
Top 0.1%	178	$219,205.49	$218,541.99	0.997
2023 CMS-HCC Model				
Entire sample	185,822	$91,178.15	$91,152.72	1.000
First (lowest) decile	18,583	$55,710.97	$55,794.20	1.001
Second decile	18,583	$67,936.21	$64,952.44	0.956
Third decile	18,582	$74,072.55	$71,655.78	0.967
Fourth decile	18,582	$78,554.42	$77,603.01	0.988
Fifth decile	18,582	$84,305.35	$83,332.40	0.988
Sixth decile	18,582	$90,339.59	$90,434.92	1.001
Seventh decile	18,582	$97,038.23	$98,016.29	1.010
Eighth decile	18,582	$105,133.28	$107,609.74	1.024
Ninth decile	18,582	$120,113.95	$121,671.13	1.013
Tenth (highest) decile	18,582	$149,127.24	$151,580.85	1.016
Top 5%	9,291	$163,169.48	$165,775.97	1.016
Top 1%	1,858	$188,228.75	$194,527.08	1.033
Top 0.1%	185	$228,120.51	$228,914.80	1.003

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-43
Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged dialysis enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	195,173	$75,956.45	$76,025.26	1.001
First (lowest) decile	19,518	$44,422.26	$44,843.53	1.009
Second decile	19,518	$52,003.24	$52,090.04	1.002
Third decile	19,518	$57,084.58	$57,837.15	1.013
Fourth decile	19,517	$61,801.44	$63,460.60	1.027
Fifth decile	19,517	$67,083.61	$67,701.43	1.009
Sixth decile	19,517	$71,696.86	$72,852.45	1.016
Seventh decile	19,517	$77,143.66	$78,153.38	1.013
Eighth decile	19,517	$88,171.85	$88,152.53	1.000
Ninth decile	19,517	$103,813.65	$102,382.80	0.986
Tenth (highest) decile	19,517	$139,689.19	$136,074.58	0.974
Top 5%	9,758	$156,716.51	$152,281.55	0.972
Top 1%	1,951	$185,149.22	$185,274.12	1.001
Top 0.1%	195	$197,570.53	$224,910.01	1.138
2023 ESRD Model				
Entire sample	192,281	$86,049.37	$85,559.74	0.994
First (lowest) decile	19,229	$53,180.24	$53,549.38	1.007
Second decile	19,228	$61,564.15	$61,090.19	0.992
Third decile	19,228	$66,453.58	$65,229.83	0.982
Fourth decile	19,228	$70,066.94	$70,395.29	1.005
Fifth decile	19,228	$75,819.28	$75,442.12	0.995
Sixth decile	19,228	$78,827.27	$79,627.78	1.010
Seventh decile	19,228	$85,981.36	$87,347.24	1.016
Eighth decile	19,228	$98,053.65	$98,258.68	1.002
Ninth decile	19,228	$115,687.64	$114,098.17	0.986
Tenth (highest) decile	19,228	$154,520.52	$149,954.34	0.970
Top 5%	9,614	$170,063.05	$166,869.66	0.981
Top 1%	1,922	$200,754.88	$200,883.86	1.001
Top 0.1%	192	$202,556.30	$238,004.63	1.175

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-44
Predictive ratios by deciles of predicted risk (sorted low to high): Dialysis continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	325,235	$81,944.86	$81,944.86	1.000
First (lowest) decile	32,524	$45,546.53	$46,590.27	1.023
Second decile	32,524	$55,967.40	$55,387.08	0.990
Third decile	32,524	$63,024.61	$61,913.97	0.982
Fourth decile	32,524	$68,304.11	$68,036.96	0.996
Fifth decile	32,524	$74,552.56	$74,393.55	0.998
Sixth decile	32,523	$81,106.30	$81,354.90	1.003
Seventh decile	32,523	$88,856.98	$89,362.93	1.006
Eighth decile	32,523	$98,450.31	$99,176.88	1.007
Ninth decile	32,523	$112,555.36	$112,990.28	1.004
Tenth (highest) decile	32,523	$144,059.81	$143,155.25	0.994
Top 5%	16,261	$158,730.93	$157,739.72	0.994
Top 1%	3,252	$185,943.38	$187,751.07	1.010
Top 0.1%	325	$205,413.83	$224,230.81	1.092
2023 ESRD Model				
Entire sample	324,468	$89,881.72	$89,881.72	1.000
First (lowest) decile	32,447	$52,750.17	$53,742.29	1.019
Second decile	32,447	$63,738.03	$62,129.74	0.975
Third decile	32,447	$69,163.39	$68,361.37	0.988
Fourth decile	32,447	$75,169.60	$74,507.31	0.991
Fifth decile	32,447	$80,603.83	$81,066.62	1.006
Sixth decile	32,447	$87,796.77	$88,444.06	1.007
Seventh decile	32,447	$95,645.99	$97,090.44	1.015
Eighth decile	32,447	$106,796.15	$107,720.62	1.009
Ninth decile	32,446	$122,965.41	$122,562.27	0.997
Tenth (highest) decile	32,446	$155,582.24	$154,500.64	0.993
Top 5%	16,223	$170,002.44	$169,747.57	0.999
Top 1%	3,244	$197,707.81	$200,654.60	1.015
Top 0.1%	324	$211,338.97	$236,504.35	1.119

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-45
Predictive ratios by deciles of predicted risk (sorted low to high): Dialysis new enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	47,941	$72,242.65	$72,255.69	1.000
First decile (lowest)	4,795	$53,189.74	$52,830.43	0.993
Second decile	4,794	$60,767.28	$62,171.73	1.023
Third decile	4,794	$63,637.16	$65,125.89	1.023
Fourth decile	4,794	$68,049.20	$67,335.22	0.990
Fifth decile	4,794	$67,600.34	$70,948.41	1.050
Sixth decile	4,794	$75,181.33	$73,308.28	0.975
Seventh decile	4,794	$71,489.54	$74,056.32	1.036
Eighth decile	4,794	$77,191.55	$77,048.20	0.998
Ninth decile	4,794	$87,005.38	$84,232.07	0.968
Tenth (highest) decile	4,794	$98,353.13	$95,218.23	0.968
Top 5%	2,397	$97,345.33	$98,230.06	1.009
Top 1%	479	$100,698.09	$100,607.98	0.999
Top 0.1%	47	$105,702.30	$105,763.05	1.001
2023 ESRD Model				
Entire sample	53,635	$78,132.13	$75,828.24	0.971
First decile (lowest)	5,364	$63,238.44	$60,825.97	0.962
Second decile	5,364	$65,578.07	$63,386.22	0.967
Third decile	5,364	$69,088.12	$65,843.40	0.953
Fourth decile	5,364	$73,480.06	$71,364.16	0.971
Fifth decile	5,364	$76,928.59	$75,165.05	0.977
Sixth decile	5,363	$79,279.76	$76,730.61	0.968
Seventh decile	5,363	$79,905.66	$77,574.57	0.971
Eighth decile	5,363	$83,707.20	$80,664.42	0.964
Ninth decile	5,363	$88,239.92	$87,506.62	0.992
Tenth (highest) decile	5,363	$101,185.25	$98,383.03	0.972
Top 5%	2,681	$103,188.17	$100,355.06	0.973
Top 1%	536	$110,276.81	$106,007.93	0.961
Top 0.1%	53	$94,534.54	$109,718.85	1.161

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-46
Predictive ratios by deciles of predicted risk (sorted low to high): Aged dialysis continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	170,485	$86,661.90	$86,661.90	1.000
First decile (lowest)	17,049	$52,770.68	$52,429.80	0.994
Second decile	17,049	$64,914.80	$61,647.58	0.950
Third decile	17,049	$69,646.28	$67,900.87	0.975
Fourth decile	17,049	$74,899.98	$73,825.60	0.986
Fifth decile	17,049	$80,047.45	$79,838.22	0.997
Sixth decile	17,048	$86,231.69	$86,416.86	1.002
Seventh decile	17,048	$92,664.57	$93,893.98	1.013
Eighth decile	17,048	$101,719.41	$103,101.49	1.014
Ninth decile	17,048	$113,863.67	$116,002.27	1.019
Tenth (highest) decile	17,048	$141,712.71	$144,060.56	1.017
Top 5%	8,524	$154,766.66	$157,714.30	1.019
Top 1%	1,704	$184,363.47	$185,959.40	1.009
Top 0.1%	170	$220,003.30	$219,050.56	0.996
2023 ESRD Model				
Entire sample	176,688	$91,338.54	$91,338.54	1.000
First decile (lowest)	17,669	$55,218.04	$55,531.30	1.006
Second decile	17,669	$67,556.95	$64,444.59	0.954
Third decile	17,669	$73,241.40	$70,860.76	0.967
Fourth decile	17,669	$78,323.88	$77,049.07	0.984
Fifth decile	17,669	$84,316.89	$83,568.00	0.991
Sixth decile	17,669	$90,884.12	$90,688.80	0.998
Seventh decile	17,669	$97,303.90	$98,895.68	1.016
Eighth decile	17,669	$106,445.78	$108,993.88	1.024
Ninth decile	17,668	$121,309.71	$122,982.28	1.014
Tenth (highest) decile	17,668	$150,496.82	$152,669.38	1.014
Top 5%	8,834	$164,400.05	$166,769.21	1.014
Top 1%	1,766	$188,341.18	$195,386.46	1.037
Top 0.1%	176	$230,889.43	$229,693.28	0.995

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-47
Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged dialysis continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	154,750	$77,213.11	$77,213.11	1.000
First decile (lowest)	15,475	$43,565.92	$43,889.81	1.007
Second decile	15,475	$50,351.78	$50,568.82	1.004
Third decile	15,475	$55,114.30	$56,054.16	1.017
Fourth decile	15,475	$60,868.68	$61,596.20	1.012
Fifth decile	15,475	$66,245.77	$67,554.93	1.020
Sixth decile	15,475	$73,291.13	$74,434.16	1.016
Seventh decile	15,475	$82,724.46	$82,847.20	1.001
Eighth decile	15,475	$92,456.37	$93,412.53	1.010
Ninth decile	15,475	$110,511.03	$108,552.04	0.982
Tenth (highest) decile	15,475	$145,977.94	$141,658.62	0.970
Top 5%	7,737	$162,369.03	$157,454.53	0.970
Top 1%	1,547	$187,937.91	$189,433.78	1.008
Top 0.1%	154	$198,816.19	$228,500.54	1.149
2023 ESRD Model				
Entire sample	147,780	$88,269.95	$88,269.95	1.000
First decile (lowest)	14,778	$51,762.94	$52,339.29	1.011
Second decile	14,778	$59,695.82	$59,791.07	1.002
Third decile	14,778	$65,630.50	$65,652.91	1.000
Fourth decile	14,778	$70,222.53	$71,461.89	1.018
Fifth decile	14,778	$75,828.59	$77,890.29	1.027
Sixth decile	14,778	$83,933.17	$85,381.42	1.017
Seventh decile	14,778	$92,761.17	$94,483.90	1.019
Eighth decile	14,778	$106,193.67	$105,929.79	0.998
Ninth decile	14,778	$125,088.81	$121,986.16	0.975
Tenth (highest) decile	14,778	$160,913.04	$156,491.24	0.973
Top 5%	7,389	$175,548.56	$172,973.83	0.985
Top 1%	1,477	$203,648.68	$205,674.41	1.010
Top 0.1%	147	$199,235.43	$242,123.68	1.215

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-48
Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual dialysis continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	125,271	$91,345.35	$88,750.62	0.972
First decile (lowest)	12,528	$51,362.32	$51,499.59	1.003
Second decile	12,527	$61,774.78	$60,182.54	0.974
Third decile	12,527	$68,973.04	$67,191.37	0.974
Fourth decile	12,527	$75,370.31	$73,879.20	0.980
Fifth decile	12,527	$83,221.75	$80,844.81	0.971
Sixth decile	12,527	$90,901.05	$88,430.60	0.973
Seventh decile	12,527	$99,722.99	$97,048.02	0.973
Eighth decile	12,527	$112,539.77	$107,651.48	0.957
Ninth decile	12,527	$127,603.16	$122,426.85	0.959
Tenth (highest) decile	12,527	$157,973.55	$153,658.83	0.973
Top 5%	6,263	$172,777.39	$168,621.84	0.976
Top 1%	1,252	$195,636.15	$199,053.96	1.017
Top 0.1%	125	$207,888.64	$233,618.94	1.124
2023 ESRD Model				
Entire sample	123,576	$100,133.55	$98,692.41	0.986
First decile (lowest)	12,358	$61,931.93	$60,343.20	0.974
Second decile	12,358	$69,776.69	$69,052.02	0.990
Third decile	12,358	$75,564.92	$75,822.71	1.003
Fourth decile	12,358	$83,020.08	$82,495.03	0.994
Fifth decile	12,358	$90,013.29	$89,699.82	0.997
Sixth decile	12,358	$97,811.73	$97,766.03	1.000
Seventh decile	12,357	$108,893.42	$107,043.64	0.983
Eighth decile	12,357	$121,372.68	$118,362.72	0.975
Ninth decile	12,357	$138,738.54	$134,021.36	0.966
Tenth (highest) decile	12,357	$168,753.23	$166,429.29	0.986
Top 5%	6,178	$182,576.83	$181,764.63	0.996
Top 1%	1,235	$207,774.02	$212,240.08	1.021
Top 0.1%	123	$220,257.20	$247,676.58	1.124

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-49
Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual dialysis continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	43,918	$76,371.00	$81,615.43	1.069
First decile (lowest)	4,392	$45,913.05	$49,728.97	1.083
Second decile	4,392	$52,126.71	$56,673.14	1.087
Third decile	4,392	$58,022.22	$62,382.09	1.075
Fourth decile	4,392	$62,932.41	$67,891.30	1.079
Fifth decile	4,392	$68,767.93	$73,716.40	1.072
Sixth decile	4,392	$74,522.25	$80,290.57	1.077
Seventh decile	4,392	$81,595.07	$88,000.86	1.079
Eighth decile	4,392	$89,221.26	$97,260.00	1.090
Ninth decile	4,391	$104,316.55	$110,337.21	1.058
Tenth (highest) decile	4,391	$135,906.60	$139,532.31	1.027
Top 5%	2,195	$151,347.97	$153,691.89	1.015
Top 1%	439	$185,958.02	$182,806.38	0.983
Top 0.1%	43	$199,776.48	$216,948.77	1.086
2023 ESRD Model				
Entire sample	44,932	$85,950.55	$85,895.71	0.999
First decile (lowest)	4,494	$52,764.10	$52,835.42	1.001
Second decile	4,494	$59,824.59	$60,025.37	1.003
Third decile	4,493	$65,526.21	$65,682.07	1.002
Fourth decile	4,493	$70,510.69	$71,061.20	1.008
Fifth decile	4,493	$75,351.99	$77,010.58	1.022
Sixth decile	4,493	$83,223.55	$83,925.95	1.008
Seventh decile	4,493	$89,104.36	$92,023.42	1.033
Eighth decile	4,493	$102,764.79	$102,373.60	0.996
Ninth decile	4,493	$119,440.63	$116,500.37	0.975
Tenth (highest) decile	4,493	$151,360.30	$147,320.40	0.973
Top 5%	2,246	$166,051.92	$162,090.53	0.976
Top 1%	449	$184,933.92	$193,052.94	1.044
Top 0.1%	44	$194,542.01	$233,801.10	1.202

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-50
Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual dialysis continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	189,315	$80,422.33	$78,378.47	0.975
First decile (lowest	18,932	$43,702.18	$44,319.04	1.014
Second decile	18,932	$54,976.66	$52,974.46	0.964
Third decile	18,932	$62,635.21	$59,344.15	0.947
Fourth decile	18,932	$68,344.28	$65,277.79	0.955
Fifth decile	18,932	$73,886.27	$71,365.97	0.966
Sixth decile	18,931	$80,280.29	$78,054.19	0.972
Seventh decile	18,931	$87,627.13	$85,713.30	0.978
Eighth decile	18,931	$96,140.60	$95,107.43	0.989
Ninth decile	18,931	$109,367.11	$108,332.76	0.991
Tenth (highest) decile	18,931	$141,305.95	$137,025.28	0.970
Top 5%	9,465	$155,686.58	$151,134.48	0.971
Top 1%	1,893	$185,415.06	$180,574.36	0.974
Top 0.1%	189	$212,022.93	$215,603.69	1.017
2023 ESRD Model				
Entire sample	189,692	$87,185.59	$85,499.27	0.981
First decile (lowest	18,970	$49,759.38	$52,024.55	1.046
Second decile	18,970	$62,605.02	$59,468.46	0.950
Third decile	18,969	$68,332.12	$65,279.50	0.955
Fourth decile	18,969	$73,903.07	$70,951.11	0.960
Fifth decile	18,969	$78,786.10	$77,124.12	0.979
Sixth decile	18,969	$85,728.64	$84,119.38	0.981
Seventh decile	18,969	$93,474.07	$92,276.18	0.987
Eighth decile	18,969	$103,102.70	$102,396.08	0.993
Ninth decile	18,969	$116,689.21	$116,408.82	0.998
Tenth (highest) decile	18,969	$151,680.77	$146,860.49	0.968
Top 5%	9,484	$166,692.52	$161,431.43	0.968
Top 1%	1,896	$202,419.92	$191,281.04	0.945
Top 0.1%	189	$218,236.67	$224,942.42	1.031

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-51a
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				325,235	$81,944.86	$81,944.86	1.000
HCC1	HIV/AIDS	Y	Y	5,368	$93,286.27	$93,286.27	1.000
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		50,106	$115,238.51	$115,238.51	1.000
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			3,295	$114,225.36	$111,685.92	0.978
HCC4	Viral and Late Effects Central Nervous System Infections			766	$111,793.70	$105,623.27	0.945
HCC5	Tuberculosis			831	$96,183.38	$95,191.73	0.990
HCC6	Opportunistic Infections	Y		3,641	$118,788.78	$118,788.78	1.000
HCC7	Other Infectious Diseases			126,689	$98,203.72	$96,245.82	0.980
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	3,902	$115,409.30	$115,409.30	1.000
HCC9	Lung and Other Severe Cancers	Y	Y	6,514	$104,672.15	$104,672.15	1.000
HCC10	Lymphoma and Other Cancers	Y	Y	3,681	$102,470.54	$102,470.54	1.000
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	10,082	$91,478.80	$91,478.80	1.000
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	13,117	$87,310.70	$87,310.70	1.000
HCC13	Other Respiratory and Heart Neoplasms			1,008	$103,622.59	$101,111.21	0.976
HCC14	Other Digestive and Urinary Neoplasms			22,280	$88,496.40	$86,885.49	0.982
HCC15	Other Neoplasms			16,736	$85,899.45	$84,731.03	0.986
HCC16	Benign Neoplasms of Skin, Breast, Eye			12,722	$86,663.56	$84,122.37	0.971
HCC17	Diabetes with Acute Complications	Y	Y	7,343	$119,644.24	$119,644.24	1.000
HCC18	Diabetes with Chronic Complications	Y	Y	154,693	$91,698.12	$91,698.12	1.000
HCC19	Diabetes without Complication	Y	Y	43,646	$80,872.14	$80,872.14	1.000
HCC20	Type I Diabetes Mellitus		Y	56,754	$99,864.76	$97,432.95	0.976
HCC21	Protein-Calorie Malnutrition	Y		26,653	$119,639.77	$119,639.77	1.000
HCC22	Morbid Obesity	Y	Y	36,934	$100,943.91	$100,943.91	1.000
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	102,255	$93,888.91	$93,888.91	1.000
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			154,841	$99,007.08	$96,664.08	0.976

(continued)

Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC25	Disorders of Lipoid Metabolism		Y	199,880	$90,543.07	$89,678.75	0.990
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	148,420	$95,560.17	$93,611.66	0.980
HCC27	End-Stage Liver Disease	Y	Y	6,445	$119,910.28	$119,910.28	1.000
HCC28	Cirrhosis of Liver	Y	Y	6,129	$103,213.36	$103,213.36	1.000
HCC29	Chronic Hepatitis	Y	Y	7,278	$95,783.55	$95,783.55	1.000
HCC30	Acute Liver Failure/Disease			1,724	$112,425.32	$116,634.27	1.037
HCC31	Other Hepatitis and Liver Disease		Y	10,582	$97,369.13	$92,456.12	0.950
HCC32	Gallbladder and Biliary Tract Disorders			9,473	$104,152.59	$102,492.81	0.984
HCC33	Intestinal Obstruction/Perforation	Y		18,896	$105,960.08	$105,960.08	1.000
HCC34	Chronic Pancreatitis	Y	Y	3,399	$114,771.34	$114,771.34	1.000
HCC35	Inflammatory Bowel Disease	Y	Y	4,059	$103,406.16	$103,406.16	1.000
HCC36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			63,995	$105,400.82	$101,155.79	0.960
HCC37	Appendicitis			968	$96,818.93	$98,019.27	1.012
HCC38	Other Gastrointestinal Disorders			192,045	$92,172.71	$91,267.32	0.990
HCC39	Bone/Joint/Muscle Infections/Necrosis	Y		20,768	$118,987.79	$118,987.79	1.000
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	Y	Y	21,627	$96,218.98	$96,218.98	1.000
HCC41	Disorders of the Vertebrae and Spinal Discs		Y	41,652	$98,427.28	$93,707.88	0.952
HCC42	Osteoarthritis of Hip or Knee		Y	25,450	$96,576.33	$90,851.90	0.941
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	56,889	$101,055.94	$99,221.42	0.982
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	424	$110,646.11	$99,689.62	0.901
HCC45	Other Musculoskeletal and Connective Tissue Disorders			219,797	$90,932.46	$89,237.39	0.981
HCC46	Severe Hematological Disorders	Y	Y	5,513	$119,441.15	$119,441.15	1.000
HCC47	Disorders of Immunity	Y	Y	14,351	$112,129.70	$112,129.70	1.000

(continued)

Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	44,683	$105,895.14	$105,895.14	1.000
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			165,137	$86,926.51	$86,095.45	0.990
HCC50	Delirium and Encephalopathy			37,060	$117,821.47	$114,771.11	0.974
HCC51	Dementia With Complications	Y	Y	5,700	$116,485.55	$116,485.55	1.000
HCC52	Dementia Without Complication	Y	Y	21,600	$107,207.70	$107,207.70	1.000
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	3,327	$98,069.37	$95,292.34	0.972
HCC54	Drug/Alcohol Psychosis	Y	Y	3,236	$117,866.92	$119,125.09	1.011
HCC55	Drug/Alcohol Dependence	Y	Y	8,026	$114,083.33	$113,594.47	0.996
HCC56	Drug/Alcohol Abuse, Without Dependence		Y	47,121	$91,498.80	$89,004.80	0.973
HCC57	Schizophrenia	Y	Y	4,281	$105,144.21	$105,144.21	1.000
HCC58	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	23,228	$106,365.80	$106,365.80	1.000
HCC59	Reactive and Unspecified Psychosis			7,730	$108,931.32	$106,766.99	0.980
HCC60	Personality Disorders		Y	470	$118,367.92	$100,334.19	0.848
HCC61	Depression		Y	43,819	$98,022.84	$95,230.98	0.972
HCC62	Anxiety Disorders		Y	3,917	$89,432.09	$87,530.88	0.979
HCC63	Other Psychiatric Disorders		Y	21,276	$91,267.42	$89,860.82	0.985
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	114	$110,920.87	$103,063.22	0.929
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	94	$107,969.13	$94,391.36	0.874
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	179	$87,537.45	$87,720.89	1.002

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Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	1,694	$88,101.84	$90,980.88	1.033
HCC68	Other Developmental Disorders		Y	1,354	$94,007.23	$87,013.36	0.926
HCC69	Attention Deficit Disorder		Y	922	$102,552.64	$95,009.97	0.926
HCC70	Quadriplegia	Y	Y	1,290	$145,600.56	$145,600.56	1.000
HCC71	Paraplegia	Y	Y	1,464	$126,851.45	$126,851.45	1.000
HCC72	Spinal Cord Disorders/Injuries	Y	Y	2,503	$108,724.39	$108,724.39	1.000
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	Y	Y	120	$131,088.53	$121,408.04	0.926
HCC74	Cerebral Palsy	Y	Y	482	$102,572.29	$102,572.29	1.000
HCC75	Polyneuropathy	Y	Y	81,790	$102,494.21	$102,494.21	1.000
HCC76	Muscular Dystrophy	Y	Y	138	$110,084.46	$106,104.73	0.964
HCC77	Multiple Sclerosis	Y	Y	980	$105,391.26	$105,391.26	1.000
HCC78	Parkinson's and Huntington's Diseases	Y	Y	3,762	$107,324.55	$107,324.55	1.000
HCC79	Seizure Disorders and Convulsions	Y	Y	24,526	$106,076.82	$106,076.82	1.000
HCC80	Coma, Brain Compression/Anoxic Damage	Y	Y	2,566	$126,314.74	$126,400.22	1.001
HCC81	Mononeuropathy, Other Neurological Conditions/Injuries		Y	56,039	$99,817.90	$96,730.90	0.969
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	4,272	$141,398.96	$141,398.96	1.000
HCC83	Respiratory Arrest	Y		889	$123,310.05	$123,310.05	1.000
HCC84	Cardio-Respiratory Failure and Shock	Y		53,137	$109,041.09	$109,041.09	1.000
HCC85	Congestive Heart Failure	Y	Y	156,608	$97,253.20	$97,253.20	1.000
HCC86	Acute Myocardial Infarction	Y	Y	19,529	$114,588.99	$114,588.99	1.000
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	19,710	$106,391.08	$106,391.08	1.000
HCC88	Angina Pectoris	Y	Y	12,077	$93,163.77	$93,163.77	1.000

(continued)

Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	106,910	$91,246.69	$88,918.25	0.974
HCC90	Heart Infection/Inflammation, Except Rheumatic			16,317	$104,559.28	$102,631.65	0.982
HCC91	Valvular and Rheumatic Heart Disease		Y	85,187	$96,766.39	$94,708.87	0.979
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	375	$96,763.37	$95,946.23	0.992
HCC93	Other Congenital Heart/Circulatory Disease		Y	2,520	$90,795.46	$91,359.38	1.006
HCC94	Hypertensive Heart Disease		Y	12,175	$78,174.59	$77,088.00	0.986
HCC95	Hypertension		Y	111,470	$73,226.69	$71,941.00	0.982
HCC96	Specified Heart Arrhythmias	Y	Y	84,832	$101,842.39	$101,842.39	1.000
HCC97	Other Heart Rhythm and Conduction Disorders		Y	43,926	$93,870.32	$90,382.51	0.963
HCC98	Other and Unspecified Heart Disease		Y	71,637	$97,794.46	$96,488.93	0.987
HCC99	Cerebral Hemorrhage	Y	Y	4,006	$109,381.14	$112,552.22	1.029
HCC100	Ischemic or Unspecified Stroke	Y	Y	25,593	$107,259.36	$106,770.83	0.995
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	29,755	$93,728.31	$91,843.68	0.980
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	5,308	$100,642.57	$97,535.04	0.969
HCC103	Hemiplegia/Hemiparesis	Y	Y	11,482	$112,562.47	$112,562.47	1.000
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	853	$107,647.76	$107,647.76	1.000
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	12,244	$102,552.63	$99,897.61	0.974
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	Y	Y	19,708	$125,416.57	$125,416.57	1.000
HCC107	Vascular Disease with Complications	Y		19,187	$103,700.14	$103,700.14	1.000
HCC108	Vascular Disease	Y	Y	110,112	$90,637.15	$90,637.15	1.000
HCC109	Other Circulatory Disease			53,737	$79,100.04	$78,628.75	0.994
HCC110	Cystic Fibrosis	Y	Y	88	$159,367.77	$118,967.11	0.746

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Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	74,533	$103,665.22	$103,707.34	1.000
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	4,541	$95,600.54	$95,600.54	1.000
HCC113	Asthma		Y	15,732	$88,011.13	$84,199.71	0.957
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		13,008	$125,089.51	$125,089.51	1.000
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		3,444	$104,630.90	$104,630.90	1.000
HCC116	Viral and Unspecified Pneumonia, Pleurisy			59,924	$101,968.59	$99,672.77	0.977
HCC117	Pleural Effusion/Pneumothorax			32,420	$109,646.70	$106,575.09	0.972
HCC118	Other Respiratory Disorders			103,375	$96,241.60	$94,665.70	0.984
HCC119	Legally Blind		Y	9,513	$99,933.04	$98,466.86	0.985
HCC120	Major Eye Infections/Inflammations			1,579	$100,740.29	$95,438.22	0.947
HCC121	Retinal Detachment			6,596	$87,589.69	$86,935.63	0.993
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	Y	Y	38,898	$86,694.97	$87,277.37	1.007
HCC123	Diabetic and Other Vascular Retinopathies		Y	47,070	$93,537.80	$92,858.64	0.993
HCC124	Exudative Macular Degeneration	Y	Y	3,860	$90,980.99	$90,980.99	1.000
HCC125	Other Retinal Disorders		Y	12,839	$85,738.21	$84,743.12	0.988
HCC126	Glaucoma		Y	42,523	$88,835.74	$87,967.93	0.990
HCC127	Cataract		Y	69,114	$88,256.31	$87,040.58	0.986
HCC128	Other Eye Disorders			94,977	$89,596.62	$88,265.39	0.985
HCC129	Significant Ear, Nose, and Throat Disorders			4,023	$104,976.75	$99,091.95	0.944
HCC130	Hearing Loss		Y	20,032	$96,158.07	$93,162.92	0.969
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			96,914	$90,635.46	$88,875.98	0.981
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End-Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status		Y	.	.	.	.

(continued)

Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC135	Acute Renal Failure			.	.	.	.
HCC136	Chronic Kidney Disease, Stage 5		Y	.	.	.	.
HCC137	Chronic Kidney Disease, Severe (Stage 4)		Y	.	.	.	.
HCC138	Chronic Kidney Disease, Moderate (Stage 3)		Y	.	.	.	.
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1–2 or Unspecified)		Y	.	.	.	.
HCC140	Unspecified Renal Failure		Y	.	.	.	.
HCC141	Nephritis		Y	.	.	.	.
HCC142	Urinary Obstruction and Retention			28,404	$99,199.83	$95,279.38	0.960
HCC143	Urinary Incontinence		Y	10,305	$105,292.63	$98,691.23	0.937
HCC144	Urinary Tract Infection			55,869	$104,020.90	$100,985.51	0.971
HCC145	Other Urinary Tract Disorders			80,248	$95,741.06	$92,095.16	0.962
HCC146	Female Infertility		Y	80	$93,878.71	$92,639.78	0.987
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	5,767	$91,339.73	$89,742.44	0.983
HCC148	Other Female Genital Disorders		Y	14,539	$88,620.00	$88,037.94	0.993
HCC149	Male Genital Disorders		Y	40,275	$91,592.22	$89,414.19	0.976
HCC150	Ectopic and Molar Pregnancy			*			
HCC151	Miscarriage/Terminated Pregnancy			98	$87,116.52	$79,215.25	0.909
HCC152	Completed Pregnancy With Major Complications			189	$89,024.07	$91,675.07	1.030
HCC153	Completed Pregnancy With Complications			90	$78,541.93	$79,730.57	1.015
HCC154	Completed Pregnancy With No or Minor Complications			35	$93,234.22	$90,072.91	0.966
HCC155	Uncompleted Pregnancy With Complications			108	$121,564.32	$98,892.99	0.814
HCC156	Uncompleted Pregnancy With No or Minor Complications			135	$93,705.42	$92,137.83	0.983
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	Y	Y	2,780	$149,826.81	$149,826.81	1.000

(continued)

Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	6,261	$133,070.31	$133,070.31	1.000
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss	Y	Y	4,924	$126,461.11	$126,461.11	1.000
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage	Y	Y	9,219	$120,459.04	$120,459.04	1.000
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	23,608	$98,315.18	$98,315.18	1.000
HCC162	Severe Skin Burn or Condition	Y		205	$109,266.06	$115,465.01	1.057
HCC163	Moderate Skin Burn or Condition			409	$114,395.59	$107,451.37	0.939
HCC164	Cellulitis, Local Skin Infection			67,927	$106,076.37	$101,588.59	0.958
HCC165	Other Dermatological Disorders			117,461	$94,154.06	$91,756.41	0.975
HCC166	Severe Head Injury	Y		56	$120,853.89	$116,989.87	0.968
HCC167	Major Head Injury	Y		3,236	$108,632.81	$108,632.81	1.000
HCC168	Concussion or Unspecified Head Injury			9,165	$106,504.18	$100,331.36	0.942
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		4,242	$105,491.29	$105,491.29	1.000
HCC170	Hip Fracture/Dislocation	Y		7,799	$106,862.51	$106,862.51	1.000
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			8,474	$103,807.51	$98,877.20	0.953
HCC172	Internal Injuries			3,927	$109,924.93	$108,596.34	0.988
HCC173	Traumatic Amputations and Complications	Y		7,691	$121,525.45	$121,525.45	1.000
HCC174	Other Injuries			113,795	$98,751.11	$95,532.88	0.967
HCC175	Poisonings and Allergic and Inflammatory Reactions			39,689	$109,153.36	$105,096.96	0.963
HCC176	Complications of Specified Implanted Device or Graft	Y		85,428	$92,089.82	$93,678.32	1.017
HCC177	Other Complications of Medical Care			115,199	$94,179.89	$94,691.01	1.005
HCC178	Major Symptoms, Abnormalities			243,319	$89,901.96	$88,922.41	0.989
HCC179	Minor Symptoms, Signs, Findings			36,096	$66,804.32	$67,770.82	1.014

(continued)

Table 5-51a (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	*			
HCC181	Premature Newborns, Including Birthweight 1000–1499 Grams		Y	.	.	.	.
HCC182	Serious Perinatal Problem Affecting Newborn		Y	210	$116,448.14	$102,225.35	0.878
HCC183	Other Perinatal Problems Affecting Newborn			213	$99,891.91	$99,936.60	1.000
HCC184	Term or Post-Term Singleton Newborn, Normal or High Birthweight		Y	.	.	.	.
HCC185	Major Organ Transplant (procedure)		Y	.	.	.	.
HCC186	Major Organ Transplant or Replacement Status	Y	Y	4,840	$106,992.88	$106,992.88	1.000
HCC187	Other Organ Transplant Status/Replacement		Y	9,030	$83,122.85	$82,188.62	0.989
HCC188	Artificial Openings for Feeding or Elimination	Y	Y	9,325	$118,212.40	$118,212.40	1.000
HCC189	Amputation Status, Lower Limb/Amputation Complications	Y	Y	15,041	$102,428.83	$102,428.83	1.000
HCC190	Amputation Status, Upper Limb			1,007	$110,718.60	$101,855.57	0.920
HCC191	Post-Surgical States/Aftercare/Elective			221,586	$90,463.79	$90,027.44	0.995
HCC192	Radiation Therapy			1,430	$92,363.98	$93,988.78	1.018
HCC193	Chemotherapy			3,480	$117,492.12	$100,854.91	0.858
HCC194	Rehabilitation			25,198	$103,132.74	$104,466.15	1.013
HCC195	Screening/Observation/Special Exams			179,888	$88,921.28	$87,524.56	0.984
HCC196	History of Disease			190,819	$93,143.40	$92,296.33	0.991
HCC197	Supplemental Oxygen			14,030	$115,012.23	$110,577.87	0.961
HCC198	CPAP/IPPB/Nebulizers			.	.	.	.
HCC199	Patient Lifts, Power Operated Vehicles, Beds			1,845	$154,807.56	$133,185.88	0.860
HCC200	Wheelchairs, Commodes			3,624	$119,338.58	$114,358.23	0.958
HCC201	Walkers			.	.	.	.

1. An asterisk * indicates data suppressed because cell count less than or equal to 30.

2. Kidney disease group omitted because renal HCCs 132–141 are excluded from the dialysis model.
3. Other HCCs with missing data have a count of 0 or are not populated because they correspond to procedures or durable medical equipment.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) 100% ESRD sample claims and enrollment data.

Table 5-51b
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				324,468	$89,881.72	$89,881.72	1.000
HCC1	HIV/AIDS	Y	Y	5,141	$103,031.63	$103,031.63	1.000
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		54,506	$123,975.47	$123,975.47	1.000
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			1,909	$127,687.24	$124,442.43	0.975
HCC4	Viral and Late Effects Central Nervous System Infections			783	$118,213.61	$114,676.05	0.970
HCC5	Tuberculosis			671	$106,449.66	$107,402.96	1.009
HCC6	Opportunistic Infections	Y		3,907	$129,006.83	$129,006.83	1.000
HCC7	Other Infectious Diseases			128,068	$107,278.83	$104,650.27	0.975
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	4,471	$128,678.89	$128,678.89	1.000
HCC9	Lung and Other Severe Cancers	Y	Y	6,757	$113,617.69	$113,617.69	1.000
HCC10	Lymphoma and Other Cancers	Y	Y	3,766	$108,860.32	$108,860.32	1.000
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	10,736	$97,152.54	$97,152.54	1.000
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	13,351	$94,483.46	$94,483.46	1.000
HCC13	Other Respiratory and Heart Neoplasms			575	$107,033.83	$104,792.56	0.979
HCC14	Other Digestive and Urinary Neoplasms			22,917	$95,491.87	$93,978.12	0.984
HCC15	Other Neoplasms			16,286	$94,061.10	$91,274.37	0.970
HCC16	Benign Neoplasms of Skin, Breast, Eye			13,131	$95,423.26	$92,191.68	0.966
HCC17	Diabetes with Acute Complications	Y	Y	8,898	$126,174.06	$115,290.32	0.914
HCC18	Diabetes with Chronic Complications	Y	Y	198,034	$96,714.12	$97,169.43	1.005
HCC19	Diabetes without Complication	Y	Y	8,428	$84,873.87	$85,126.87	1.003
HCC20	Type I Diabetes Mellitus		Y	40,897	$108,536.81	$104,753.28	0.965
HCC21	Protein-Calorie Malnutrition	Y		28,885	$128,002.21	$128,002.21	1.000
HCC22	Morbid Obesity	Y	Y	49,679	$106,888.11	$106,888.11	1.000
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	118,890	$102,556.58	$102,556.58	1.000

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			167,957	$106,859.86	$104,241.46	0.975
HCC25	Disorders of Lipoid Metabolism		Y	217,416	$97,383.02	$96,526.69	0.991
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	168,301	$102,320.40	$100,483.62	0.982
HCC27	End-Stage Liver Disease	Y	Y	7,384	$128,825.68	$128,825.68	1.000
HCC28	Cirrhosis of Liver	Y	Y	7,539	$111,161.75	$111,161.75	1.000
HCC29	Chronic Hepatitis	Y	Y	7,669	$105,741.41	$105,741.41	1.000
HCC30	Acute Liver Failure/Disease			1,689	$130,936.13	$130,753.55	0.999
HCC31	Other Hepatitis and Liver Disease		Y	10,951	$107,976.20	$103,179.22	0.956
HCC32	Gallbladder and Biliary Tract Disorders			9,177	$114,376.35	$111,424.19	0.974
HCC33	Intestinal Obstruction/Perforation	Y		18,246	$116,245.42	$116,245.42	1.000
HCC34	Chronic Pancreatitis	Y	Y	3,687	$123,715.02	$123,715.02	1.000
HCC35	Inflammatory Bowel Disease	Y	Y	4,142	$109,423.54	$109,423.54	1.000
HCC36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			66,101	$113,223.30	$109,159.88	0.964
HCC37	Appendicitis			873	$99,671.06	$102,812.70	1.032
HCC38	Other Gastrointestinal Disorders			201,073	$100,340.77	$98,938.36	0.986
HCC39	Bone/Joint/Muscle Infections/Necrosis	Y		22,588	$130,715.67	$130,715.67	1.000
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	Y	Y	24,779	$103,582.65	$103,582.65	1.000
HCC41	Disorders of the Vertebrae and Spinal Discs		Y	45,094	$106,943.12	$101,679.38	0.951
HCC42	Osteoarthritis of Hip or Knee		Y	29,762	$104,301.51	$97,673.91	0.936
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	58,902	$109,672.35	$105,617.96	0.963
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	585	$124,188.32	$113,697.52	0.916
HCC45	Other Musculoskeletal and Connective Tissue Disorders			221,926	$99,066.52	$96,869.14	0.978
HCC46	Severe Hematological Disorders	Y	Y	5,400	$134,603.54	$134,603.54	1.000
HCC47	Disorders of Immunity	Y	Y	18,431	$119,880.20	$119,880.20	1.000

