REPORT TO CONGRESS: RISK ADJUSTMENT IN MEDICARE ADVANTAGE

DECEMBER 2018

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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 risk adjustment model and the End-Stage Renal Disease (ESRD) risk adjustment model under the Medicare Advantage program every three years, with the first report to be submitted no later than December 31, 2018. 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 Medicare Advantage plans, including very high and very low cost enrollees, and groups defined by the number of chronic conditions of enrollees.

This is the first report on risk adjustment in Medicare Advantage required by the 21st Century Cures Act. It provides information on the accuracy of the Centers for Medicare & Medicaid Services (CMS) Hierarchical Condition Categories (HCC) and ESRD risk adjustment models. The standard measure of accuracy applied to the CMS-HCC model is the predictive ratio, which is a ratio of predicted cost to actual cost, for sub-groups of beneficiaries within the model sample. We include predictive ratios for both CMS-HCC models to be implemented in payment year 2019, a CMS-HCC model with additional factors that take into account the number of conditions a beneficiary has, and the ESRD models implemented for plan year 2019. 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 Fee-for-Service (FFS) program. CMS does not uniformly collect cost information for beneficiaries enrolled in the Medicare Advantage program. While some cost information is available in aggregate from plan bids, and at an enrollee level from encounter data records submitted to CMS, this information is not consistently defined between plans. For example, some plans participate in capitated or other non-FFS payment arrangements with providers for which a price per service cannot be determined at the encounter level. Thus, in our estimation the cost information available would not accurately reflect the actual cost of providing services in Medicare Advantage. Hence, the evaluation is conducted with beneficiaries in the traditional Medicare FFS program. We provide the predicted and actual cost for each population sub group considered so that interested stakeholders may consider and compare the cost expected in FFS Medicare for each defined sub-group.

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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 private insurers, otherwise known as Medicare Advantage Organizations (MAOs) that contract with the Centers for Medicare and Medicaid Services (CMS) to provide benefits as an alternative to the traditional Fee-for-Service (FFS) Medicare program. Anyone who is eligible for Medicare may elect to enroll in a Medicare Advantage plan offered in the service area in which he or she resides.[1] The Medicare Advantage program is an attractive option for some Medicare beneficiaries. Plans typically offer additional 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 Medicare Advantage enrollment as a proportion of total Medicare enrollment from 2003, when approximately 13 percent of the Medicare population was enrolled in a Medicare Advantage plan, to today in 2018, when Medicare Advantage enrollees account for over one-third of all Medicare beneficiaries.

CMS pays each MAO a monthly per-person amount for each beneficiary enrolled in its plan. The plan payment rates are determined by the plan's bid, which is submitted 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 bids are compared to a benchmark for the county, region, or state where the plan is offering services. The benchmark is the average Medicare FFS cost in the service area multiplied by a statutorily set percentage that varies based on the area's rank in a list of the highest to lowest average Medicare FFS cost. The benchmark is the maximum rate CMS will pay an MAO 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 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 pay for additional benefits not covered under the traditional Medicare FFS program or to buy-down premiums.

The per-person amount paid to each plan for enrolled beneficiaries is adjusted to account for differences in health status between enrolled beneficiaries. This is 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

[1] Exceptions are (1) beneficiaries entitled only to Part A and not enrolled in Part B, or those enrolled in Part B and not entitled to Part A, and (2) beneficiaries with end-stage renal disease (ESRD) at the time of enrollment. The exception for beneficiaries with ESRD will be eliminated in 2021 per Section 17006 (a) of the 21st Century Cures Act.

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 patients would be paid more than if they had enrolled beneficiaries with the average risk profile. The specific method of risk adjustment 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.[2]

Risk adjustment that included an adjustment for health status (the same method that is employed in Medicare Advantage today) was first authorized by the BBA in response to how individual enrollee's 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 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 "average area per capita cost" (AAPCC) for a given beneficiary's county of residence. Payments were discounted five percent based on the assumption at the time that Health Maintenance Organizations (HMOs) could operate more efficiently than FFS. Final payment amounts were adjusted for the relative risk associated with individual enrollee's demographic characteristics: age, sex, institutional status, and eligibility for Medicaid (or welfare). Enrollment in Medicare HMOs grew to around 6 million beneficiaries, approximately 15 percent of Medicare enrollment at the time, 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.[3] 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, 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 inpatient claims only.[4] Risk adjustment was 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

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[2] Health Care Financing Administration, "Proposed Method of Incorporating Health Status Risk Adjusters Into Medicare+Choice Payments" (March 1999), accessed at: https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/RTC_RiskAdjusters1999.pdf

[3] GAO, "Medicare HMOs: HCFA Can Promptly Eliminate Hundreds of Millions in Excess Payments," GAO/HEHS-97-16, Apr. 25, 1997, accessed at http://www.gao.gov/assets/230/224084.pdf.