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	49,735	$114,192.62	$114,192.62	1.000
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			168,139	$93,653.61	$92,543.31	0.988
HCC50	Delirium and Encephalopathy			46,095	$125,756.64	$121,704.61	0.968
HCC51	Dementia With Complications	Y	Y	5,385	$120,879.47	$119,227.74	0.986
HCC52	Dementia Without Complication	Y	Y	18,838	$112,297.11	$112,750.98	1.004
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	5,809	$104,734.10	$102,188.08	0.976
HCC54	Substance Use with Psychotic Complications	Y	Y	436	$115,706.56	$127,373.25	1.101
HCC55	Substance Use Disorder, Moderate/Severe, or Substance Use with Complications	Y	Y	14,395	$122,358.95	$122,032.78	0.997
HCC56	Substance Use Disorder, Mild, Except Alcohol and Cannabis	Y	Y	2,595	$117,185.71	$117,098.01	0.999
HCC57	Schizophrenia	Y	Y	4,465	$113,984.17	$114,194.55	1.002
HCC58	Reactive and Unspecified Psychosis	Y		1,728	$127,133.01	$126,564.74	0.996
HCC59	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	36,389	$111,367.02	$111,384.90	1.000
HCC60	Personality Disorders	Y	Y	303	$116,811.63	$114,711.77	0.982
HCC61	Depression		Y	40,233	$105,227.07	$102,794.50	0.977
HCC62	Anxiety Disorders		Y	7,958	$98,480.80	$96,142.99	0.976
HCC63	Other Psychiatric Disorders		Y	24,186	$100,078.85	$97,328.67	0.973
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	92	$106,734.23	$105,637.25	0.990
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	86	$87,708.39	$107,137.81	1.222
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	202	$89,927.36	$101,554.18	1.129

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	1,717	$99,008.44	$100,054.23	1.011
HCC68	Other Developmental Disorders		Y	2,027	$103,721.97	$101,785.65	0.981
HCC69	Attention Deficit Disorder		Y	704	$107,090.00	$102,689.66	0.959
HCC70	Quadriplegia	Y	Y	1,786	$150,764.34	$150,764.34	1.000
HCC71	Paraplegia	Y	Y	1,731	$133,449.04	$133,449.04	1.000
HCC72	Spinal Cord Disorders/Injuries	Y	Y	2,824	$116,116.75	$116,116.75	1.000
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	Y	Y	92	$128,550.90	$128,550.90	1.000
HCC74	Cerebral Palsy	Y	Y	572	$110,528.73	$110,528.73	1.000
HCC75	Myasthenia Gravis/Myoneural Disorders and Guillain-Barre Syndrome/Inflammatory and Toxic Neuropathy	Y	Y	5,103	$116,491.83	$116,491.83	1.000
HCC76	Muscular Dystrophy	Y	Y	145	$118,194.74	$118,194.74	1.000
HCC77	Multiple Sclerosis	Y	Y	1,022	$119,247.88	$119,247.88	1.000
HCC78	Parkinson's and Huntington's Diseases	Y	Y	4,082	$115,155.84	$115,155.84	1.000
HCC79	Seizure Disorders and Convulsions	Y	Y	23,459	$114,570.08	$114,570.08	1.000
HCC80	Coma, Brain Compression/Anoxic Damage	Y	Y	4,133	$135,042.76	$134,979.07	1.000
HCC81	Mononeuropathy, Other Neurological Conditions/Injuries		Y	145,535	$104,858.04	$102,338.50	0.976
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	5,563	$144,831.62	$144,831.62	1.000
HCC83	Respiratory Arrest	Y		621	$130,289.69	$130,289.69	1.000
HCC84	Cardio-Respiratory Failure and Shock	Y		66,078	$116,139.19	$116,139.19	1.000
HCC85	Congestive Heart Failure	Y	Y	167,039	$104,151.77	$104,151.77	1.000
HCC86	Acute Myocardial Infarction	Y	Y	30,873	$122,198.99	$122,198.99	1.000
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	15,401	$114,526.87	$114,526.87	1.000
HCC88	Angina Pectoris	Y	Y	17,313	$99,611.38	$99,611.38	1.000

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	93,233	$97,226.50	$94,659.15	0.974
HCC90	Heart Infection/Inflammation, Except Rheumatic			18,950	$114,415.51	$111,667.48	0.976
HCC91	Valvular and Rheumatic Heart Disease		Y	89,927	$104,381.52	$102,219.94	0.979
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	305	$111,532.91	$105,800.96	0.949
HCC93	Other Congenital Heart/Circulatory Disease		Y	2,100	$106,150.70	$101,343.03	0.955
HCC94	Hypertensive Heart Disease		Y	14,124	$87,533.17	$85,764.54	0.980
HCC95	Hypertension		Y	104,600	$79,472.51	$78,164.45	0.984
HCC96	Specified Heart Arrhythmias	Y	Y	89,609	$108,303.78	$108,303.78	1.000
HCC97	Other Heart Rhythm and Conduction Disorders		Y	29,662	$102,880.53	$98,141.00	0.954
HCC98	Other and Unspecified Heart Disease		Y	62,040	$106,740.26	$105,104.05	0.985
HCC99	Intracranial Hemorrhage	Y	Y	4,800	$119,138.97	$119,643.82	1.004
HCC100	Ischemic or Unspecified Stroke	Y	Y	24,312	$114,014.77	$113,917.14	0.999
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	22,874	$101,838.42	$98,876.94	0.971
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	5,658	$108,361.77	$103,541.94	0.956
HCC103	Hemiplegia/Hemiparesis	Y	Y	16,539	$117,096.99	$117,096.99	1.000
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	1,236	$113,028.00	$113,028.00	1.000
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	7,843	$111,253.40	$108,039.00	0.971
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	Y	Y	21,451	$136,531.75	$136,531.75	1.000
HCC107	Vascular Disease with Complications	Y		15,462	$116,135.02	$116,135.02	1.000
HCC108	Vascular Disease	Y	Y	115,240	$98,337.97	$98,337.97	1.000
HCC109	Other Circulatory Disease			53,295	$88,296.20	$86,091.73	0.975
HCC110	Cystic Fibrosis	Y	Y	88	$178,596.44	$178,596.44	1.000

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	73,519	$110,341.03	$110,384.34	1.000
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	3,874	$106,135.68	$105,342.15	0.993
HCC113	Asthma		Y	18,185	$96,740.34	$93,340.05	0.965
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		14,273	$134,827.65	$134,827.65	1.000
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		13,547	$112,308.19	$112,308.19	1.000
HCC116	Viral and Unspecified Pneumonia, Pleurisy			47,290	$111,025.39	$107,882.32	0.972
HCC117	Pleural Effusion/Pneumothorax			34,373	$117,554.57	$114,526.87	0.974
HCC118	Other Respiratory Disorders			115,452	$103,697.43	$102,062.53	0.984
HCC119	Legally Blind		Y	7,037	$109,307.60	$107,358.25	0.982
HCC120	Major Eye Infections/Inflammations			1,596	$105,833.84	$103,911.79	0.982
HCC121	Retinal Detachment			8,381	$94,647.08	$95,024.13	1.004
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	Y	Y	43,801	$95,334.91	$95,334.91	1.000
HCC123	Diabetic and Other Vascular Retinopathies		Y	50,744	$100,490.13	$98,369.39	0.979
HCC124	Exudative Macular Degeneration	Y	Y	3,652	$97,279.64	$97,279.64	1.000
HCC125	Other Retinal Disorders		Y	13,159	$91,799.20	$90,552.18	0.986
HCC126	Glaucoma		Y	46,143	$96,699.18	$94,824.99	0.981
HCC127	Cataract		Y	73,363	$95,733.74	$94,142.28	0.983
HCC128	Other Eye Disorders			108,775	$97,710.15	$95,736.53	0.980
HCC129	Significant Ear, Nose, and Throat Disorders			4,059	$115,040.76	$107,908.00	0.938
HCC130	Hearing Loss		Y	23,228	$102,843.57	$100,064.57	0.973
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			105,815	$98,712.62	$96,545.55	0.978
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End-Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status		Y	.	.	.	.
HCC135	Acute Renal Failure			.	.	.	.

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC136	Chronic Kidney Disease, Stage 5		Y	.	.	.	.
HCC137	Chronic Kidney Disease, Severe (Stage 4)		Y	.	.	.	.
HCC138	Chronic Kidney Disease, Moderate (Stage 3)		Y	.	.	.	.
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1–2 or Unspecified)		Y	.	.	.	.
HCC140	Unspecified Renal Failure		Y	.	.	.	.
HCC141	Nephritis		Y	.	.	.	.
HCC142	Urinary Obstruction and Retention			32,514	$105,054.04	$102,230.28	0.973
HCC143	Urinary Incontinence		Y	12,873	$110,838.80	$105,660.79	0.953
HCC144	Urinary Tract Infection			54,258	$110,051.13	$107,581.32	0.978
HCC145	Other Urinary Tract Disorders			71,484	$102,181.58	$99,169.99	0.971
HCC146	Female Infertility		Y	36	$110,234.29	$101,172.66	0.918
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	5,607	$102,572.70	$100,066.86	0.976
HCC148	Other Female Genital Disorders		Y	13,005	$99,059.05	$98,652.93	0.996
HCC149	Male Genital Disorders		Y	46,591	$98,998.72	$97,045.13	0.980
HCC150	Ectopic and Molar Pregnancy			*	$101,121.77	$102,240.69	1.011
HCC151	Miscarriage/Terminated Pregnancy			92	$83,980.10	$90,481.22	1.077
HCC152	Completed Pregnancy With Major Complications			91	$128,762.05	$107,013.95	0.831
HCC153	Completed Pregnancy With Complications			41	$91,270.04	$91,423.25	1.002
HCC154	Completed Pregnancy With No or Minor Complications			80	$103,228.06	$101,750.70	0.986
HCC155	Uncompleted Pregnancy With Complications			83	$110,880.60	$105,180.17	0.949
HCC156	Uncompleted Pregnancy With No or Minor Complications			140	$121,258.65	$105,595.44	0.871
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	Y	Y	3,617	$155,591.25	$155,591.25	1.000

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	9,789	$139,760.20	$139,760.20	1.000
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss	Y	Y	6,119	$127,370.44	$128,606.89	1.010
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage		Y	5,846	$122,625.04	$115,235.79	0.940
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	25,928	$108,339.18	$108,065.93	0.997
HCC162	Severe Skin Burn or Condition	Y		226	$130,846.21	$130,846.21	1.000
HCC163	Moderate Skin Burn or Condition			401	$120,139.05	$116,960.44	0.974
HCC164	Cellulitis, Local Skin Infection			65,509	$116,704.74	$111,327.93	0.954
HCC165	Other Dermatological Disorders			126,337	$102,748.31	$99,786.17	0.971
HCC166	Severe Head Injury	Y		34	$122,373.03	$129,275.60	1.056
HCC167	Major Head Injury	Y		3,936	$118,026.82	$118,026.82	1.000
HCC168	Concussion or Unspecified Head Injury			11,044	$113,756.66	$106,607.85	0.937
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		4,537	$118,050.31	$118,050.31	1.000
HCC170	Hip Fracture/Dislocation	Y		6,732	$116,371.90	$116,371.90	1.000
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			7,504	$112,081.81	$106,686.39	0.952
HCC172	Internal Injuries			2,969	$117,510.89	$117,036.56	0.996
HCC173	Traumatic Amputations and Complications	Y		2,916	$132,351.96	$132,351.96	1.000
HCC174	Other Injuries			99,422	$109,175.21	$104,799.66	0.960
HCC175	Poisonings and Allergic and Inflammatory Reactions			39,187	$118,672.17	$112,983.66	0.952
HCC176	Complications of Specified Implanted Device or Graft	Y		153,354	$95,230.40	$96,008.59	1.008
HCC177	Other Complications of Medical Care			63,134	$112,048.73	$109,557.00	0.978
HCC178	Major Symptoms, Abnormalities			254,083	$97,347.85	$96,133.14	0.988
HCC179	Minor Symptoms, Signs, Findings			35,524	$70,475.51	$73,295.58	1.040

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	.	.	.	.
HCC181	Premature Newborns, Including Birthweight 1000–1499 Grams		Y	.	.	.	.
HCC182	Serious Perinatal Problem Affecting Newborn		Y	440	$141,054.05	$123,523.45	0.876
HCC183	Other Perinatal Problems Affecting Newborn			711	$117,889.26	$109,001.08	0.925
HCC184	Term or Post-Term Singleton Newborn, Normal or High Birthweight		Y	.	.	.	.
HCC185	Major Organ Transplant (procedure)		Y	.	.	.	.
HCC186	Major Organ Transplant or Replacement Status	Y	Y	5,566	$118,635.49	$118,635.49	1.000
HCC187	Other Organ Transplant Status/Replacement		Y	33,987	$104,908.65	$101,971.50	0.972
HCC188	Artificial Openings for Feeding or Elimination	Y	Y	9,844	$126,024.22	$126,024.22	1.000
HCC189	Amputation Status, Lower Limb/Amputation Complications	Y	Y	17,940	$108,693.39	$108,693.39	1.000
HCC190	Amputation Status, Upper Limb			1,582	$114,258.18	$109,218.64	0.956
HCC191	Post-Surgical States/Aftercare/Elective			256,564	$96,493.03	$95,866.23	0.994
HCC192	Radiation Therapy			1,190	$115,951.23	$106,178.19	0.916
HCC193	Chemotherapy			10,093	$109,651.17	$99,797.90	0.910
HCC194	Rehabilitation			.	.	.	.
HCC195	Screening/Observation/Special Exams			192,297	$95,843.06	$94,642.88	0.987
HCC196	History of Disease			226,076	$99,039.53	$98,075.22	0.990
HCC197	Supplemental Oxygen			20,268	$121,752.34	$118,455.63	0.973
HCC198	CPAP/IPPB/Nebulizers			.	.	.	.
HCC199	Patient Lifts, Power Operated Vehicles, Beds			3,059	$152,406.72	$138,551.71	0.909
HCC200	Wheelchairs, Commodes			7,246	$125,090.91	$121,198.30	0.969
HCC201	Walkers			6,459	$122,536.08	$118,132.23	0.964

(continued)

Table 5-51b (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC202	Drug Use, Uncomplicated, Except Cannabis			1,528	$115,365.46	$104,500.55	0.906
HCC203	Alcohol/Cannabis Use or Use Disorder, Mild or Uncomplicated; Non-Psychoactive Substance		Y	43,690	$99,019.25	$96,864.76	0.978
HCC204	Abuse; Nicotine Dependence			138,396	$104,361.40	$102,536.95	0.983

1. An asterisk * indicates data suppressed because cell count less than or equal to 30.
2. Kidney disease group omitted because renal HCCs 132–141 are excluded from the dialysis model.
3. Other HCCs with missing data have a count of 0 or are not populated because they correspond to procedures or durable medical equipment.
SOURCE: RTI International analysis of Medicare 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-52
Predictive ratios for all body systems/disease groups: All dialysis continuing enrollees

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	325,235	$81,944.86	$81,944.86	1.000
Infection	56,018	$112,276.28	$112,356.53	1.001
Neoplasm	37,296	$95,462.78	$95,462.78	1.000
Diabetes	205,682	$90,348.58	$90,348.58	1.000
Metabolic	133,499	$95,882.26	$95,666.02	0.998
Liver	19,852	$105,427.09	$105,427.09	1.000
Gastrointestinal	24,971	$105,705.41	$105,632.67	0.999
Musculoskeletal	40,314	$106,279.91	$106,449.14	1.002
Blood	56,730	$106,548.11	$106,518.38	1.000
Cognitive	27,300	$109,106.31	$109,106.31	1.000
Substance Use	11,262	$115,142.06	$115,142.06	1.000
Psychiatric	27,509	$106,172.37	$106,172.37	1.000
Spinal	5,257	$122,419.85	$122,419.85	1.000
Neurological	100,563	$101,536.72	$101,530.78	1.000
Arrest	58,298	$111,488.77	$111,488.77	1.000
Heart	185,074	$95,002.84	$95,234.29	1.002
Cerebrovascular Disease	34,063	$107,069.58	$106,981.54	0.999
Vascular	149,007	$96,687.79	$96,687.79	1.000
Lung	86,463	$103,689.33	$103,851.68	1.002
Eye	42,036	$86,994.17	$87,522.73	1.006
Kidney	.	.	.	.
Skin	46,925	$112,493.79	$112,490.20	1.000
Injury	21,271	$111,145.98	$111,012.58	0.999
Complications	85,428	$92,089.82	$93,678.32	1.017
Transplant	4,840	$106,992.88	$106,992.88	1.000
Openings	9,325	$118,212.40	$118,212.40	1.000
Amputation	15,041	$102,428.83	$102,428.83	1.000

(continued)

Table 5-52 (continued)
Predictive ratios for all body systems/disease groups: All dialysis continuing enrollees

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2023 ESRD Model				
Entire sample	324,468	$89,881.72	$89,881.72	1.000
Infection	60,276	$121,082.13	$121,394.08	1.003
Neoplasm	39,081	$103,347.08	$103,347.08	1.000
Diabetes	215,360	$97,425.42	$97,425.42	1.000
Metabolic	155,732	$103,264.37	$103,076.66	0.998
Liver	22,592	$114,589.70	$114,589.70	1.000
Gastrointestinal	24,562	$115,069.81	$115,133.78	1.001
Musculoskeletal	44,950	$115,326.29	$115,350.41	1.000
Blood	63,937	$114,678.57	$114,887.34	1.002
Cognitive	24,223	$114,147.09	$114,147.09	1.000
Substance Use	17,426	$121,395.03	$121,395.03	1.000
Psychiatric	42,885	$112,295.14	$112,295.14	1.000
Spinal	6,341	$129,887.13	$129,887.13	1.000
Neurological	34,926	$114,931.81	$114,923.40	1.000
Arrest	72,262	$118,364.72	$118,364.72	1.000
Heart	196,214	$101,802.68	$101,818.14	1.000
Cerebrovascular Disease	36,539	$114,140.88	$113,828.06	0.997
Vascular	152,153	$105,226.82	$105,226.82	1.000
Lung	91,482	$110,820.24	$110,943.37	1.001
Eye	46,910	$95,400.32	$95,411.85	1.000
Kidney	.	.	.	.
Skin	45,600	$120,698.63	$120,669.63	1.000
Injury	16,689	$119,360.45	$118,787.22	0.995
Complications	153,354	$95,230.40	$96,008.59	1.008
Transplant	5,566	$118,635.49	$118,635.49	1.000
Openings	9,844	$126,024.22	$126,024.22	1.000
Amputation	17,940	$108,693.39	$108,693.39	1.000

NOTE:
1. Kidney disease group omitted because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-53
Predictive ratios by count of chronic conditions: All dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	325,235	$81,944.86	$81,944.86	1.000
0 chronic eligible HCCs	14,562	$40,813.15	$47,213.09	1.157
1–3 chronic eligible HCCs	36,342	$53,745.17	$55,108.21	1.025
4–6 chronic eligible HCCs	63,706	$64,982.53	$65,359.49	1.006
7–9 chronic eligible HCCs	75,389	$77,547.83	$77,603.63	1.001
10+ chronic eligible HCCs	135,236	$106,038.87	$104,680.41	0.987
2023 ESRD Model				
Entire sample	324,468	$89,881.72	$89,881.72	1.000
0 chronic eligible HCCs	11,783	$45,177.10	$53,044.06	1.174
1–3 chronic eligible HCCs	30,082	$59,554.92	$61,090.49	1.026
4–6 chronic eligible HCCs	56,454	$69,258.66	$70,589.79	1.019
7–9 chronic eligible HCCs	73,687	$81,374.26	$82,191.17	1.010
10+ chronic eligible HCCs	152,462	$112,449.12	$110,540.63	0.983