[4] 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.

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.[5] Similar to the PIP-DCG model, the CMS-HCC model adjusts Medicare capitation payments to MAOs 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 MAOs be paid based on the variation in expected health care costs of the population they enroll, and reducing the incentive for biased selection in Medicare's risk based payment program.

1.2 Risk Adjustment Provisions in the 21st Century Cures Act

Since the MMA was enacted in 2003, the methodology for determining the fixed monthly rate per Medicare Advantage enrollee, and calculating the risk score – the output of the CMS-HCC model – has changed as Congress and other policymakers have made changes to pay more accurately, improve the quality of care provided to Medicare Advantage, and promote competition among MAOs. However, the statute governing the structure of the risk adjustment model has not changed. The Secretary of Health and Human Services (HHS) has retained broad discretion to determine how to adjust for health status in risk adjustment. Since the MMA, Section 1853 (a)(1)(C)(i) of the Social Security Act has provided:

> IN GENERAL.—The Secretary shall adjust the payment amount under subparagraph (A)(i) and the amount specified under subparagraph (B)(i), (B)(ii), and (B)(iii) for such risk factors as age, disability status, gender, institutional status, and such other factors as the Secretary determines to be appropriate, including adjustment for health status under paragraph (3), so as to ensure actuarial equivalence. The Secretary may add to, modify, or substitute for such adjustment factors if such changes will improve the determination of actuarial equivalence.

Section 17006(f) of the 21st Century Cures Act amends Section 1853(a)(1) of the Social Security 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), the :

> (i) IN GENERAL.—In order to determine the appropriate adjustment for health status under subparagraph (C)(i), the following shall apply:

[5] 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.

(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.
(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 requires 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)) and individuals who are not full-benefit dual eligible.[6] 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 required provisions in the 21st Century Cures Act, CMS conducted research from April to November 2017 and considered several changes in how health status is taken into account when adjusting payments to Medicare Advantage plans for the risk of providing benefits to the Medicare beneficiaries they enroll. Independent of the 21st Century Cures Act, CMS implemented a model in Payment Year (PY) 2017 that made an adjustment for differences in health status between beneficiaries who are dually eligible for Medicare and

[6] 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.

Medicaid and those who are not. Beneficiaries in the community receive a separate adjustments depending on whether they are full, partial, or non-dual. We believe that splitting the community segment of the CMS-HCC model into six segments based on duals status, which was first done in payment year 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 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 and 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 PY2019 Advance Notice, published December 27, 2017. However, in response to stakeholder requests for additional information on the proposed model that included factors to take into account the number of conditions each beneficiary has, CMS did not finalize this proposed model in 2019. Instead, CMS used the time to provide additional information to stakeholders, and we will begin phasing-in a model that takes into account the number of conditions a beneficiary may have in 2020. As required by the 21st Century Cures Act, the model will be phased-in over three years from 2020 to 2022 with the model fully implemented in 2022.

In PY 2019 CMS is phasing-in a risk adjustment model with additional factors for substance use disorder, mental health, and Chronic Kidney Disease diagnoses, which was finalized in the "Announcement of Calendar Year (CY) 2019 Medicare Advantage Capitation Rates and Medicare Advantage and Part D Payment Policies and Final Call Letter," published April 2, 2018. Historically, CMS has phased-in risk adjustment models by blending risk scores over several years until 100 percent of the risk score is calculated with the new model. A blended risk score is calculated by first calculating separate risk scores with each model in the blend then summing each risk score weighted by the proportion determined in the blend. For example, see the relevant Advance Notice and Rate Announcement documents on the transition from the 2012 v12 model to the 2014 v22 model between PY2014 and PY2016. This method of phasing-in revisions to a risk adjustment model is maintained in PY 2019 when 25 percent of the risk score will be calculated with the model finalized for 2019 and 75 percent of the risk score will be calculated with the model implemented in 2017.[7]

Section 2 of this report provides an in-depth review of the CMS-HCC model. Section 3 is a detailed evaluation of the CMS-HCC and ESRD models. Section 4 discusses ongoing research on the CMS-HCC and ESRD risk adjustment models. Finally, Section 5 provides data underlying CMS evaluation of CMS-HCC risk adjustment models.