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-54
Predictive ratios by count of chronic conditions: Aged dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	170,485	$86,661.90	$86,661.90	1.000
0 chronic eligible HCCs	4,935	$41,387.19	$51,136.56	1.236
1–3 chronic eligible HCCs	12,780	$59,158.92	$59,434.93	1.005
4–6 chronic eligible HCCs	30,792	$69,398.26	$68,512.02	0.987
7–9 chronic eligible HCCs	42,169	$80,250.48	$79,809.24	0.995
10+ chronic eligible HCCs	79,809	$105,083.20	$105,007.36	0.999
2023 ESRD Model				
Entire sample	176,688	$91,338.54	$91,338.54	1.000
0 chronic eligible HCCs	4,621	$40,079.66	$52,988.45	1.322
1–3 chronic eligible HCCs	10,813	$59,904.97	$61,432.72	1.026
4–6 chronic eligible HCCs	27,034	$70,629.32	$70,223.40	0.994
7–9 chronic eligible HCCs	41,512	$81,338.14	$81,327.01	1.000
10+ chronic eligible HCCs	92,708	$109,134.91	$108,400.94	0.993

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-55
Predictive ratios by count of chronic conditions: Non-aged dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	154,750	$77,213.11	$77,213.11	1.000
0 chronic eligible HCCs	9,627	$40,541.72	$45,357.94	1.119
1–3 chronic eligible HCCs	23,562	$50,971.06	$52,891.11	1.038
4–6 chronic eligible HCCs	32,914	$61,166.65	$62,635.22	1.024
7–9 chronic eligible HCCs	33,220	$74,415.39	$75,047.27	1.008
10+ chronic eligible HCCs	55,427	$107,288.18	$104,253.00	0.972
2023 ESRD Model				
Entire sample	147,780	$88,269.95	$88,269.95	1.000
0 chronic eligible HCCs	7,162	$48,245.51	$53,077.53	1.100
1–3 chronic eligible HCCs	19,269	$59,366.39	$60,906.16	1.026
4–6 chronic eligible HCCs	29,420	$68,078.33	$70,905.30	1.042
7–9 chronic eligible HCCs	32,175	$81,417.84	$83,233.82	1.022
10+ chronic eligible HCCs	59,754	$117,189.38	$113,601.01	0.969

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-56
Predictive ratios by count of chronic conditions: Any Medicaid dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	160,672	$86,768.99	$86,768.99	1.000
0 chronic eligible HCCs	5,592	$47,269.19	$50,945.33	1.078
1–3 chronic eligible HCCs	17,841	$55,476.06	$57,980.95	1.045
4–6 chronic eligible HCCs	30,665	$66,304.38	$68,399.39	1.032
7–9 chronic eligible HCCs	36,371	$79,899.79	$80,936.20	1.013
10+ chronic eligible HCCs	70,203	$112,123.14	$109,571.29	0.977
2023 ESRD Model				
Entire sample	159,111	$95,778.17	$95,243.97	0.994
0 chronic eligible HCCs	4,371	$54,367.02	$56,224.34	1.034
1–3 chronic eligible HCCs	14,240	$62,014.55	$63,809.20	1.029
4–6 chronic eligible HCCs	27,236	$71,531.88	$73,691.18	1.030
7–9 chronic eligible HCCs	35,032	$84,556.99	$85,998.98	1.017
10+ chronic eligible HCCs	78,232	$119,227.73	$116,157.36	0.974

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-57
Predictive ratios by count of chronic conditions: Non-Medicaid dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	164,563	$76,933.93	$76,933.93	1.000
0 chronic eligible HCCs	8,970	$36,506.23	$44,723.26	1.225
1–3 chronic eligible HCCs	18,501	$51,972.38	$52,165.93	1.004
4–6 chronic eligible HCCs	33,041	$63,675.43	$62,353.52	0.979
7–9 chronic eligible HCCs	39,018	$75,205.59	$74,284.82	0.988
10+ chronic eligible HCCs	65,033	$99,025.91	$99,042.99	1.000
2023 ESRD Model				
Entire sample	165,357	$83,860.86	$84,406.33	1.007
0 chronic eligible HCCs	7,412	$39,336.07	$51,022.70	1.297
1–3 chronic eligible HCCs	15,842	$57,200.37	$58,487.92	1.023
4–6 chronic eligible HCCs	29,218	$67,006.55	$67,517.19	1.008
7–9 chronic eligible HCCs	38,655	$78,305.50	$78,519.70	1.003
10+ chronic eligible HCCs	74,230	$104,853.51	$104,246.95	0.994

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-58
Predictive ratios by count of chronic conditions: Full benefit dual dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	125,271	$91,345.35	$88,750.62	0.972
0 chronic eligible HCCs	3,885	$49,853.97	$51,011.10	1.023
1–3 chronic eligible HCCs	12,770	$57,923.88	$58,250.10	1.006
4–6 chronic eligible HCCs	22,725	$69,221.76	$68,886.38	0.995
7–9 chronic eligible HCCs	28,050	$82,967.83	$81,487.53	0.982
10+ chronic eligible HCCs	57,841	$115,982.47	$110,893.01	0.956
2023 ESRD Model				
Entire sample	123,576	$100,133.55	$98,692.41	0.986
0 chronic eligible HCCs	3,008	$57,649.75	$58,379.51	1.013
1–3 chronic eligible HCCs	10,204	$64,248.80	$65,866.91	1.025
4–6 chronic eligible HCCs	19,985	$74,039.62	$75,709.07	1.023
7–9 chronic eligible HCCs	26,490	$87,268.88	$88,045.69	1.009
10+ chronic eligible HCCs	63,889	$122,782.04	$118,699.20	0.967

NOTE:

1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-59
Predictive ratios by count of chronic conditions: Partial benefit dual dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	43,918	$76,371.00	$81,615.43	1.069
0 chronic eligible HCCs	1,964	$43,296.81	$50,816.22	1.174
1–3 chronic eligible HCCs	5,915	$51,592.71	$57,356.53	1.112
4–6 chronic eligible HCCs	9,498	$60,769.86	$67,177.75	1.105
7–9 chronic eligible HCCs	10,249	$73,325.56	$79,430.80	1.083
10+ chronic eligible HCCs	16,292	$101,719.02	$105,202.86	1.034
2023 ESRD Model				
Entire sample	44,932	$85,950.55	$85,895.71	0.999
0 chronic eligible HCCs	1,604	$49,331.13	$52,164.58	1.057
1–3 chronic eligible HCCs	4,814	$57,612.65	$59,392.21	1.031
4–6 chronic eligible HCCs	8,883	$66,866.34	$68,896.09	1.030
7–9 chronic eligible HCCs	10,562	$79,133.54	$80,640.05	1.019
10+ chronic eligible HCCs	19,069	$110,255.44	$107,514.45	0.975

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-60
Predictive ratios by count of chronic conditions: Non-dual dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	189,315	$80,422.33	$78,378.47	0.975
0 chronic eligible HCCs	10,134	$39,078.49	$45,479.50	1.164
1–3 chronic eligible HCCs	21,192	$53,739.49	$52,919.13	0.985
4–6 chronic eligible HCCs	37,623	$65,476.02	$63,087.10	0.964
7–9 chronic eligible HCCs	44,363	$77,509.34	$75,184.31	0.970
10+ chronic eligible HCCs	76,003	$104,151.71	$100,882.32	0.969
2023 ESRD Model				
Entire sample	189,692	$87,185.59	$85,499.27	0.981
0 chronic eligible HCCs	8,339	$42,064.28	$51,411.58	1.222
1–3 chronic eligible HCCs	18,207	$58,969.86	$58,845.58	0.998
4–6 chronic eligible HCCs	33,445	$68,587.31	$67,993.36	0.991
7–9 chronic eligible HCCs	43,909	$80,622.82	$79,201.51	0.982
10+ chronic eligible HCCs	85,792	$109,566.48	$105,791.33	0.966

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-61
Predictive ratios by count of payment conditions: Aged dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	170,485	$86,661.90	$86,661.90	1.000
0 payment HCCs	9,527	$50,448.70	$51,912.27	1.029
1–3 payment HCCs	50,060	$68,475.85	$65,721.51	0.960
4–6 payment HCCs	52,713	$83,644.53	$83,609.96	1.000
7–9 payment HCCs	33,886	$101,457.17	$103,169.57	1.017
10+ payment HCCs	24,299	$129,704.19	$132,940.51	1.025
2023 ESRD Model				
Entire sample	176,688	$91,338.54	$91,338.54	1.000
0 payment HCCs	7,324	$47,863.78	$53,532.14	1.118
1–3 payment HCCs	45,794	$69,974.05	$66,695.19	0.953
4–6 payment HCCs	56,126	$85,515.05	$84,830.55	0.992
7–9 payment HCCs	39,074	$103,711.97	$106,049.68	1.023
10+ payment HCCs	28,370	$136,048.57	$138,332.75	1.017

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-62
Predictive ratios by count of payment conditions: Non-aged dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	154,750	$77,213.11	$77,213.11	1.000
0 payment HCCs	16,818	$43,464.18	$45,678.84	1.051
1–3 payment HCCs	52,007	$57,874.50	$58,297.76	1.007
4–6 payment HCCs	41,194	$76,683.22	$77,208.47	1.007
7–9 payment HCCs	25,068	$98,990.20	$98,564.56	0.996
10+ payment HCCs	19,663	$136,426.01	$132,500.83	0.971
2023 ESRD Model				
Entire sample	147,780	$88,269.95	$88,269.95	1.000
0 payment HCCs	10,384	$50,195.93	$52,514.21	1.046
1–3 payment HCCs	45,794	$64,872.43	$65,098.46	1.003
4–6 payment HCCs	43,021	$83,288.90	$84,552.62	1.015
7–9 payment HCCs	27,206	$107,502.25	$107,362.08	0.999
10+ payment HCCs	21,375	$147,369.38	$143,055.18	0.971

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-63
Predictive ratios by count of payment conditions: Full benefit dual dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	125,271	$91,345.35	$88,750.62	0.972
0 payment HCCs	7,728	$51,600.26	$51,005.41	0.988
1–3 payment HCCs	34,794	$66,115.90	$64,651.18	0.978
4–6 payment HCCs	35,597	$85,536.65	$83,432.39	0.975
7–9 payment HCCs	25,116	$107,440.30	$104,021.75	0.968
10+ payment HCCs	22,036	$142,447.78	$137,193.13	0.963
2023 ESRD Model				
Entire sample	123,576	$100,133.55	$98,692.41	0.986
0 payment HCCs	4,782	$58,132.01	$57,893.16	0.996
1–3 payment HCCs	30,048	$71,335.61	$70,467.17	0.988
4–6 payment HCCs	36,339	$89,645.32	$89,109.04	0.994
7–9 payment HCCs	27,408	$111,983.74	$110,955.44	0.991
10+ payment HCCs	24,999	$150,165.44	$145,774.63	0.971

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-64
Predictive ratios by count of payment conditions: Partial benefit dual dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	43,918	$76,371.00	$81,615.43	1.069
0 payment HCCs	3,821	$46,370.71	$50,811.81	1.096
1–3 payment HCCs	14,799	$58,510.50	$63,356.86	1.083
4–6 payment HCCs	12,642	$75,704.51	$81,801.91	1.081
7–9 payment HCCs	7,675	$96,302.39	$102,059.22	1.060
10+ payment HCCs	4,981	$128,950.28	$133,001.42	1.031
2023 ESRD Model				
Entire sample	44,932	$85,950.55	$85,895.71	0.999
0 payment HCCs	2,336	$50,583.16	$51,650.51	1.021
1–3 payment HCCs	13,580	$64,211.59	$63,690.61	0.992
4–6 payment HCCs	14,077	$80,749.86	$82,067.26	1.016
7–9 payment HCCs	8,916	$103,308.48	$104,016.48	1.007
10+ payment HCCs	6,023	$140,665.30	$136,568.05	0.971

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-65
Predictive ratios by count of payment conditions: Non-dual dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	189,315	$80,422.33	$78,378.47	0.975
0 payment HCCs	17,320	$45,036.53	$46,059.93	1.023
1–3 payment HCCs	61,834	$63,796.30	$60,008.50	0.941
4–6 payment HCCs	54,929	$80,851.63	$78,930.97	0.976
7–9 payment HCCs	32,719	$99,814.51	$99,141.76	0.993
10+ payment HCCs	22,513	$131,185.33	$129,354.37	0.986
2023 ESRD Model				
Entire sample	189,692	$87,185.59	$85,499.27	0.981
0 payment HCCs	12,269	$47,271.91	$51,251.83	1.084
1–3 payment HCCs	56,816	$67,359.47	$63,891.66	0.949
4–6 payment HCCs	58,570	$84,433.86	$82,562.57	0.978
7–9 payment HCCs	37,055	$104,369.33	$104,091.90	0.997
10+ payment HCCs	24,982	$138,489.12	$136,477.10	0.985

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the dialysis model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-66
Predictive ratios by deciles of predicted risk (sorted low to high): All functioning graft enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	105,059	$24,863.86	$24,907.11	1.002
First (lowest) decile	10,506	$9,821.03	$10,735.67	1.093
Second decile	10,506	$12,549.31	$13,780.25	1.098
Third decile	10,506	$15,381.94	$16,340.27	1.062
Fourth decile	10,506	$17,743.03	$18,800.47	1.060
Fifth decile	10,506	$20,666.05	$21,130.33	1.022
Sixth decile	10,506	$23,306.35	$23,904.22	1.026
Seventh decile	10,506	$26,721.06	$27,468.64	1.028
Eighth decile	10,506	$32,399.91	$32,335.05	0.998
Ninth decile	10,506	$39,501.19	$39,286.40	0.995
Tenth (highest) decile	10,505	$64,486.32	$57,652.11	0.894
Top 5%	5,252	$76,720.97	$66,969.49	0.873
Top 1%	1,050	$105,523.87	$88,347.09	0.837
Top 0.1%	105	$139,967.18	$116,802.87	0.835
2023 ESRD Model				
Entire sample	104,383	$27,878.55	$27,878.83	1.000
First (lowest) decile	10,439	$11,634.81	$8,781.54	0.755
Second decile	10,439	$13,361.49	$13,976.64	1.046
Third decile	10,439	$17,387.45	$17,306.35	0.995
Fourth decile	10,438	$18,678.69	$20,382.73	1.091
Fifth decile	10,438	$21,430.67	$23,057.12	1.076
Sixth decile	10,438	$25,681.52	$26,543.77	1.034
Seventh decile	10,438	$29,675.74	$30,762.69	1.037
Eighth decile	10,438	$34,266.21	$35,940.30	1.049
Ninth decile	10,438	$43,205.59	$43,777.13	1.013
Tenth (highest) decile	10,438	$70,192.64	$64,612.76	0.921
Top 5%	5,219	$83,806.88	$75,347.91	0.899
Top 1%	1,043	$110,160.52	$100,068.34	0.908
Top 0.1%	104	$154,371.39	$135,443.54	0.877

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-67
Predictive ratios by deciles of predicted risk (sorted low to high): Aged functioning graft enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	38,609	$26,964.08	$27,024.13	1.002
First (lowest) decile	3,861	$10,525.86	$13,876.80	1.318
Second decile	3,861	$14,577.83	$16,323.27	1.120
Third decile	3,861	$17,382.05	$18,587.82	1.069
Fourth decile	3,861	$18,872.58	$20,413.77	1.082
Fifth decile	3,861	$21,177.19	$22,896.07	1.081
Sixth decile	3,861	$25,130.30	$25,866.98	1.029
Seventh decile	3,861	$29,021.29	$29,539.87	1.018
Eighth decile	3,861	$35,342.91	$34,408.23	0.974
Ninth decile	3,861	$43,580.87	$41,743.42	0.958
Tenth (highest) decile	3,860	$70,453.67	$59,624.85	0.846
Top 5%	1,930	$83,331.87	$68,659.59	0.824
Top 1%	386	$113,306.59	$87,598.87	0.773
Top 0.1%	38	$172,327.20	$112,239.19	0.651
2023 ESRD Model				
Entire sample	44,240	$30,048.01	$30,086.82	1.001
First (lowest) decile	4,424	$11,170.34	$13,933.49	1.247
Second decile	4,424	$17,144.62	$17,192.16	1.003
Third decile	4,424	$18,397.53	$20,276.76	1.102
Fourth decile	4,424	$19,878.86	$22,527.72	1.133
Fifth decile	4,424	$24,445.44	$25,339.96	1.037
Sixth decile	4,424	$28,176.86	$28,919.27	1.026
Seventh decile	4,424	$32,732.40	$33,101.50	1.011
Eighth decile	4,424	$38,411.47	$38,204.80	0.995
Ninth decile	4,424	$47,430.96	$45,787.72	0.965
Tenth (highest) decile	4,424	$73,927.05	$65,051.61	0.880
Top 5%	2,212	$87,035.50	$75,055.79	0.862
Top 1%	442	$113,924.15	$97,298.50	0.854
Top 0.1%	44	$166,261.15	$130,559.17	0.785

SOURCE: RTI International analysis of Medicare 2014–2015 100% (V21) and 2018-2019 (V24) ESRD sample claims and enrollment data.

Table 5-68
Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged functioning graft enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	66,450	$23,450.62	$23,482.56	1.001
First (lowest) decile	6,645	$8,941.06	$10,084.27	1.128
Second decile	6,645	$12,105.39	$12,314.87	1.017
Third decile	6,645	$14,891.64	$14,817.27	0.995
Fourth decile	6,645	$16,534.26	$17,444.75	1.055
Fifth decile	6,645	$20,192.13	$20,084.12	0.995
Sixth decile	6,645	$22,912.23	$22,704.54	0.991
Seventh decile	6,645	$25,855.33	$26,177.85	1.012
Eighth decile	6,645	$30,728.50	$30,985.92	1.008
Ninth decile	6,645	$35,773.34	$37,786.27	1.056
Tenth (highest) decile	6,645	$61,072.88	$56,396.94	0.923
Top 5%	3,322	$72,553.57	$65,870.69	0.908
Top 1%	664	$102,662.20	$88,880.38	0.866
Top 0.1%	66	$130,483.41	$119,198.26	0.914
2023 ESRD Model				
Entire sample	60,143	$26,113.28	$26,082.20	0.999
First (lowest) decile	6,015	$9,816.28	$7,235.05	0.737
Second decile	6,015	$14,217.72	$11,345.88	0.798
Third decile	6,015	$15,943.66	$14,916.84	0.936
Fourth decile	6,014	$17,698.59	$18,240.58	1.031
Fifth decile	6,014	$20,334.30	$21,258.24	1.045
Sixth decile	6,014	$23,699.76	$24,600.93	1.038
Seventh decile	6,014	$27,147.19	$28,912.44	1.065
Eighth decile	6,014	$31,693.94	$34,043.25	1.074
Ninth decile	6,014	$38,426.73	$42,025.94	1.094
Tenth (highest) decile	6,014	$67,375.11	$64,225.69	0.953
Top 5%	3,007	$80,438.95	$75,504.80	0.939
Top 1%	601	$106,351.65	$101,993.93	0.959
Top 0.1%	60	$146,572.19	$137,494.35	0.938

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-69
Predictive ratios by deciles of predicted risk (sorted low to high): Functioning graft community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	97,806	$24,786.13	$24,831.56	1.002
First (lowest) decile	9,781	$9,687.87	$10,611.14	1.095
Second decile	9,781	$12,296.37	$13,530.67	1.100
Third decile	9,781	$14,970.69	$15,931.05	1.064
Fourth decile	9,781	$17,417.94	$18,381.54	1.055
Fifth decile	9,781	$20,326.02	$21,054.41	1.036
Sixth decile	9,781	$23,111.74	$24,048.51	1.041
Seventh decile	9,780	$27,039.61	$27,711.20	1.025
Eighth decile	9,780	$32,473.59	$32,460.65	1.000
Ninth decile	9,780	$40,138.86	$39,639.06	0.988
Tenth (highest) decile	9,780	$65,242.52	$57,910.85	0.888
Top 5%	4,890	$77,585.46	$67,007.98	0.864
Top 1%	978	$106,756.65	$87,878.72	0.823
Top 0.1%	97	$145,842.10	$115,737.53	0.794
2023 ESRD Model				
Entire sample	97,044	$27,804.45	$27,804.45	1.000
First (lowest) decile	9,705	$11,374.87	$8,547.35	0.751
Second decile	9,705	$13,340.16	$13,659.72	1.024
Third decile	9,705	$17,074.25	$16,830.54	0.986
Fourth decile	9,705	$18,529.25	$19,942.23	1.076
Fifth decile	9,704	$21,285.20	$23,060.36	1.083
Sixth decile	9,704	$25,419.05	$26,646.98	1.048
Seventh decile	9,704	$29,965.86	$31,004.86	1.035
Eighth decile	9,704	$34,652.59	$36,455.75	1.052
Ninth decile	9,704	$43,770.86	$44,350.18	1.013
Tenth (highest) decile	9,704	$70,511.21	$64,760.34	0.918
Top 5%	4,852	$83,660.71	$75,292.73	0.900
Top 1%	970	$110,047.30	$99,512.77	0.904
Top 0.1%	97	$147,613.36	$133,568.38	0.905

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-70
Predictive ratios by deciles of predicted risk (sorted low to high): Functioning graft institutional continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	906	$51,704.15	$51,722.00	1.000
First (lowest) decile	91	$30,055.04	$27,480.72	0.914
Second decile	91	$30,351.03	$33,317.34	1.098
Third decile	91	$40,251.17	$37,336.69	0.928
Fourth decile	91	$44,729.44	$41,634.31	0.931
Fifth decile	91	$43,837.32	$46,086.64	1.051
Sixth decile	91	$46,310.91	$51,277.82	1.107
Seventh decile	90	$59,685.21	$57,252.53	0.959
Eighth decile	90	$54,641.70	$64,934.92	1.188
Ninth decile	90	$68,901.36	$75,776.38	1.100
Tenth (highest) decile	90	$115,090.90	$98,588.22	0.857
Top 5%	45	$114,875.71	$107,996.63	0.940
Top 1%	*			
2023 ESRD Model				
Entire sample	898	$64,625.44	$64,625.44	1.000
First (lowest) decile	90	$28,852.54	$38,569.21	1.337
Second decile	90	$35,491.52	$44,858.80	1.264
Third decile	90	$48,122.85	$49,825.33	1.035
Fourth decile	90	$50,060.84	$54,234.00	1.083
Fifth decile	90	$49,160.57	$59,343.80	1.207
Sixth decile	90	$73,206.88	$63,903.09	0.873
Seventh decile	90	$68,079.46	$69,890.74	1.027
Eighth decile	90	$89,315.83	$77,891.29	0.872
Ninth decile	89	$102,650.91	$89,208.99	0.869
Tenth (highest) decile	89	$122,324.64	$112,622.30	0.921
Top 5%	44	$145,357.14	$126,761.01	0.872
Top 1%	*			

NOTE:
1. An asterisk * indicates data suppressed because cell count less than or equal to 30.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-71
Predictive ratios by deciles of predicted risk (sorted low to high): Functioning graft new enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	6,779	$22,921.40	$22,922.77	1.000
First (lowest) decile	678	$18,347.81	$17,942.71	0.978
Second decile	678	$16,401.55	$19,056.28	1.162
Third decile	678	$16,804.00	$19,472.44	1.159
Fourth decile	678	$23,183.02	$20,488.67	0.884
Fifth decile	678	$23,934.99	$20,934.29	0.875
Sixth decile	678	$24,564.42	$22,066.91	0.898
Seventh decile	678	$26,153.62	$23,754.72	0.908
Eighth decile	678	$26,798.69	$26,095.61	0.974
Ninth decile	678	$30,841.07	$34,025.96	1.103
Tenth (highest) decile	677	$34,140.56	$38,501.62	1.128
Top 5%	338	$32,692.82	$40,145.64	1.228
Top 1%	67	$34,903.47	$42,335.73	1.213
Top 0.1%	*			
2023 ESRD Model				
Entire sample	6,853	$24,770.39	$24,776.49	1.000
First (lowest) decile	686	$17,416.18	$16,477.84	0.946
Second decile	686	$20,040.52	$20,390.13	1.017
Third decile	686	$16,868.42	$21,256.22	1.260
Fourth decile	685	$22,077.98	$21,948.59	0.994
Fifth decile	685	$21,287.45	$22,411.92	1.053
Sixth decile	685	$23,367.80	$23,609.79	1.010
Seventh decile	685	$30,446.93	$27,273.91	0.896
Eighth decile	685	$31,141.18	$30,418.10	0.977
Ninth decile	685	$31,060.70	$32,720.01	1.053
Tenth (highest) decile	685	$41,957.69	$37,543.77	0.895
Top 5%	342	$40,007.54	$39,858.94	0.996
Top 1%	68	$36,236.77	$42,863.92	1.183
Top 0.1%	*			

NOTE:
1. An asterisk * indicates data suppressed because cell count less than or equal to 30.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-72a
Predictive ratios by deciles of predicted risk (sorted low to high): Aged Non-dual or Partial benefit dual functioning graft community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model[+]				
Entire sample	36,600	$27,000.69	$27,065.02	1.002
First (lowest) decile	3,660	$10,324.06	$13,801.71	1.337
Second decile	3,660	$14,354.33	$16,137.95	1.124
Third decile	3,660	$17,409.44	$18,437.98	1.059
Fourth decile	3,660	$19,193.72	$20,691.70	1.078
Fifth decile	3,660	$21,379.30	$23,185.60	1.084
Sixth decile	3,660	$25,283.05	$26,187.48	1.036
Seventh decile	3,660	$29,080.27	$29,836.07	1.026
Eighth decile	3,660	$36,024.30	$34,643.15	0.962
Ninth decile	3,660	$43,630.48	$42,003.19	0.963
Tenth (highest) decile	3,660	$70,822.07	$59,538.53	0.841
Top 5%	1,830	$83,287.06	$68,352.85	0.821
Top 1%	366	$111,434.28	$86,991.73	0.781
Top 0.1%	36	$165,317.40	$111,018.99	0.672
2023 ESRD Model				
Entire sample	37,518	$28,851.14	$28,851.14	1.000
First (lowest) decile	3,752	$10,657.37	$13,664.86	1.282
Second decile	3,752	$16,403.61	$16,383.90	0.999
Third decile	3,752	$17,941.80	$19,215.35	1.071
Fourth decile	3,752	$20,409.53	$21,818.47	1.069
Fifth decile	3,752	$22,553.77	$24,609.87	1.091
Sixth decile	3,752	$27,807.54	$27,913.98	1.004
Seventh decile	3,752	$31,567.26	$31,909.76	1.011
Eighth decile	3,752	$37,949.22	$36,858.31	0.971
Ninth decile	3,751	$46,151.69	$44,026.26	0.954
Tenth (highest) decile	3,751	$68,240.86	$61,630.36	0.903
Top 5%	1,875	$81,144.03	$70,547.79	0.869
Top 1%	375	$106,280.87	$90,118.94	0.848
Top 0.1%	37	$161,384.25	$116,186.04	0.720

[+] 2020 ESRD Model is predictive ratio by deciles: Aged functioning graft community continuing enrollees.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-72b
Predictive ratios by deciles of predicted risk (sorted low to high): Aged Full benefit dual functioning graft community continuing

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model[+]				
Entire sample	36,600	$27,000.69	$27,065.02	1.002
First (lowest) decile	3,660	$10,324.06	$13,801.71	1.337
Second decile	3,660	$14,354.33	$16,137.95	1.124
Third decile	3,660	$17,409.44	$18,437.98	1.059
Fourth decile	3,660	$19,193.72	$20,691.70	1.078
Fifth decile	3,660	$21,379.30	$23,185.60	1.084
Sixth decile	3,660	$25,283.05	$26,187.48	1.036
Seventh decile	3,660	$29,080.27	$29,836.07	1.026
Eighth decile	3,660	$36,024.30	$34,643.15	0.962
Ninth decile	3,660	$43,630.48	$42,003.19	0.963
Tenth (highest) decile	3,660	$70,822.07	$59,538.53	0.841
Top 5%	1,830	$83,287.06	$68,352.85	0.821
Top 1%	366	$111,434.28	$86,991.73	0.781
Top 0.1%	36	$165,317.40	$111,018.99	0.672
2023 ESRD Model				
Entire sample	5,470	$39,090.30	$39,090.30	1.000
First (lowest) decile	547	$15,915.22	$19,878.23	1.249
Second decile	547	$19,006.78	$23,698.55	1.247
Third decile	547	$25,564.82	$27,076.47	1.059
Fourth decile	547	$27,780.89	$30,203.36	1.087
Fifth decile	547	$32,049.56	$33,897.56	1.058
Sixth decile	547	$34,642.20	$37,970.80	1.096
Seventh decile	547	$40,375.79	$42,815.77	1.060
Eighth decile	547	$51,387.83	$49,124.81	0.956
Ninth decile	547	$69,011.72	$58,363.01	0.846
Tenth (highest) decile	547	$93,641.11	$82,021.82	0.876
Top 5%	273	$117,272.09	$94,633.89	0.807
Top 1%	54	$145,392.02	$121,764.40	0.837
Top 0.1%	*			

[+] 2020 ESRD Model is predictive ratio by deciles: Aged functioning graft community continuing enrollees.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-73a
Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged Non-dual or Partial benefit dual functioning graft community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model[+]				
Entire sample	61,206	$23,290.54	$23,323.20	1.001
First (lowest) decile	6,121	$8,669.30	$9,996.74	1.153
Second decile	6,121	$11,864.08	$12,030.43	1.014
Third decile	6,121	$14,651.57	$14,309.67	0.977
Fourth decile	6,121	$15,663.66	$16,791.21	1.072
Fifth decile	6,121	$19,316.14	$19,501.94	1.010
Sixth decile	6,121	$22,718.49	$22,604.89	0.995
Seventh decile	6,120	$25,729.41	$26,285.55	1.022
Eighth decile	6,120	$30,801.81	$31,020.90	1.007
Ninth decile	6,120	$36,549.59	$38,095.65	1.042
Tenth (highest) decile	6,120	$62,097.09	$56,890.85	0.916
Top 5%	3,060	$73,670.46	$66,144.79	0.898
Top 1%	612	$104,070.32	$88,492.86	0.850
Top 0.1%	61	$132,375.35	$117,770.08	0.890
2023 ESRD Model				
Entire sample	38,329	$23,893.42	$23,893.42	1.000
First (lowest) decile	3,833	$8,157.58	$6,228.05	0.763
Second decile	3,833	$13,228.73	$9,411.99	0.711
Third decile	3,833	$15,261.21	$12,779.38	0.837
Fourth decile	3,833	$15,603.78	$15,956.25	1.023
Fifth decile	3,833	$18,018.80	$19,162.93	1.063
Sixth decile	3,833	$21,353.72	$22,545.89	1.056
Seventh decile	3,833	$24,571.21	$26,753.63	1.089
Eighth decile	3,833	$28,649.73	$32,094.87	1.120
Ninth decile	3,833	$35,921.42	$39,786.15	1.108
Tenth (highest) decile	3,832	$63,782.89	$60,224.54	0.944
Top 5%	1,916	$79,341.85	$70,637.46	0.890
Top 1%	383	$98,609.98	$96,013.99	0.974
Top 0.1%	38	$112,935.19	$131,052.50	1.160

[+] 2020 ESRD Model is predictive ratio by deciles: Non-aged functioning graft community continuing enrollees.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-73b
Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged Full benefit dual functioning graft community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model+				
Entire sample	61,206	$23,290.54	$23,323.20	1.001
First (lowest) decile	6,121	$8,669.30	$9,996.74	1.153
Second decile	6,121	$11,864.08	$12,030.43	1.014
Third decile	6,121	$14,651.57	$14,309.67	0.977
Fourth decile	6,121	$15,663.66	$16,791.21	1.072
Fifth decile	6,121	$19,316.14	$19,501.94	1.010
Sixth decile	6,121	$22,718.49	$22,604.89	0.995
Seventh decile	6,120	$25,729.41	$26,285.55	1.022
Eighth decile	6,120	$30,801.81	$31,020.90	1.007
Ninth decile	6,120	$36,549.59	$38,095.65	1.042
Tenth (highest) decile	6,120	$62,097.09	$56,890.85	0.916
Top 5%	3,060	$73,670.46	$66,144.79	0.898
Top 1%	612	$104,070.32	$88,492.86	0.850
Top 0.1%	61	$132,375.35	$117,770.08	0.890
2023 ESRD Model				
Entire sample	20,189	$29,994.77	$29,994.77	1.000
First (lowest) decile	2,019	$12,162.69	$10,352.43	0.851
Second decile	2,019	$15,968.96	$14,011.42	0.877
Third decile	2,019	$18,467.89	$17,284.35	0.936
Fourth decile	2,019	$20,247.92	$20,634.48	1.019
Fifth decile	2,019	$23,946.00	$24,249.68	1.013
Sixth decile	2,019	$27,449.71	$28,308.19	1.031
Seventh decile	2,019	$31,707.32	$33,411.95	1.054
Eighth decile	2,019	$35,033.66	$39,672.14	1.132
Ninth decile	2,019	$49,093.49	$48,833.36	0.995
Tenth (highest) decile	2,018	$74,243.34	$71,894.01	0.968
Top 5%	1,009	$88,165.95	$83,744.09	0.950
Top 1%	201	$112,830.13	$108,806.34	0.964
Top 0.1%	*			

+ 2020 ESRD Model is predictive ratio by deciles: Non-aged functioning graft community continuing enrollees.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-74
Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual functioning graft continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	27,855	$30,081.30	$26,921.79	0.895
First (lowest) decile	2,786	$11,522.14	$11,281.80	0.979
Second decile	2,786	$16,137.19	$14,108.70	0.874
Third decile	2,786	$17,637.95	$17,044.93	0.966
Fourth decile	2,786	$21,240.65	$19,826.87	0.933
Fifth decile	2,786	$24,632.94	$22,864.10	0.928
Sixth decile	2,785	$28,131.70	$26,176.46	0.930
Seventh decile	2,785	$32,387.75	$30,157.37	0.931
Eighth decile	2,785	$38,163.41	$35,315.44	0.925
Ninth decile	2,785	$49,702.10	$42,997.47	0.865
Tenth (highest) decile	2,785	$78,241.59	$63,381.75	0.810
Top 5%	1,392	$89,334.45	$73,473.45	0.822
Top 1%	278	$119,736.13	$96,313.95	0.804
Top 0.1%	*			
2023 ESRD Model				
Entire sample	26,341	$33,163.50	$32,214.00	0.971
First (lowest) decile	2,635	$12,583.59	$10,532.40	0.837
Second decile	2,634	$17,380.18	$15,187.00	0.874
Third decile	2,634	$18,747.89	$19,087.65	1.018
Fourth decile	2,634	$21,829.69	$22,767.41	1.043
Fifth decile	2,634	$26,544.41	$26,578.36	1.001
Sixth decile	2,634	$31,120.94	$30,917.39	0.993
Seventh decile	2,634	$33,198.08	$36,065.77	1.086
Eighth decile	2,634	$41,495.61	$42,495.13	1.024
Ninth decile	2,634	$54,289.97	$52,016.67	0.958
Tenth (highest) decile	2,634	$84,263.32	$75,659.92	0.898
Top 5%	1,317	$99,022.62	$87,645.93	0.885
Top 1%	263	$123,639.94	$113,771.91	0.920
Top 0.1%	*			

NOTE:
1. An asterisk * indicates data suppressed because cell count less than or equal to 30.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-75
Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual functioning graft continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	11,339	$25,364.84	$25,293.65	0.997
First (lowest) decile	1,134	$11,919.62	$11,295.05	0.948
Second decile	1,134	$13,911.23	$13,762.26	0.989
Third decile	1,134	$15,044.69	$16,467.39	1.095
Fourth decile	1,134	$17,299.27	$18,990.51	1.098
Fifth decile	1,134	$19,846.99	$21,721.36	1.094
Sixth decile	1,134	$24,166.58	$24,747.21	1.024
Seventh decile	1,134	$26,682.74	$28,317.02	1.061
Eighth decile	1,134	$33,529.95	$33,261.68	0.992
Ninth decile	1,134	$41,973.71	$40,386.83	0.962
Tenth (highest) decile	1,133	$66,283.81	$59,042.20	0.891
Top 5%	566	$76,501.88	$68,294.51	0.893
Top 1%	113	$100,705.12	$89,096.88	0.885
Top 0.1%	*			
2023 ESRD Model				
Entire sample	10,984	$28,027.80	$27,265.62	0.973
First (lowest) decile	1,099	$12,982.42	$8,399.60	0.647
Second decile	1,099	$14,407.18	$12,673.25	0.880
Third decile	1,099	$17,955.22	$16,270.71	0.906
Fourth decile	1,099	$18,687.37	$19,502.56	1.044
Fifth decile	1,098	$20,183.04	$22,796.90	1.130
Sixth decile	1,098	$26,458.62	$26,399.05	0.998
Seventh decile	1,098	$30,395.83	$30,690.71	1.010
Eighth decile	1,098	$35,977.41	$36,340.64	1.010
Ninth decile	1,098	$43,558.47	$44,199.96	1.015
Tenth (highest) decile	1,098	$68,750.26	$64,549.10	0.939
Top 5%	549	$82,034.62	$75,195.84	0.917
Top 1%	109	$92,700.99	$100,291.29	1.082
Top 0.1%	*			

NOTE:

1. An asterisk * indicates data suppressed because cell count less than or equal to 30.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-76
Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual functioning graft continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	66,344	$23,843.30	$24,327.14	1.020
First (lowest) decile	6,635	$9,051.25	$10,295.96	1.138
Second decile	6,635	$11,365.08	$13,348.58	1.175
Third decile	6,635	$14,340.72	$15,563.95	1.085
Fourth decile	6,635	$16,951.16	$17,901.17	1.056
Fifth decile	6,634	$18,824.48	$20,487.21	1.088
Sixth decile	6,634	$22,254.53	$23,354.20	1.049
Seventh decile	6,634	$25,586.58	$26,973.82	1.054
Eighth decile	6,634	$31,968.12	$31,617.37	0.989
Ninth decile	6,634	$38,197.30	$38,720.92	1.014
Tenth (highest) decile	6,634	$63,290.42	$56,643.82	0.895
Top 5%	3,317	$76,116.01	$65,576.00	0.862
Top 1%	663	$107,497.41	$85,771.74	0.798
Top 0.1%	66	$181,649.39	$111,904.22	0.616
2023 ESRD Model				
Entire sample	67,370	$26,856.91	$26,633.65	0.992
First (lowest) decile	6,737	$10,479.44	$7,886.97	0.753
Second decile	6,737	$12,871.88	$13,348.65	1.037
Third decile	6,737	$16,079.71	$16,259.91	1.011
Fourth decile	6,737	$17,880.96	$19,245.73	1.076
Fifth decile	6,737	$20,828.29	$22,165.45	1.064
Sixth decile	6,737	$24,180.83	$25,506.52	1.055
Seventh decile	6,737	$28,236.16	$29,643.00	1.050
Eighth decile	6,737	$33,726.31	$34,797.47	1.032
Ninth decile	6,737	$42,730.35	$42,212.62	0.988
Tenth (highest) decile	6,737	$68,653.06	$61,318.09	0.893
Top 5%	3,368	$81,533.10	$71,074.38	0.872
Top 1%	673	$108,173.63	$93,835.01	0.867
Top 0.1%	67	$129,885.75	$124,622.66	0.959