[7] Advance Notice of Methodological Changes and Announcement of Calendar Year Medicare Capitation Rates and Medicare Advantage and Part D Payment Policies: https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Announcements-and-Documents.html?DLSort=2&DLEntries=10&DLPage=1&DLSortDir=descending

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

In this section we present an introduction and overview on the CMS-HCC risk adjustment system. As mentioned in the introduction, risk adjustment is a method of adjusting capitation payments to 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, co-payment amounts, etc. charged to individuals or groups of enrollees within the rules of markets in which they operate. The risk adjustment models used in the Medicare Advantage 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 expected cost associated with their age, sex, and the conditions they have. As with any insurance design, risk adjustment is intended to be accurate at the group level. At the individual level, predicted medical costs can be lower or higher than actual medical costs, but 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 2017, the Medicare program, administered by CMS, provides insurance to approximately 58 million beneficiaries (CMS, 2018). 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 cost and may require more care, which will lead to higher medical costs on average than their healthier counterparts. 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 Medicare Advantage 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.[8] For example, if a health plan were to set high copayment rates for office visits to specialists, beneficiaries needing care from specialists might not to enroll in that plan. To address this issue of risk selection and to compensate Medicare Advantage health plans for accepting the risk of enrolling beneficiaries of varying health statuses, the Medicare Advantage program uses risk adjustment, along with benefit-related policies that serve to maintain a level playing field and encourage competition among plans.

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

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

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.[9] The predicted costs from the risk adjustment models are then converted to relative risk factors so that payment adjustments can be made relative to the average Medicare 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.[10] 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 Medicare Advantage plans, CMS reduces the incentives of these plans to risk select only the healthiest beneficiaries and avoids indirectly penalizing plans that provide care for the most seriously ill beneficiaries. For beneficiaries with lower-than-average predicted costs, CMS pays the MAO an amount that is incrementally lower based on their risk profile and, for beneficiaries with higher-than-average predicted costs, CMS pays the MAO 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 these conditions as well as the comorbidities and complications related to these conditions. Section 3 presents the evaluation of the model's ability to predict risk for enrollee groups that have concentrations 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 are proposed in the annual Advance Notice, then subsequently finalized in the Rate Announcement pursuant to section 1853(b) of the Social Security Act. Types of changes to the model include updates to data years –pairwise years of diagnosis and cost information– to adjust the model coefficients to take into account more recent patterns of health status and cost in the FFS Medicare 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 sub-populations.

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

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

In Medicare Advantage, all risk adjustment models in use for payment are HCC-based models. Model segments are named by the sub-population for which they predict cost, the version, and the payment years they are in use. The version of the model indicates clinical classification of the conditions (HCCs). Occasionally 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.

Table 2-1 presents a summary of the Medicare Advantage risk adjustment models and their explanatory power for individual beneficiary's cost as measured by R^2. It is followed by a description of each of the 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 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 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).[11,12,13] 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 use of 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 Principal Inpatient Diagnostic Cost Group (PIP-DCG) model as its health-based payment risk adjuster (Pope et al., 2000a). This model estimated beneficiary health status (the expected 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,

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[11] 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.

[12] 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.

[13] 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.

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.

Table 2-1
Medicare managed care historic risk adjustment model R^2 statistics

Risk adjustment model	Payment years	R^2
Adjusted Average Per Capita Cost (AAPCC)[2]	pre-2000	0.0077
PIP-DCG[2]	2000-2003	0.055
Version 12 CMS-HCC[3]	2004-2006	0.0976
Version 12 CMS-HCC[3]	2007-2008	0.1049
Version 12 CMS-HCC[3]	2009-2012	0.1091
Version 12 CMS-HCC[3]	2013-2015	0.1184
Version 22 CMS-HCC[4]	2014-2016	0.1189
Version 22 CMS-HCC Six Community Segments[3,5]	2017-2019	
Non-dual aged		0.1189
Non-dual disabled		0.1200
Partial-dual aged		0.1117
Partial-dual disabled		0.1234
Full-dual aged		0.1207
Full-dual disabled		0.1140
Version 23 CMS-HCC Six Community Segments[3,6,7]	2019	
Non-dual aged		0.1245
Non-dual disabled		0.1142
Partial-dual aged		0.1107
Partial-dual disabled		0.0981
Full-dual aged		0.1198
Full-dual disabled		0.1310

Notes:

[1.] The R^2 statistic refers to the percentage of variation in individual expenditures explained by the model.