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-77a
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				98,280	$24,956.69	$24,948.20	1.000
HCC1	HIV/AIDS	Y	Y	762	$30,245.38	$30,791.55	1.018
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		8,994	$49,549.16	$43,614.86	0.880
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			856	$49,687.94	$41,342.16	0.832
HCC4	Viral and Late Effects Central Nervous System Infections			242	$35,609.63	$38,706.94	1.087
HCC5	Tuberculosis			284	$36,505.22	$35,667.70	0.977
HCC6	Opportunistic Infections	Y		4,629	$35,462.40	$40,619.93	1.145
HCC7	Other Infectious Diseases			36,364	$33,031.45	$30,678.23	0.929
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	773	$61,516.55	$59,154.62	0.962
HCC9	Lung and Other Severe Cancers	Y	Y	997	$42,906.93	$43,494.25	1.014
HCC10	Lymphoma and Other Cancers	Y	Y	1,167	$37,757.47	$37,856.12	1.003
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	2,307	$31,534.37	$32,448.52	1.029
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	3,952	$28,534.87	$29,069.43	1.019
HCC13	Other Respiratory and Heart Neoplasms			248	$44,490.31	$34,555.82	0.777
HCC14	Other Digestive and Urinary Neoplasms			6,334	$29,799.28	$27,774.72	0.932
HCC15	Other Neoplasms			11,405	$24,851.12	$24,552.20	0.988
HCC16	Benign Neoplasms of Skin, Breast, Eye			7,375	$23,251.65	$23,854.88	1.026
HCC17	Diabetes with Acute Complications	Y	Y	1,960	$47,214.92	$37,642.26	0.797
HCC18	Diabetes with Chronic Complications	Y	Y	34,704	$32,037.65	$30,477.92	0.951
HCC19	Diabetes without Complication	Y	Y	14,235	$23,228.94	$23,636.32	1.018
HCC20	Type I Diabetes Mellitus		Y	17,993	$34,367.33	$31,600.25	0.919
HCC21	Protein-Calorie Malnutrition	Y		3,228	$57,987.08	$51,957.24	0.896
HCC22	Morbid Obesity	Y	Y	5,494	$36,063.61	$33,515.62	0.929
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	28,327	$29,685.89	$29,809.45	1.004

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			36,566	$36,405.97	$32,868.13	0.903
HCC25	Disorders of Lipoid Metabolism		Y	61,572	$27,556.54	$27,104.61	0.984
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	49,706	$29,092.72	$28,537.19	0.981
HCC27	End-Stage Liver Disease	Y	Y	908	$49,445.32	$46,008.38	0.930
HCC28	Cirrhosis of Liver	Y	Y	1,134	$38,076.06	$34,890.22	0.916
HCC29	Chronic Hepatitis	Y	Y	2,317	$30,166.03	$30,607.85	1.015
HCC30	Acute Liver Failure/Disease			243	$49,123.07	$39,093.75	0.796
HCC31	Other Hepatitis and Liver Disease		Y	2,984	$32,732.76	$29,928.96	0.914
HCC32	Gallbladder and Biliary Tract Disorders			1,961	$42,706.78	$35,566.13	0.833
HCC33	Intestinal Obstruction/Perforation	Y		4,110	$42,990.91	$40,802.80	0.949
HCC34	Chronic Pancreatitis	Y	Y	573	$48,213.01	$42,725.71	0.886
HCC35	Inflammatory Bowel Disease	Y	Y	1,334	$38,919.84	$34,717.82	0.892
HCC36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			12,282	$41,731.39	$35,168.37	0.843
HCC37	Appendicitis			263	$31,933.11	$34,745.50	1.088
HCC38	Other Gastrointestinal Disorders			52,151	$31,303.61	$29,384.98	0.939
HCC39	Bone/Joint/Muscle Infections/Necrosis	Y		3,771	$48,761.78	$44,620.84	0.915
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	Y	Y	7,301	$29,958.98	$31,094.12	1.038
HCC41	Disorders of the Vertebrae and Spinal Discs		Y	12,205	$33,809.45	$29,359.01	0.868
HCC42	Osteoarthritis of Hip or Knee		Y	6,401	$32,675.83	$28,537.33	0.873
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	22,583	$29,606.61	$28,894.67	0.976
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	172	$38,076.39	$30,463.42	0.800
HCC45	Other Musculoskeletal and Connective Tissue Disorders			58,716	$29,534.97	$27,994.43	0.948
HCC46	Severe Hematological Disorders	Y	Y	1,118	$70,689.86	$62,654.16	0.886
HCC47	Disorders of Immunity	Y	Y	25,344	$30,898.68	$34,164.22	1.106

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	10,902	$37,390.22	$35,865.68	0.959
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			27,592	$28,725.87	$24,686.56	0.859
HCC50	Delirium and Encephalopathy			4,176	$56,500.92	$45,254.44	0.801
HCC51	Dementia With Complications	Y	Y	553	$49,482.87	$45,135.53	0.912
HCC52	Dementia Without Complication	Y	Y	1,913	$47,695.72	$40,372.18	0.846
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	910	$39,174.35	$32,342.27	0.826
HCC54	Drug/Alcohol Psychosis	Y	Y	613	$46,554.69	$44,628.31	0.959
HCC55	Drug/Alcohol Dependence	Y	Y	1,437	$41,888.65	$37,462.62	0.894
HCC56	Drug/Alcohol Abuse, Without Dependence		Y	7,189	$32,419.68	$28,950.95	0.893
HCC57	Schizophrenia	Y	Y	601	$35,658.65	$33,528.29	0.940
HCC58	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	6,059	$35,257.57	$32,021.43	0.908
HCC59	Reactive and Unspecified Psychosis			947	$48,182.86	$40,688.04	0.844
HCC60	Personality Disorders		Y	89	$35,246.24	$29,362.83	0.833
HCC61	Depression		Y	9,743	$34,872.39	$31,008.78	0.889
HCC62	Anxiety Disorders		Y	1,061	$27,404.46	$26,597.33	0.971
HCC63	Other Psychiatric Disorders		Y	5,433	$30,879.27	$28,635.58	0.927
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	60	$26,004.95	$31,173.47	1.199
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	*			
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	66	$29,375.25	$25,118.61	0.855

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Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	473	$27,108.87	$26,139.50	0.964
HCC68	Other Developmental Disorders		Y	1,071	$27,018.49	$26,146.74	0.968
HCC69	Attention Deficit Disorder		Y	451	$24,334.00	$26,067.49	1.071
HCC70	Quadriplegia	Y	Y	136	$74,666.78	$61,141.96	0.819
HCC71	Paraplegia	Y	Y	183	$72,010.48	$52,706.65	0.732
HCC72	Spinal Cord Disorders/Injuries	Y	Y	666	$40,890.40	$38,716.71	0.947
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	Y	Y	*			
HCC74	Cerebral Palsy	Y	Y	186	$32,356.19	$29,292.01	0.905
HCC75	Polyneuropathy	Y	Y	17,814	$39,208.99	$36,146.63	0.922
HCC76	Muscular Dystrophy	Y	Y	44	$42,235.15	$39,073.41	0.925
HCC77	Multiple Sclerosis	Y	Y	244	$37,105.68	$37,397.59	1.008
HCC78	Parkinson's and Huntington's Diseases	Y	Y	526	$42,729.16	$39,141.01	0.916
HCC79	Seizure Disorders and Convulsions	Y	Y	4,423	$39,401.86	$35,921.11	0.912
HCC80	Coma, Brain Compression/Anoxic Damage	Y	Y	329	$61,862.33	$51,917.26	0.839
HCC81	Mononeuropathy, Other Neurological Conditions/Injuries		Y	14,744	$35,102.48	$31,427.35	0.895
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	599	$80,821.28	$63,068.45	0.780
HCC83	Respiratory Arrest	Y		61	$44,723.12	$49,966.28	1.117
HCC84	Cardio-Respiratory Failure and Shock	Y		5,873	$52,467.07	$46,719.60	0.890
HCC85	Congestive Heart Failure	Y	Y	20,858	$42,590.48	$37,029.79	0.869
HCC86	Acute Myocardial Infarction	Y	Y	1,813	$54,080.06	$44,120.83	0.816
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	2,904	$43,665.90	$38,076.19	0.872
HCC88	Angina Pectoris	Y	Y	2,128	$35,217.51	$31,324.17	0.889

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	22,797	$33,372.55	$30,436.51	0.912
HCC90	Heart Infection/Inflammation, Except Rheumatic			2,526	$47,238.55	$38,598.53	0.817
HCC91	Valvular and Rheumatic Heart Disease		Y	16,319	$38,158.01	$32,712.57	0.857
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	115	$34,037.91	$30,853.59	0.906
HCC93	Other Congenital Heart/Circulatory Disease		Y	545	$31,327.31	$32,409.44	1.035
HCC94	Hypertensive Heart Disease		Y	3,993	$26,150.41	$25,867.47	0.989
HCC95	Hypertension		Y	61,846	$21,355.50	$22,692.75	1.063
HCC96	Specified Heart Arrhythmias	Y	Y	14,184	$39,953.89	$35,234.95	0.882
HCC97	Other Heart Rhythm and Conduction Disorders		Y	10,325	$34,935.23	$32,176.35	0.921
HCC98	Other and Unspecified Heart Disease		Y	13,488	$39,788.98	$34,707.12	0.872
HCC99	Cerebral Hemorrhage	Y	Y	605	$45,590.09	$42,017.89	0.922
HCC100	Ischemic or Unspecified Stroke	Y	Y	3,478	$41,795.75	$37,483.15	0.897
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	5,335	$36,255.48	$31,117.78	0.858
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	905	$36,269.48	$33,365.47	0.920
HCC103	Hemiplegia/Hemiparesis	Y	Y	1,223	$46,847.31	$42,427.72	0.906
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	137	$50,013.86	$39,815.49	0.796
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	1,692	$42,016.38	$36,099.91	0.859
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	Y	Y	2,384	$58,085.35	$50,758.40	0.874
HCC107	Vascular Disease with Complications	Y		3,379	$42,422.91	$38,173.62	0.900
HCC108	Vascular Disease	Y	Y	20,425	$35,158.84	$32,858.72	0.935
HCC109	Other Circulatory Disease			11,789	$31,034.78	$28,620.96	0.922
HCC110	Cystic Fibrosis	Y	Y	73	$48,231.38	$60,232.55	1.249

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Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	7,924	$41,704.13	$38,101.91	0.914
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	1,547	$37,398.67	$35,086.61	0.938
HCC113	Asthma		Y	4,761	$31,292.83	$27,451.04	0.877
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		1,542	$67,939.67	$55,638.39	0.819
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		680	$46,073.12	$40,977.22	0.889
HCC116	Viral and Unspecified Pneumonia, Pleurisy			8,345	$43,709.39	$36,593.23	0.837
HCC117	Pleural Effusion/Pneumothorax			3,377	$57,446.92	$45,052.57	0.784
HCC118	Other Respiratory Disorders			24,928	$33,632.36	$30,612.54	0.910
HCC119	Legally Blind		Y	2,097	$37,247.50	$34,377.64	0.923
HCC120	Major Eye Infections/Inflammations			340	$36,936.51	$30,833.25	0.835
HCC121	Retinal Detachment			1,541	$30,098.77	$29,812.25	0.990
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	Y	Y	10,773	$32,752.46	$31,945.43	0.975
HCC123	Diabetic and Other Vascular Retinopathies		Y	10,804	$33,857.28	$30,861.03	0.912
HCC124	Exudative Macular Degeneration	Y	Y	736	$30,862.12	$32,996.76	1.069
HCC125	Other Retinal Disorders		Y	4,451	$24,805.62	$25,259.98	1.018
HCC126	Glaucoma		Y	12,261	$29,276.32	$27,942.27	0.954
HCC127	Cataract		Y	20,345	$27,137.13	$27,067.28	0.997
HCC128	Other Eye Disorders			29,959	$28,700.51	$27,649.62	0.963
HCC129	Significant Ear, Nose, and Throat Disorders			1,210	$37,045.85	$32,339.31	0.873
HCC130	Hearing Loss		Y	5,807	$31,608.09	$29,240.84	0.925
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			31,999	$28,367.51	$27,067.03	0.954
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End-Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status		Y	.	.	.	.
HCC135	Acute Renal Failure			.	.	.	.

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC136	Chronic Kidney Disease, Stage 5		Y	.	.	.	.
HCC137	Chronic Kidney Disease, Severe (Stage 4)		Y	.	.	.	.
HCC138	Chronic Kidney Disease, Moderate (Stage 3)		Y	.	.	.	.
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1–2 or Unspecified)		Y	.	.	.	.
HCC140	Unspecified Renal Failure		Y	.	.	.	.
HCC141	Nephritis		Y	.	.	.	.
HCC142	Urinary Obstruction and Retention			12,588	$36,786.39	$32,839.40	0.893
HCC143	Urinary Incontinence		Y	4,435	$38,003.97	$32,630.00	0.859
HCC144	Urinary Tract Infection			23,098	$34,655.52	$31,253.21	0.902
HCC145	Other Urinary Tract Disorders			30,977	$31,822.59	$29,455.23	0.926
HCC146	Female Infertility		Y	46	$26,386.39	$23,426.30	0.888
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	2,342	$29,546.00	$27,231.69	0.922
HCC148	Other Female Genital Disorders		Y	6,586	$27,344.69	$26,048.02	0.953
HCC149	Male Genital Disorders		Y	14,385	$30,466.77	$29,234.71	0.960
HCC150	Ectopic and Molar Pregnancy			*			
HCC151	Miscarriage/Terminated Pregnancy			51	$37,799.43	$24,549.06	0.649
HCC152	Completed Pregnancy With Major Complications			53	$32,312.62	$26,008.59	0.805
HCC153	Completed Pregnancy With Complications			48	$42,416.50	$23,520.19	0.555
HCC154	Completed Pregnancy With No or Minor Complications			*			
HCC155	Uncompleted Pregnancy With Complications			58	$40,027.97	$26,901.65	0.672
HCC156	Uncompleted Pregnancy With No or Minor Complications			88	$26,452.90	$29,649.45	1.121
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	Y	Y	185	$102,060.89	$78,659.48	0.771

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	482	$67,780.46	$62,423.17	0.921
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss	Y	Y	446	$69,105.84	$56,094.08	0.812
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage	Y	Y	1,045	$55,772.89	$49,240.88	0.883
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	5,322	$40,218.29	$35,750.54	0.889
HCC162	Severe Skin Burn or Condition	Y		*			
HCC163	Moderate Skin Burn or Condition			60	$51,738.92	$37,880.84	0.732
HCC164	Cellulitis, Local Skin Infection			13,899	$39,594.85	$34,249.59	0.865
HCC165	Other Dermatological Disorders			40,109	$28,189.13	$27,519.86	0.976
HCC166	Severe Head Injury	Y		*			
HCC167	Major Head Injury	Y		472	$45,838.52	$39,131.95	0.854
HCC168	Concussion or Unspecified Head Injury			1,327	$42,210.69	$32,835.95	0.778
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		737	$43,438.65	$38,781.07	0.893
HCC170	Hip Fracture/Dislocation	Y		953	$45,282.05	$40,139.85	0.886
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			1,721	$35,402.89	$31,315.06	0.885
HCC172	Internal Injuries			1,247	$44,496.50	$39,934.10	0.897
HCC173	Traumatic Amputations and Complications	Y		1,350	$51,767.88	$48,033.71	0.928
HCC174	Other Injuries			27,642	$33,918.77	$30,367.33	0.895
HCC175	Poisonings and Allergic and Inflammatory Reactions			13,339	$36,651.69	$33,864.78	0.924
HCC176	Complications of Specified Implanted Device or Graft	Y		8,518	$40,294.73	$40,372.66	1.002
HCC177	Other Complications of Medical Care			25,450	$38,802.06	$35,186.03	0.907
HCC178	Major Symptoms, Abnormalities			62,292	$30,746.26	$28,771.23	0.936
HCC179	Minor Symptoms, Signs, Findings			20,183	$17,776.52	$20,653.60	1.162

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2020 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	.	.	.	.
HCC181	Premature Newborns, Including Birthweight 1000–1499 Grams		Y	.	.	.	.
HCC182	Serious Perinatal Problem Affecting Newborn		Y	97	$42,699.17	$34,813.11	0.815
HCC183	Other Perinatal Problems Affecting Newborn			69	$38,058.50	$34,403.63	0.904
HCC184	Term or Post-Term Singleton Newborn, Normal or High Birthweight		Y	.	.	.	.
HCC185	Major Organ Transplant (procedure)		Y	.	.	.	.
HCC186	Major Organ Transplant or Replacement Status	Y	Y	10,538	$29,746.86	$29,791.70	1.002
HCC187	Other Organ Transplant Status/Replacement		Y	1,254	$34,718.43	$29,787.54	0.858
HCC188	Artificial Openings for Feeding or Elimination	Y	Y	2,192	$49,313.36	$45,161.01	0.916
HCC189	Amputation Status, Lower Limb/Amputation Complications	Y	Y	2,768	$46,314.81	$41,542.20	0.897
HCC190	Amputation Status, Upper Limb			205	$51,541.79	$39,206.76	0.761
HCC191	Post-Surgical States/Aftercare/Elective			74,931	$27,667.54	$27,017.38	0.977
HCC192	Radiation Therapy			478	$39,641.10	$34,846.00	0.879
HCC193	Chemotherapy			909	$65,214.47	$42,321.25	0.649
HCC194	Rehabilitation			5,744	$40,640.60	$35,704.28	0.879
HCC195	Screening/Observation/Special Exams			70,102	$27,181.58	$26,767.47	0.985
HCC196	History of Disease			52,215	$31,486.25	$29,785.01	0.946
HCC197	Supplemental Oxygen			966	$58,091.18	$45,090.45	0.776
HCC198	CPAP/IPPB/Nebulizers			.	.	.	.
HCC199	Patient Lifts, Power Operated Vehicles, Beds			69	$82,822.01	$64,051.95	0.773
HCC200	Wheelchairs, Commodes			333	$63,474.00	$48,038.93	0.757
HCC201	Walkers			.	.	.	.

1. An asterisk * indicates data suppressed because cell count less than or equal to 30.

2. Kidney disease group omitted because renal HCCs 132–141 are excluded from the functioning graft model.
3. Other HCCs with missing data have a count of 0 or are not populated because they correspond to procedures or durable medical equipment.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) 100% ESRD sample claims and enrollment data.

Table 5-77b
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				97,530	$28,028.41	$28,028.41	1.000
HCC1	HIV/AIDS	Y	Y	993	$32,231.38	$33,469.40	1.038
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		10,329	$51,962.88	$48,144.84	0.927
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			437	$61,296.29	$50,103.37	0.817
HCC4	Viral and Late Effects Central Nervous System Infections			260	$46,077.93	$42,826.52	0.929
HCC5	Tuberculosis			154	$39,734.46	$38,907.31	0.979
HCC6	Opportunistic Infections	Y		5,938	$38,442.75	$42,257.58	1.099
HCC7	Other Infectious Diseases			37,975	$36,421.95	$34,395.51	0.944
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	898	$66,774.32	$71,767.44	1.075
HCC9	Lung and Other Severe Cancers	Y	Y	1,183	$47,429.12	$51,109.97	1.078
HCC10	Lymphoma and Other Cancers	Y	Y	1,195	$41,866.63	$43,136.69	1.030
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	2,537	$35,333.06	$37,728.25	1.068
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	4,094	$32,379.06	$33,732.06	1.042
HCC13	Other Respiratory and Heart Neoplasms			137	$38,583.72	$36,153.04	0.937
HCC14	Other Digestive and Urinary Neoplasms			6,107	$32,710.49	$30,606.37	0.936
HCC15	Other Neoplasms			12,728	$28,050.74	$26,923.28	0.960
HCC16	Benign Neoplasms of Skin, Breast, Eye			8,651	$25,512.26	$26,042.95	1.021
HCC17	Diabetes with Acute Complications	Y	Y	2,550	$51,405.17	$41,914.09	0.815
HCC18	Diabetes with Chronic Complications	Y	Y	43,555	$33,846.63	$32,936.81	0.973
HCC19	Diabetes without Complication	Y	Y	5,615	$21,951.30	$23,643.81	1.077
HCC20	Type I Diabetes Mellitus		Y	14,163	$38,071.55	$35,168.41	0.924
HCC21	Protein-Calorie Malnutrition	Y		3,924	$59,326.99	$57,597.24	0.971
HCC22	Morbid Obesity	Y	Y	8,071	$36,040.03	$34,873.34	0.968
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	34,010	$31,975.45	$33,105.49	1.035

(continued)

Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			37,889	$39,038.09	$36,424.44	0.933
HCC25	Disorders of Lipoid Metabolism		Y	64,369	$30,762.51	$30,370.06	0.987
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	56,591	$31,692.62	$31,335.86	0.989
HCC27	End-Stage Liver Disease	Y	Y	1,044	$49,571.22	$52,262.77	1.054
HCC28	Cirrhosis of Liver	Y	Y	1,342	$37,686.16	$39,396.52	1.045
HCC29	Chronic Hepatitis	Y	Y	2,435	$32,729.60	$34,452.25	1.053
HCC30	Acute Liver Failure/Disease			220	$53,616.56	$51,144.62	0.954
HCC31	Other Hepatitis and Liver Disease		Y	3,332	$36,099.88	$34,209.38	0.948
HCC32	Gallbladder and Biliary Tract Disorders			2,004	$43,253.27	$39,120.78	0.904
HCC33	Intestinal Obstruction/Perforation	Y		3,563	$46,192.54	$47,706.60	1.033
HCC34	Chronic Pancreatitis	Y	Y	601	$49,694.90	$44,213.31	0.890
HCC35	Inflammatory Bowel Disease	Y	Y	1,298	$40,396.86	$38,309.50	0.948
HCC36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			12,521	$44,482.15	$39,532.37	0.889
HCC37	Appendicitis			242	$43,077.82	$38,940.46	0.904
HCC38	Other Gastrointestinal Disorders			54,231	$34,116.95	$32,779.59	0.961
HCC39	Bone/Joint/Muscle Infections/Necrosis	Y		3,948	$55,366.41	$50,319.49	0.909
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	Y	Y	8,460	$33,238.32	$34,104.80	1.026
HCC41	Disorders of the Vertebrae and Spinal Discs		Y	13,143	$36,597.07	$32,776.26	0.896
HCC42	Osteoarthritis of Hip or Knee		Y	7,729	$35,824.95	$31,558.55	0.881
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	24,560	$32,223.49	$31,270.19	0.970
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	166	$40,429.41	$34,799.10	0.861
HCC45	Other Musculoskeletal and Connective Tissue Disorders			59,888	$32,617.97	$31,252.35	0.958
HCC46	Severe Hematological Disorders	Y	Y	1,072	$93,882.61	$68,234.75	0.727
HCC47	Disorders of Immunity	Y	Y	39,356	$32,366.76	$35,955.42	1.111

(continued)

Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	12,173	$41,015.61	$40,647.93	0.991
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			21,985	$30,307.99	$25,273.41	0.834
HCC50	Delirium and Encephalopathy			5,087	$62,419.96	$50,511.18	0.809
HCC51	Dementia With Complications	Y	Y	618	$55,568.01	$49,646.46	0.893
HCC52	Dementia Without Complication	Y	Y	1,689	$51,811.80	$44,660.44	0.862
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	1,497	$40,924.65	$35,848.11	0.876
HCC54	Substance Use with Psychotic Complications	Y	Y	72	$54,688.68	$57,574.16	1.053
HCC55	Substance Use Disorder, Moderate/Severe, or Substance Use with Complications	Y	Y	2,505	$43,980.49	$40,751.21	0.927
HCC56	Substance Use Disorder, Mild, Except Alcohol and Cannabis	Y	Y	276	$39,045.07	$40,305.97	1.032
HCC57	Schizophrenia	Y	Y	578	$40,179.87	$35,957.36	0.895
HCC58	Reactive and Unspecified Psychosis	Y		287	$49,137.52	$43,530.14	0.886
HCC59	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	8,863	$37,027.79	$34,757.36	0.939
HCC60	Personality Disorders	Y	Y	56	$40,849.50	$33,885.48	0.830
HCC61	Depression		Y	8,882	$38,083.64	$34,866.99	0.916
HCC62	Anxiety Disorders		Y	2,164	$30,883.69	$29,991.63	0.971
HCC63	Other Psychiatric Disorders		Y	6,449	$34,267.75	$32,221.15	0.940
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	41	$61,133.41	$41,584.72	0.680
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	*			
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	67	$30,864.04	$28,514.52	0.924

(continued)

Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	588	$26,260.07	$29,666.01	1.130
HCC68	Other Developmental Disorders		Y	1,232	$32,897.18	$29,865.06	0.908
HCC69	Attention Deficit Disorder		Y	452	$31,809.83	$29,454.18	0.926
HCC70	Quadriplegia	Y	Y	147	$89,389.32	$68,535.77	0.767
HCC71	Paraplegia	Y	Y	201	$60,107.72	$55,745.78	0.927
HCC72	Spinal Cord Disorders/Injuries	Y	Y	798	$43,194.28	$41,427.88	0.959
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	Y	Y	*			
HCC74	Cerebral Palsy	Y	Y	188	$30,075.18	$32,698.79	1.087
HCC75	Myasthenia Gravis/Myoneural Disorders and Guillain-Barre Syndrome/Inflammatory and Toxic Neuropathy	Y	Y	1,306	$42,525.41	$44,488.51	1.046
HCC76	Muscular Dystrophy	Y	Y	38	$39,877.23	$42,386.86	1.063
HCC77	Multiple Sclerosis	Y	Y	254	$44,278.61	$48,487.81	1.095
HCC78	Parkinson's and Huntington's Diseases	Y	Y	804	$45,803.30	$44,007.58	0.961
HCC79	Seizure Disorders and Convulsions	Y	Y	4,082	$43,567.29	$39,670.27	0.911
HCC80	Coma, Brain Compression/Anoxic Damage	Y	Y	509	$67,376.64	$57,595.01	0.855
HCC81	Mononeuropathy, Other Neurological Conditions/Injuries		Y	34,367	$38,132.74	$35,088.85	0.920
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	673	$72,416.94	$68,326.32	0.944
HCC83	Respiratory Arrest	Y		36	$71,381.96	$67,374.38	0.944
HCC84	Cardio-Respiratory Failure and Shock	Y		6,191	$57,927.85	$52,169.59	0.901
HCC85	Congestive Heart Failure	Y	Y	22,566	$45,029.70	$41,024.56	0.911
HCC86	Acute Myocardial Infarction	Y	Y	3,042	$59,529.60	$47,653.50	0.801
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	1,839	$47,750.50	$43,269.26	0.906
HCC88	Angina Pectoris	Y	Y	3,117	$37,243.24	$35,674.06	0.958

(continued)

Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	20,859	$36,736.18	$34,118.30	0.929
HCC90	Heart Infection/Inflammation, Except Rheumatic			2,831	$51,634.83	$42,951.92	0.832
HCC91	Valvular and Rheumatic Heart Disease		Y	17,041	$41,588.84	$36,462.73	0.877
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	81	$42,483.17	$37,276.58	0.877
HCC93	Other Congenital Heart/Circulatory Disease		Y	464	$34,035.73	$36,096.70	1.061
HCC94	Hypertensive Heart Disease		Y	4,159	$31,862.02	$30,830.27	0.968
HCC95	Hypertension		Y	60,287	$23,756.74	$24,941.50	1.050
HCC96	Specified Heart Arrhythmias	Y	Y	15,730	$43,159.26	$39,170.72	0.908
HCC97	Other Heart Rhythm and Conduction Disorders		Y	5,212	$37,599.78	$34,751.04	0.924
HCC98	Other and Unspecified Heart Disease		Y	11,310	$44,674.10	$39,121.15	0.876
HCC99	Intracranial Hemorrhage	Y	Y	724	$54,983.86	$48,458.05	0.881
HCC100	Ischemic or Unspecified Stroke	Y	Y	3,369	$49,281.13	$42,396.94	0.860
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	4,087	$38,736.15	$34,509.58	0.891
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	1,084	$39,588.45	$34,866.08	0.881
HCC103	Hemiplegia/Hemiparesis	Y	Y	1,818	$52,281.38	$47,275.89	0.904
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	180	$52,720.22	$43,711.03	0.829
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	1,277	$49,064.12	$40,689.56	0.829
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	Y	Y	2,589	$65,937.64	$55,751.94	0.846
HCC107	Vascular Disease with Complications	Y		2,827	$47,371.56	$43,329.44	0.915
HCC108	Vascular Disease	Y	Y	22,534	$37,803.22	$36,731.74	0.972
HCC109	Other Circulatory Disease			11,859	$32,929.81	$32,053.70	0.973
HCC110	Cystic Fibrosis	Y	Y	58	$64,079.19	$62,620.67	0.977

(continued)

Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	7,787	$44,807.94	$42,145.77	0.941
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	1,280	$40,411.30	$39,675.94	0.982
HCC113	Asthma		Y	5,456	$33,788.67	$31,429.87	0.930
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		1,760	$71,250.42	$60,111.21	0.844
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		2,402	$46,319.62	$43,055.05	0.930
HCC116	Viral and Unspecified Pneumonia, Pleurisy			6,220	$47,780.69	$40,927.62	0.857
HCC117	Pleural Effusion/Pneumothorax			3,420	$61,497.83	$50,577.98	0.822
HCC118	Other Respiratory Disorders			27,640	$36,401.70	$34,105.83	0.937
HCC119	Legally Blind		Y	1,592	$44,867.81	$40,145.51	0.895
HCC120	Major Eye Infections/Inflammations			419	$45,131.29	$35,369.95	0.784
HCC121	Retinal Detachment			1,850	$35,980.19	$35,269.36	0.980
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	Y	Y	11,675	$37,112.89	$36,669.26	0.988
HCC123	Diabetic and Other Vascular Retinopathies		Y	11,256	$37,011.26	$33,184.30	0.897
HCC124	Exudative Macular Degeneration	Y	Y	766	$37,547.92	$36,722.94	0.978
HCC125	Other Retinal Disorders		Y	5,391	$27,613.54	$28,694.02	1.039
HCC126	Glaucoma		Y	13,638	$32,782.05	$31,595.61	0.964
HCC127	Cataract		Y	21,547	$30,057.61	$30,382.86	1.011
HCC128	Other Eye Disorders			34,199	$31,872.32	$31,184.10	0.978
HCC129	Significant Ear, Nose, and Throat Disorders			1,142	$43,789.55	$37,844.47	0.864
HCC130	Hearing Loss		Y	6,918	$35,297.33	$33,229.86	0.941
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			34,841	$31,523.26	$30,417.73	0.965
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End-Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status		Y	.	.	.	.
HCC135	Acute Renal Failure			.	.	.	.

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Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC136	Chronic Kidney Disease, Stage 5		Y	.	.	.	.
HCC137	Chronic Kidney Disease, Severe (Stage 4)		Y	.	.	.	.
HCC138	Chronic Kidney Disease, Moderate (Stage 3)		Y	.	.	.	.
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1–2 or Unspecified)		Y	.	.	.	.
HCC140	Unspecified Renal Failure		Y	.	.	.	.
HCC141	Nephritis		Y	.	.	.	.
HCC142	Urinary Obstruction and Retention			13,134	$40,308.36	$37,020.32	0.918
HCC143	Urinary Incontinence		Y	5,366	$39,711.87	$36,164.59	0.911
HCC144	Urinary Tract Infection			23,595	$37,620.52	$34,854.34	0.926
HCC145	Other Urinary Tract Disorders			29,313	$33,495.33	$32,637.89	0.974
HCC146	Female Infertility		Y	49	$30,654.48	$28,423.67	0.927
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	2,233	$34,789.38	$31,805.85	0.914
HCC148	Other Female Genital Disorders		Y	5,553	$30,754.91	$29,927.38	0.973
HCC149	Male Genital Disorders		Y	16,524	$34,247.72	$33,229.07	0.970
HCC150	Ectopic and Molar Pregnancy			*			
HCC151	Miscarriage/Terminated Pregnancy			*			
HCC152	Completed Pregnancy With Major Complications			27	$34,965.02	$33,115.98	0.947
HCC153	Completed Pregnancy With Complications			32	$23,138.39	$23,105.46	0.999
HCC154	Completed Pregnancy With No or Minor Complications			*			
HCC155	Uncompleted Pregnancy With Complications			32	$35,803.44	$31,106.17	0.869
HCC156	Uncompleted Pregnancy With No or Minor Complications			54	$33,064.59	$33,316.18	1.008
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	Y	Y	250	$84,211.96	$78,857.62	0.936

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Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	930	$69,101.71	$63,284.15	0.916
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss	Y	Y	661	$63,720.39	$55,482.51	0.871
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage		Y	705	$62,556.81	$47,354.18	0.757
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	5,096	$45,369.14	$42,087.67	0.928
HCC162	Severe Skin Burn or Condition	Y		40	$29,317.82	$45,079.22	1.538
HCC163	Moderate Skin Burn or Condition			63	$38,875.42	$46,724.89	1.202
HCC164	Cellulitis, Local Skin Infection			13,163	$44,364.87	$38,872.20	0.876
HCC165	Other Dermatological Disorders			44,126	$31,384.30	$30,800.41	0.981
HCC166	Severe Head Injury	Y		*			
HCC167	Major Head Injury	Y		592	$49,280.12	$43,817.41	0.889
HCC168	Concussion or Unspecified Head Injury			1,558	$45,958.80	$37,579.27	0.818
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		765	$51,521.16	$44,734.17	0.868
HCC170	Hip Fracture/Dislocation	Y		841	$54,116.64	$46,996.87	0.868
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			1,382	$42,681.35	$35,829.43	0.839
HCC172	Internal Injuries			636	$52,250.00	$46,312.83	0.886
HCC173	Traumatic Amputations and Complications	Y		431	$52,644.91	$50,590.42	0.961
HCC174	Other Injuries			25,249	$37,434.71	$34,204.39	0.914
HCC175	Poisonings and Allergic and Inflammatory Reactions			12,194	$43,970.20	$40,522.36	0.922
HCC176	Complications of Specified Implanted Device or Graft	Y		12,161	$42,042.20	$45,376.50	1.079
HCC177	Other Complications of Medical Care			10,795	$45,298.88	$43,480.52	0.960
HCC178	Major Symptoms, Abnormalities			66,776	$32,821.13	$31,626.52	0.964
HCC179	Minor Symptoms, Signs, Findings			19,625	$19,803.37	$22,270.19	1.125

(continued)

Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	.	.	.	.
HCC181	Premature Newborns, Including Birthweight 1000–1499 Grams		Y	.	.	.	.
HCC182	Serious Perinatal Problem Affecting Newborn		Y	147	$49,912.97	$42,609.36	0.854
HCC183	Other Perinatal Problems Affecting Newborn			161	$44,936.87	$39,670.76	0.883
HCC184	Term or Post-Term Singleton Newborn, Normal or High Birthweight		Y	.	.	.	.
HCC185	Major Organ Transplant (procedure)		Y	.	.	.	.
HCC186	Major Organ Transplant or Replacement Status	Y	Y	11,039	$33,082.90	$33,083.94	1.000
HCC187	Other Organ Transplant Status/Replacement		Y	1,628	$47,285.03	$39,054.63	0.826
HCC188	Artificial Openings for Feeding or Elimination	Y	Y	2,221	$54,326.85	$52,926.67	0.974
HCC189	Amputation Status, Lower Limb/Amputation Complications	Y	Y	3,221	$46,693.57	$44,469.80	0.952
HCC190	Amputation Status, Upper Limb			289	$48,521.85	$43,251.76	0.891
HCC191	Post-Surgical States/Aftercare/Elective			82,689	$30,040.92	$29,707.49	0.989
HCC192	Radiation Therapy			414	$45,707.28	$47,212.30	1.033
HCC193	Chemotherapy			5,677	$36,807.00	$32,993.34	0.896
HCC194	Rehabilitation			.	.	.	.
HCC195	Screening/Observation/Special Exams			67,409	$30,266.27	$30,189.37	0.997
HCC196	History of Disease			64,078	$32,946.93	$32,125.39	0.975
HCC197	Supplemental Oxygen			1,400	$62,833.88	$51,931.64	0.826
HCC198	CPAP/IPPB/Nebulizers			.	.	.	.
HCC199	Patient Lifts, Power Operated Vehicles, Beds			137	$84,561.85	$66,847.12	0.791
HCC200	Wheelchairs, Commodes			498	$71,799.67	$53,367.30	0.743
HCC201	Walkers			1,034	$57,988.32	$49,839.36	0.859
HCC202	Drug Use, Uncomplicated, Except Cannabis			340	$39,368.14	$35,456.69	0.901

(continued)

Table 5-77b (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2023 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC203	Alcohol/Cannabis Use or Use Disorder, Mild or Uncomplicated; Non-Psychoactive Substance Abuse; Nicotine Dependence		Y	5,883	$35,004.57	$33,004.23	0.943
HCC204	External Causes of Morbidity, Except Self-Inflicted Injury			29,621	$40,499.62	$37,153.73	0.917

1. An asterisk * indicates data suppressed because cell count less than or equal to 30.
2. Kidney disease group omitted because renal HCCs 132–141 are excluded from the functioning graft model.
3. Other HCCs with missing data have a count of 0 or are not populated because they correspond to procedures or durable medical equipment.
SOURCE: RTI International analysis of Medicare 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-78
Predictive ratios for all body systems/disease groups: All functioning graft continuing enrollees

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	98,280	$24,956.69	$25,001.95	1.002
Infection	13,228	$42,847.40	$40,860.26	0.954
Neoplasm	9,196	$34,450.87	$34,811.32	1.010
Diabetes	50,899	$30,053.64	$28,769.36	0.957
Metabolic	33,334	$31,455.87	$30,913.11	0.983
Liver	4,359	$36,214.38	$34,893.35	0.964
Gastrointestinal	5,751	$41,834.53	$38,885.59	0.930
Musculoskeletal	10,628	$36,173.46	$35,461.93	0.980
Blood	32,265	$31,933.83	$33,867.59	1.061
Cognitive	2,466	$48,091.33	$41,426.60	0.861
Substance Use	2,050	$43,240.17	$39,538.18	0.914
Psychiatric	6,660	$35,294.32	$32,159.48	0.911
Spinal	985	$51,255.59	$44,359.91	0.865
Neurological	21,727	$38,511.07	$35,503.04	0.922
Arrest	6,533	$54,946.12	$48,217.34	0.878
Heart	30,317	$38,199.56	$34,351.77	0.899
Cerebrovascular Disease	4,589	$42,571.77	$38,166.97	0.897
Vascular	26,188	$38,281.56	$35,251.71	0.921
Lung	10,936	$42,622.86	$38,787.32	0.910
Eye	11,372	$32,631.14	$31,957.94	0.979
Kidney	.	.	.	.
Skin	7,496	$47,136.49	$41,420.53	0.879
Injury	3,304	$46,637.74	$42,016.25	0.901
Complications	8,518	$40,294.73	$40,372.66	1.002
Transplant	10,538	$29,746.86	$29,791.70	1.002
Openings	2,192	$49,313.36	$45,161.01	0.916
Amputation	2,768	$46,314.81	$41,542.20	0.897

(continued)

Table 5-78 (continued)
Predictive ratios for all body systems/disease groups: All functioning graft continuing enrollees

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2023 ESRD Model				
Entire sample	97,530	$28,028.41	$28,028.41	1.000
Infection	15,717	$44,710.91	$43,941.59	0.983
Neoplasm	9,907	$38,768.87	$40,939.57	1.056
Diabetes	51,720	$33,350.34	$32,322.01	0.969
Metabolic	40,336	$33,193.87	$33,868.87	1.020
Liver	4,821	$37,629.55	$39,549.79	1.051
Gastrointestinal	5,190	$44,512.37	$44,645.11	1.003
Musculoskeletal	11,892	$39,910.27	$38,842.02	0.973
Blood	44,959	$33,213.20	$35,781.08	1.077
Cognitive	2,307	$52,799.63	$45,971.70	0.871
Substance Use	2,853	$43,779.30	$41,135.10	0.940
Psychiatric	9,784	$37,592.12	$35,080.67	0.933
Spinal	1,146	$51,561.86	$47,112.22	0.914
Neurological	6,693	$43,481.20	$41,160.66	0.947
Arrest	6,900	$59,408.09	$53,821.25	0.906
Heart	32,712	$40,980.24	$38,003.91	0.927
Cerebrovascular Disease	4,936	$49,994.17	$43,212.70	0.864
Vascular	27,950	$41,371.31	$39,156.95	0.946
Lung	11,962	$45,834.54	$42,898.77	0.936
Eye	12,333	$37,186.84	$36,620.46	0.985
Kidney	.	.	.	.
Skin	6,969	$51,240.67	$47,212.35	0.921
Injury	2,467	$51,615.51	$45,284.14	0.877
Complications	12,161	$42,042.20	$45,376.50	1.079
Transplant	11,039	$33,082.90	$33,083.94	1.000
Openings	2,221	$54,326.85	$52,926.67	0.974
Amputation	3,221	$46,693.57	$44,469.80	0.952