[2.] The R^2 statistics for the three earliest models are based on the 1999-2000 calibration sample which included both community and institutional beneficiaries.

[3.] The R^2 statistic is calculated using the community continuing enrollees only, no months of institutional status are included.

[4.] The R^2 statistic for the V22 Single segment community model is based on the 2010-2011 calibration sample.

[5.] The R^2 statistics for the V22 six community segments are based on the 2013–2014 calibration sample.

[6.] The R^2 statistics for the V23 six community segments are based on the 2014–2015 calibration sample.

[7.] The V23 model apples HCPCS-filtered diagnoses to estimate the HCC coefficients. Previous models used specialty-filtered HCCs.

SOURCE: RTI analysis of Medicare claims and enrollment data—1999-2000, 2004-2005, and 2006-2007 5% sample; 2010-2011, 2013–2014, and 2014–2015 full 100% samples.

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".[14] 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 previous methodology, increasing explanatory power of individual variation in beneficiaries' expenditures to about 10 percent (compared to 5.5 percent in the PIP-DCG model).

One of the CMS-HCC model's strengths is its facility to be improved with modification—as evidenced by the most recent update that will be implemented in 2019. CMS updates the software annually to account for changes in International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes and, since October 2015, ICD-10-CM diagnosis codes. It recalibrates the model regularly on more recent diagnosis and expenditure data. Periodically, CMS conducts a clinical 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. A major clinical revision was done in 2009 and resulted in the models that were implemented for the Program of All-Inclusive Care for the Elderly (PACE) starting in 2012 and phased-in for Medicare Advantage starting in 2014; most recently the CMS-HCC model underwent a revision that will be implemented in 2019, in response to the 21st Century Cures Act. The model may also undergo periodic structural changes to improve its predictive power for subpopulations. For example, in payment year 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). These modifications have again increased the CMS-HCC model's explanatory power, raising it to 11-13 percent for most versions and segments of the model. (See **Table 3-1**.)[15]

A final modification to the most recent Version 23 CMS-HCC model calibration was in the diagnosis filtering method. The purpose of diagnosis filtering is to select diagnoses that are relevant to predicting costs. In the calibration for models other than the 2019 CMS-HCC model, Medicare uses 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.[16] For these models, roughly 70 physician specialty codes were

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[14] Centers for Medicare & Medicaid Services (CMS). 45 Day Notice for 2004 M+C Rates: Attachment 2. https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Advance2004.pdf. Last Modified, March 28, 2003.

[15] Throughout this report, we refer to V12, V21, V22, and V23 of the CMS-HCC risk adjustment model. These shorthand names refer to the versions of the model. Model versions are updated when the diagnosis-to-HCC mappings are changed, such as when we recalibrate to incorporate clinical and other updates. Not all model versions are used for payment.

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

acceptable, including 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 specialty, all diagnosis data on the claim was accepted.

Starting with the calibration of the CMS-HCC model finalized for 2019 payment, CMS used a filtering approach based on selected Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) codes to identify eligible diagnoses. 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 the FFS outpatient or professional claim, all data from that claim is applied to risk adjustment. If a claim contains only CPT/HCPCS codes that do not meet inclusion criteria, that claim is not included in the model calibration.[17]

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.[18] These codes should all relate to a reasonably well-specified disease or medical condition which 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.

[17] CMS uses HCPCS-based filtering to identify risk adjustment eligible diagnoses from encounter data records, which has been used in payment since 2015.

[18] 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, 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, 18 Aug. 2017, www.cdc.gov/nchs/icd/icd10cm.htm .

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 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 achieve a feasible, health-based payment system.

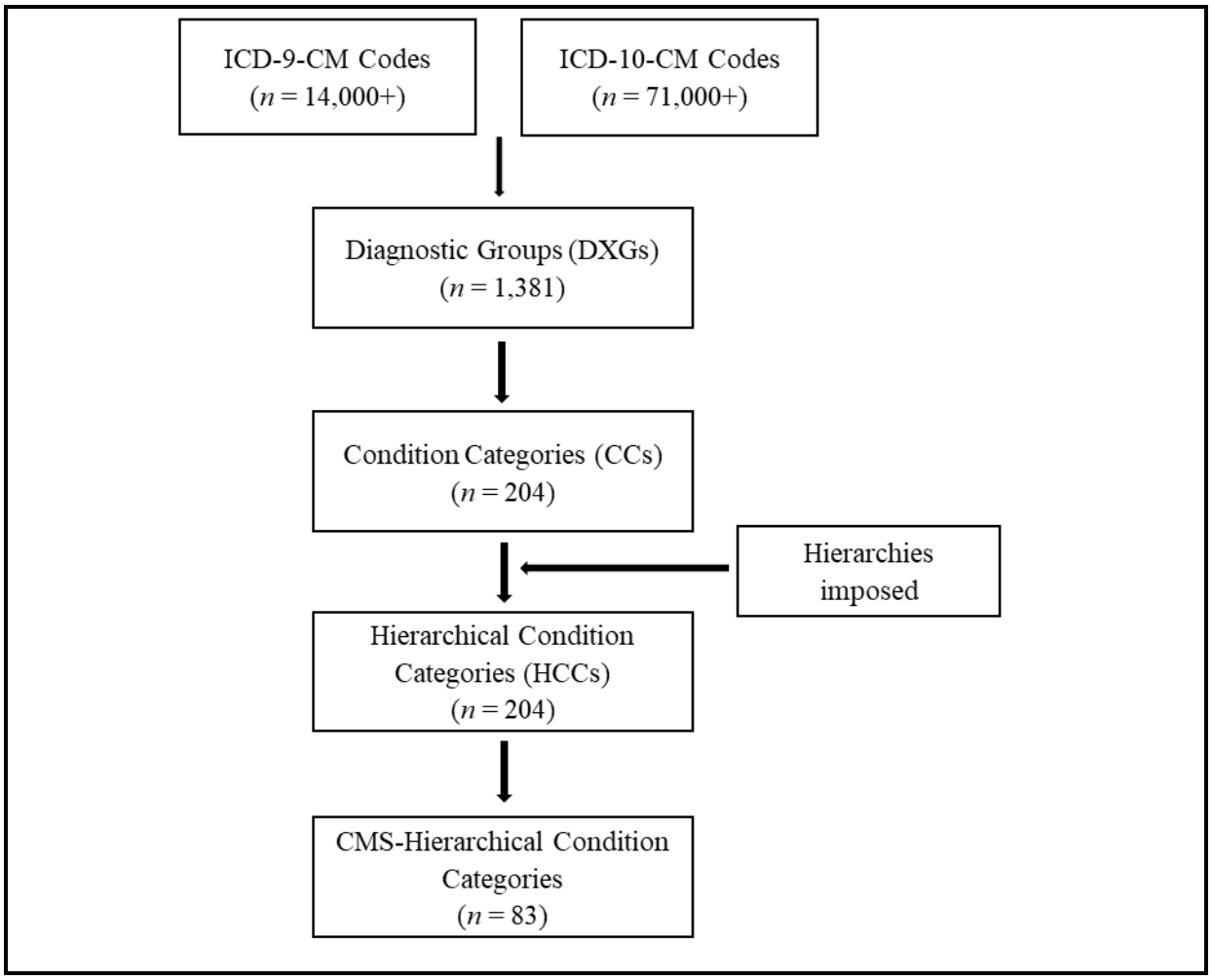
2.4 Elements and Organization of the CMS-HCC Model

2.4.1 Diagnostic Classification System

The HCC diagnostic classification system begins by classifying over 14,000 ICD-9-CM diagnosis codes (and over 71,000 ICD-10-CM diagnosis codes) into 1,391 diagnostic groups, or DXGs (see **Figure 2-1**). Each ICD-9-CM code maps to exactly one DXG, which represents a well-specified medical condition, such as *DXG 96.01 precerebral or cerebral arterial occlusion with infarction*. [19] DXGs are further aggregated into 204 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 *CC 96 Ischemic or Unspecified Stroke*, which includes *DXG 96.01 precerebral or cerebral arterial occlusion with infarction* and *DXG 96.02 acute but ill-defined cerebrovascular disease*.

[19] For explanatory purposes, this report primarily describes the classification of ICD-9-CM diagnosis codes because those codes were used in the calibrations of the models being evaluated. Because the structure of ICD-10-CM diagnosis codes differs and they may contain multiple clinical concepts, many ICD-10-CM diagnosis codes map to two or more DXGs. ICD-10 mappings are presently used for risk score calculation.

Figure 2-1
Aggregating ICD-9/10 codes into hierarchical condition categories



NOTE: ICD-9-CM is International Classification of Diseases, Ninth Revision, Clinical Modification. ICD-10-CM is International Classification of Diseases, Tenth Revision, Clinical Modification.