NOTE:
1. Kidney disease group omitted because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-79
Predictive ratios by count of chronic conditions: All functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	98,280	$24,956.69	$25,001.95	1.002
0 chronic eligible HCCs	2,804	$6,828.84	$12,246.17	1.793
1–3 chronic eligible HCCs	15,137	$12,661.70	$14,518.93	1.147
4–6 chronic eligible HCCs	27,447	$17,381.37	$19,115.46	1.100
7–9 chronic eligible HCCs	25,247	$24,172.45	$25,147.09	1.040
10+ chronic eligible HCCs	27,645	$42,437.75	$38,253.73	0.901
2023 ESRD Model				
Entire sample	97,530	$28,028.41	$28,028.41	1.000
0 chronic eligible HCCs	2,460	$7,214.76	$10,649.00	1.476
1–3 chronic eligible HCCs	11,398	$13,571.47	$14,131.69	1.041
4–6 chronic eligible HCCs	24,501	$18,542.18	$19,817.01	1.069
7–9 chronic eligible HCCs	26,510	$24,917.48	$26,575.05	1.067
10+ chronic eligible HCCs	32,661	$43,882.25	$41,144.22	0.938

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-80
Predictive ratios by count of chronic conditions: Aged functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	36,883	$27,231.59	$27,279.17	1.002
0 chronic eligible HCCs	797	$5,196.13	$14,186.60	2.730
1–3 chronic eligible HCCs	3,480	$12,869.18	$16,471.27	1.280
4–6 chronic eligible HCCs	9,195	$17,287.33	$20,187.30	1.168
7–9 chronic eligible HCCs	10,491	$24,748.31	$25,615.06	1.035
10+ chronic eligible HCCs	12,920	$43,101.08	$38,494.07	0.893
2023 ESRD Model				
Entire sample	42,342	$30,290.78	$30,290.78	1.000
0 chronic eligible HCCs	909	$6,532.84	$13,995.21	2.142
1–3 chronic eligible HCCs	3,052	$14,014.14	$17,058.21	1.217
4–6 chronic eligible HCCs	8,919	$18,054.08	$21,215.80	1.175
7–9 chronic eligible HCCs	12,116	$25,348.66	$27,125.76	1.070
10+ chronic eligible HCCs	17,346	$44,688.21	$40,744.14	0.912

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-81
Predictive ratios by count of chronic conditions: Non-aged functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	61,397	$23,411.83	$23,455.50	1.002
0 chronic eligible HCCs	2,007	$7,644.17	$11,277.17	1.475
1–3 chronic eligible HCCs	11,657	$12,587.66	$13,822.16	1.098
4–6 chronic eligible HCCs	18,252	$17,435.91	$18,493.87	1.061
7–9 chronic eligible HCCs	14,756	$23,706.23	$24,768.21	1.045
10+ chronic eligible HCCs	14,725	$41,801.27	$38,023.11	0.910
2023 ESRD Model				
Entire sample	55,188	$26,154.93	$26,154.93	1.000
0 chronic eligible HCCs	1,551	$7,708.45	$8,226.47	1.067
1–3 chronic eligible HCCs	8,346	$13,384.88	$12,898.11	0.964
4–6 chronic eligible HCCs	15,582	$18,850.07	$18,934.65	1.004
7–9 chronic eligible HCCs	14,394	$24,527.48	$26,076.92	1.063
10+ chronic eligible HCCs	15,315	$42,942.97	$41,610.49	0.969

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-82
Predictive ratios by count of chronic conditions: Any Medicaid functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	37,245	$28,301.84	$26,418.74	0.933
0 chronic eligible HCCs	774	$11,390.95	$13,281.34	1.166
1–3 chronic eligible HCCs	5,940	$14,344.37	$15,174.17	1.058
4–6 chronic eligible HCCs	10,524	$19,713.77	$20,071.74	1.018
7–9 chronic eligible HCCs	9,385	$26,801.25	$26,384.46	0.984
10+ chronic eligible HCCs	10,622	$47,834.85	$40,455.24	0.846
2023 ESRD Model				
Entire sample	35,356	$31,331.81	$30,753.41	0.982
0 chronic eligible HCCs	562	$11,596.56	$11,965.43	1.032
1–3 chronic eligible HCCs	4,323	$14,931.18	$15,056.41	1.008
4–6 chronic eligible HCCs	9,095	$21,264.69	$21,366.11	1.005
7–9 chronic eligible HCCs	9,407	$27,293.40	$28,941.30	1.060
10+ chronic eligible HCCs	11,969	$48,794.71	$45,639.87	0.935

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-83
Predictive ratios by count of chronic conditions: Non-Medicaid functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	61,035	$23,021.95	$24,182.51	1.050
0 chronic eligible HCCs	2,030	$5,312.87	$11,902.20	2.240
1–3 chronic eligible HCCs	9,197	$11,615.18	$14,111.40	1.215
4–6 chronic eligible HCCs	16,923	$16,008.38	$18,552.54	1.159
7–9 chronic eligible HCCs	15,862	$22,715.71	$24,461.40	1.077
10+ chronic eligible HCCs	17,023	$39,215.74	$36,939.45	0.942
2023 ESRD Model				
Entire sample	62,174	$26,180.57	$26,504.11	1.012
0 chronic eligible HCCs	1,898	$5,995.25	$10,282.62	1.715
1–3 chronic eligible HCCs	7,075	$12,732.43	$13,561.06	1.065
4–6 chronic eligible HCCs	15,406	$16,945.64	$18,908.58	1.116
7–9 chronic eligible HCCs	17,103	$23,642.40	$25,305.14	1.070
10+ chronic eligible HCCs	20,692	$41,111.03	$38,608.13	0.939

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-84
Predictive ratios by count of chronic conditions: Full benefit dual functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	27,855	$30,081.30	$26,921.79	0.895
0 chronic eligible HCCs	560	$12,125.49	$13,250.51	1.093
1–3 chronic eligible HCCs	4,402	$15,121.60	$15,211.46	1.006
4–6 chronic eligible HCCs	7,698	$20,677.83	$20,247.56	0.979
7–9 chronic eligible HCCs	6,942	$28,328.22	$26,534.86	0.937
10+ chronic eligible HCCs	8,253	$49,975.08	$40,956.14	0.820
2023 ESRD Model				
Entire sample	26,341	$33,163.50	$32,214.00	0.971
0 chronic eligible HCCs	370	$12,514.49	$12,741.57	1.018
1–3 chronic eligible HCCs	3,180	$15,998.76	$15,789.17	0.987
4–6 chronic eligible HCCs	6,657	$22,430.86	$22,179.38	0.989
7–9 chronic eligible HCCs	6,919	$28,249.32	$29,989.16	1.062
10+ chronic eligible HCCs	9,215	$51,098.81	$47,315.24	0.926

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-85
Predictive ratios by count of chronic conditions: Partial benefit dual functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	11,339	$25,364.84	$25,293.65	0.997
0 chronic eligible HCCs	243	$11,412.13	$13,396.71	1.174
1–3 chronic eligible HCCs	1,818	$13,211.78	$15,099.30	1.143
4–6 chronic eligible HCCs	3,370	$17,906.69	$19,627.17	1.096
7–9 chronic eligible HCCs	2,947	$24,679.97	$26,013.09	1.054
10+ chronic eligible HCCs	2,961	$44,234.54	$39,073.16	0.883
2023 ESRD Model				
Entire sample	10,984	$28,027.80	$27,265.62	0.973
0 chronic eligible HCCs	224	$11,279.97	$10,870.41	0.964
1–3 chronic eligible HCCs	1,354	$12,685.50	$13,338.78	1.051
4–6 chronic eligible HCCs	2,931	$19,586.07	$19,492.90	0.995
7–9 chronic eligible HCCs	3,033	$26,162.08	$26,495.00	1.013
10+ chronic eligible HCCs	3,442	$43,892.30	$41,005.66	0.934

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-86
Predictive ratios by count of chronic conditions: Non-dual functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	66,344	$23,843.30	$24,327.14	1.020
0 chronic eligible HCCs	2,190	$5,769.14	$11,986.12	2.078
1–3 chronic eligible HCCs	10,121	$12,011.01	$14,189.10	1.181
4–6 chronic eligible HCCs	18,382	$16,555.47	$18,632.94	1.125
7–9 chronic eligible HCCs	17,179	$23,524.27	$24,650.35	1.048
10+ chronic eligible HCCs	18,472	$40,713.40	$37,238.39	0.915
2023 ESRD Model				
Entire sample	67,370	$26,856.91	$26,633.65	0.992
0 chronic eligible HCCs	2,013	$6,424.49	$10,279.11	1.600
1–3 chronic eligible HCCs	7,823	$13,034.37	$13,556.29	1.040
4–6 chronic eligible HCCs	16,826	$17,342.16	$19,007.23	1.096
7–9 chronic eligible HCCs	18,417	$24,199.33	$25,473.71	1.053
10+ chronic eligible HCCs	22,291	$42,460.88	$38,983.72	0.918

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-87
Predictive ratios by count of payment conditions: Aged functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	36,883	$27,231.59	$27,279.17	1.002
0 payment HCCs	3,469	$10,756.42	$14,250.36	1.325
1–3 payment HCCs	17,096	$18,950.02	$20,673.08	1.091
4–6 payment HCCs	10,360	$30,819.80	$31,475.84	1.021
7–9 payment HCCs	4,028	$51,921.49	$44,685.99	0.861
10+ payment HCCs	1,930	$77,428.88	$63,929.34	0.826
2023 ESRD Model				
Entire sample	42,342	$30,290.78	$30,290.78	1.000
0 payment HCCs	3,131	$10,599.44	$14,129.94	1.333
1–3 payment HCCs	18,422	$20,228.49	$21,846.56	1.080
4–6 payment HCCs	12,910	$33,044.05	$33,718.01	1.020
7–9 payment HCCs	5,326	$51,249.01	$47,222.70	0.921
10+ payment HCCs	2,553	$80,883.22	$67,115.65	0.830

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-88
Predictive ratios by count of payment conditions: Non-aged functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	61,397	$23,411.83	$23,455.50	1.002
0 payment HCCs	7,951	$10,058.41	$11,043.62	1.098
1–3 payment HCCs	29,575	$17,114.63	$17,670.87	1.033
4–6 payment HCCs	15,636	$28,302.14	$28,987.10	1.024
7–9 payment HCCs	5,749	$43,991.95	$42,062.85	0.956
10+ payment HCCs	2,486	$71,543.77	$61,924.64	0.866
2023 ESRD Model				
Entire sample	55,188	$26,154.93	$26,154.93	1.000
0 payment HCCs	5,130	$10,049.02	$7,987.55	0.795
1–3 payment HCCs	25,739	$18,416.93	$17,392.07	0.944
4–6 payment HCCs	16,085	$28,981.77	$31,208.07	1.077
7–9 payment HCCs	5,866	$45,119.82	$47,482.81	1.052
10+ payment HCCs	2,368	$77,528.19	$71,380.46	0.921

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-89
Predictive ratios by count of payment conditions: Full benefit dual functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	27,855	$30,081.30	$26,921.79	0.895
0 payment HCCs	2,741	$12,860.76	$12,410.06	0.965
1–3 payment HCCs	12,710	$20,831.96	$19,452.19	0.934
4–6 payment HCCs	7,632	$32,586.72	$30,747.23	0.944
7–9 payment HCCs	3,211	$52,936.76	$44,043.47	0.832
10+ payment HCCs	1,561	$84,143.75	$65,233.72	0.775
2023 ESRD Model				
Entire sample	26,341	$33,163.50	$32,214.00	0.971
0 payment HCCs	1,712	$12,661.40	$11,583.39	0.915
1–3 payment HCCs	11,227	$21,693.53	$20,819.84	0.960
4–6 payment HCCs	8,305	$33,958.97	$35,163.83	1.035
7–9 payment HCCs	3,345	$53,067.57	$52,025.11	0.980
10+ payment HCCs	1,752	$89,431.07	$77,124.97	0.862

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-90
Predictive ratios by count of payment conditions: Partial benefit dual functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	11,339	$25,364.84	$25,293.65	0.997
0 payment HCCs	1,226	$12,744.68	$12,574.98	0.987
1–3 payment HCCs	5,422	$17,538.95	$19,169.04	1.093
4–6 payment HCCs	3,026	$30,026.59	$30,100.50	1.002
7–9 payment HCCs	1,167	$48,303.93	$43,049.05	0.891
10+ payment HCCs	498	$72,396.29	$62,916.39	0.869
2023 ESRD Model				
Entire sample	10,984	$28,027.80	$27,265.62	0.973
0 payment HCCs	834	$11,116.10	$9,642.41	0.867
1–3 payment HCCs	5,010	$19,461.14	$18,474.41	0.949
4–6 payment HCCs	3,278	$30,497.57	$31,247.89	1.025
7–9 payment HCCs	1,323	$47,935.23	$46,750.07	0.975
10+ payment HCCs	539	$74,169.76	$68,036.32	0.917

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-91
Predictive ratios by count of payment conditions: Non-dual functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	66,344	$23,843.30	$24,327.14	1.020
0 payment HCCs	8,252	$9,568.88	$12,020.69	1.256
1–3 payment HCCs	31,835	$17,296.62	$18,632.14	1.077
4–6 payment HCCs	17,294	$28,990.77	$29,776.65	1.027
7–9 payment HCCs	6,189	$46,151.05	$42,881.47	0.929
10+ payment HCCs	2,774	$72,751.90	$61,708.72	0.848
2023 ESRD Model				
Entire sample	67,370	$26,856.91	$26,633.65	0.992
0 payment HCCs	6,272	$9,737.31	$10,358.87	1.064
1–3 payment HCCs	31,064	$18,632.78	$18,942.01	1.017
4–6 payment HCCs	19,590	$30,467.87	$31,408.61	1.031
7–9 payment HCCs	7,365	$47,265.92	$45,486.67	0.962
10+ payment HCCs	3,079	$77,580.65	$65,321.94	0.842

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-92
Predictive ratios by post-graft factor: Functioning graft community continuing enrollees

Post-graft factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	97,806	$24,786.13	$24,831.56	1.002
Non-Aged, 4–9 months since transplant	9,335	$36,998.29	$37,007.18	1.000
Non-Aged, 10+ months since transplant	51,871	$22,285.44	$22,319.85	1.002
Aged, 4–9 months since transplant	2,626	$43,266.28	$43,222.86	0.999
Aged, 10+ months since transplant	33,974	$26,534.18	$26,601.60	1.003
2023 ESRD Model				
Entire sample	97,044	$27,804.45	$27,804.45	1.000
Non-Aged, 4-9 months since transplant, Non-Dual and Partial Benefit Dual	6,442	$36,156.88	$37,133.35	1.027
Non-Aged, 10+ months since transplant, Non-Dual and Partial Benefit Dual	35,746	$23,723.50	$23,838.89	1.005
Non-Aged, 4-9 months since transplant, Full Benefit Dual	3,769	$40,889.25	$41,875.95	1.024
Non-Aged, 10+ months since transplant, Full Benefit Dual	18,690	$29,351.24	$29,172.88	0.994
Aged, 4-9 months since transplant, Non-Dual and Partial Benefit Dual	3,231	$40,362.26	$40,588.96	1.006
Aged, 10+ months since transplant, Non-Dual and Partial Benefit Dual	36,323	$28,855.02	$28,830.96	0.999
Aged, 4-9 months since transplant, Full Benefit Dual	455	$50,679.33	$49,404.15	0.975
Aged, 10+ months since transplant, Full Benefit Dual	5,292	$40,282.20	$38,259.64	0.950

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2020 and 2023 ESRD models because renal HCCs 132–141 are excluded from the functioning graft model.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-93
Predictive ratios by post-graft factor: Functioning graft institutional continuing enrollees

Post-graft factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	906	$51,704.15	$51,722.00	1.000
Non-Aged, 4–9 months since transplant	*			
Non-Aged, 10+ months since transplant	325	$52,923.88	$55,418.51	1.047
Aged, 4–9 months since transplant	*			
Aged, 10+ months since transplant	563	$51,146.61	$49,246.97	0.963
2023 ESRD Model				
Entire sample	898	$64,625.44	$64,625.44	1.000
Non-Aged, 4-9 months since transplant, Non-Dual and Partial Benefit Dual	*			
Non-Aged, 10+ months since transplant, Non-Dual and Partial Benefit Dual	43	$114,362.71	$73,451.16	0.642
Non-Aged, 4-9 months since transplant, Full Benefit Dual	*			
Non-Aged, 10+ months since transplant, Full Benefit Dual	256	$75,120.38	$75,451.95	1.004
Aged, 4-9 months since transplant, Non-Dual and Partial Benefit Dual	*			
Aged, 10+ months since transplant, Non-Dual and Partial Benefit Dual	174	$64,943.26	$57,009.96	0.878
Aged, 4-9 months since transplant, Full Benefit Dual	*			
Aged, 10+ months since transplant, Full Benefit Dual	467	$60,192.59	$60,018.53	0.997

NOTE:
1. An asterisk * indicates data suppressed because cell count less than or equal to 30.
SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-94
Predictive ratios by post-graft factor: Functioning graft new enrollees

Post-graft factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Entire sample	6,779	$22,921.40	$22,922.77	1.000
Non-Aged, 4–9 months since transplant	1,181	$32,198.55	$36,454.65	1.132
Non-Aged, 10+ months since transplant	3,872	$22,683.24	$21,643.27	0.954
Aged, 4–9 months since transplant	146	$32,535.57	$37,162.86	1.142
Aged, 10+ months since transplant	1,580	$20,181.24	$20,385.19	1.010
2023 ESRD Model				
Entire sample	6,853	$24,770.39	$24,776.49	1.000
Non-Aged, 4-9 months since transplant, Non-Dual and Partial Benefit Dual	952	$28,502.92	$26,510.11	0.930
Non-Aged, 10+ months since transplant, Non-Dual and Partial Benefit Dual	2,756	$21,184.06	$21,178.67	1.000
Non-Aged, 4-9 months since transplant, Full Benefit Dual	653	$33,564.70	$33,683.40	1.004
Non-Aged, 10+ months since transplant, Full Benefit Dual	1,282	$29,910.73	$29,268.61	0.979
Aged, 4-9 months since transplant, Non-Dual and Partial Benefit Dual	200	$33,924.85	$31,672.99	0.934
Aged, 10+ months since transplant, Non-Dual and Partial Benefit Dual	1,571	$20,442.55	$23,118.29	1.131
Aged, 4-9 months since transplant, Full Benefit Dual	32	$35,193.66	$41,573.80	1.181
Aged, 10+ months since transplant, Full Benefit Dual	193	$47,448.01	$36,366.96	0.766

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.

Table 5-95
Predictive ratios by kidney transplant factor: Kidney transplant enrollees

Kidney transplant factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2020 ESRD Model				
Kidney transplant month 1	9,606	$41,260.76	$41,260.76	1.000
Kidney transplant month 2	9,405	$7,274.64	$6,126.29	0.842
Kidney transplant month 3	9,246	$4,958.20	$6,126.29	1.236
Kidney transplant months 2 and 3	8,481	$12,096.78	$12,252.58	1.013
2023 ESRD Model				
Kidney transplant month 1	11,478	$43,517.92	$43,517.92	1.000
Kidney transplant month 2	11,189	$8,053.08	$6,840.27	0.849
Kidney transplant month 3	10,958	$5,601.89	$6,840.27	1.221
Kidney transplant months 2 and 3	10,093	$13,395.88	$13,680.54	1.021

SOURCE: RTI International analysis of Medicare 2014–2015 (V21) and 2018-2019 (V24) 100% ESRD sample claims and enrollment data.