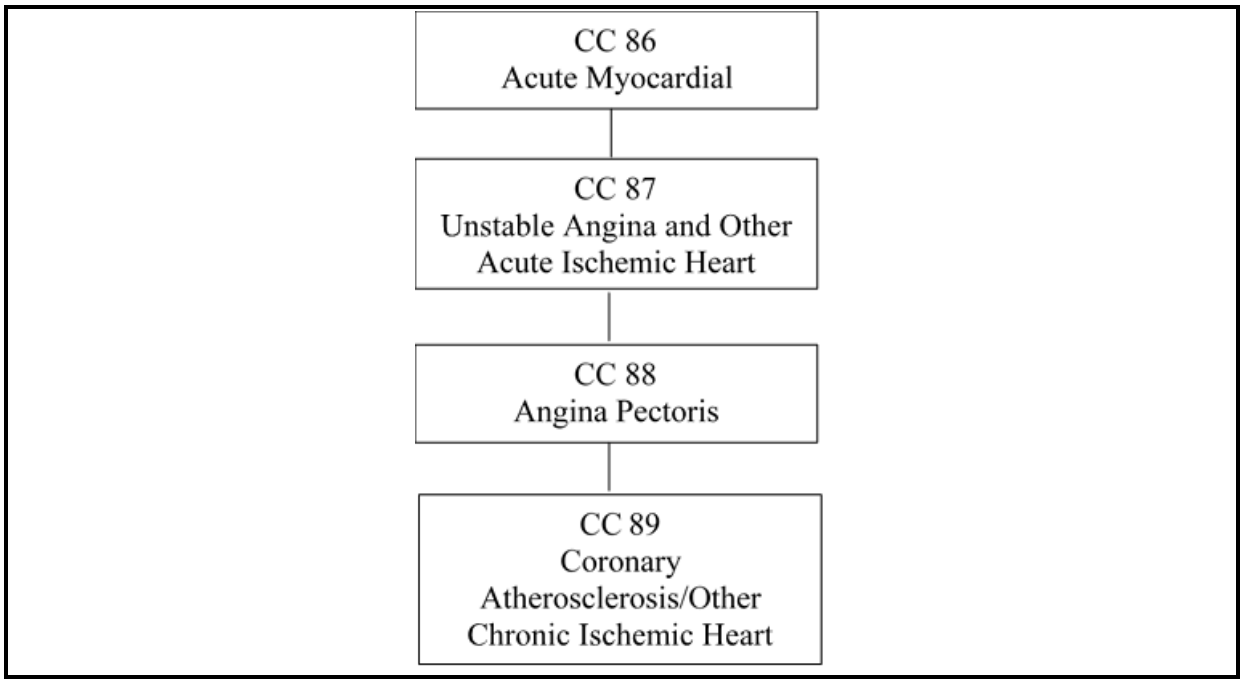
SOURCE: RTI International.

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-9-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 86 Acute Myocardial Infarction* to *CC 89 Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease*. All CCs that a person has are coded. For example, a person with ICD-9-CM diagnoses in *CC 87 Unstable Angina and Other Acute Ischemic Heart Disease* and *CC 88 Angina Pectoris/Old Myocardial Infarction* is coded with both CC 87 and CC 88.

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-9-CM code that groups into HCC 86, having CC 86 precludes HCCs 87 or 88 from being assigned, even if ICD-9-CM codes that group into those categories were also present. Similarly, a person with ICD-9-CM codes that group into both *CC 87 Unstable Angina and Other Acute Ischemic Heart Disease* and *CC 88 Angina Pectoris/Old Myocardial Infarction* is coded for HCC 87, but not HCC 88.

Figure 2-2
Hierarchical condition categories for coronary artery disease



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 predicted cost will reflect increments for all three problems.

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 expected 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 disease parameters included in the model.[20] 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–principal diagnoses, (2) hospital inpatient–secondary diagnoses, (3) hospital outpatient, and (4) physician and clinically-trained non-physician (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 CMS-HCC V22 model includes the 79 HCCs (out of a total of 201 HCCs) that best predict Part A and Part B medical expenditures as payment HCCs. The CMS-HCC V23 model includes 83 HCCs (out of a total of 204 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 V22 model implemented in 2017, 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 two-way disease-group interactions that correspond to highly prevalent conditions among the Medicare population that result in increased costs (e.g., diabetes and congestive heart failure). 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 as the community segments with additional interaction terms for conditions that are unique to this population, such as sepsis and pressure ulcers. 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.

[20] Note that not all disease parameters are used in the CMS-HCC payment model. See Section 3.4.3 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.

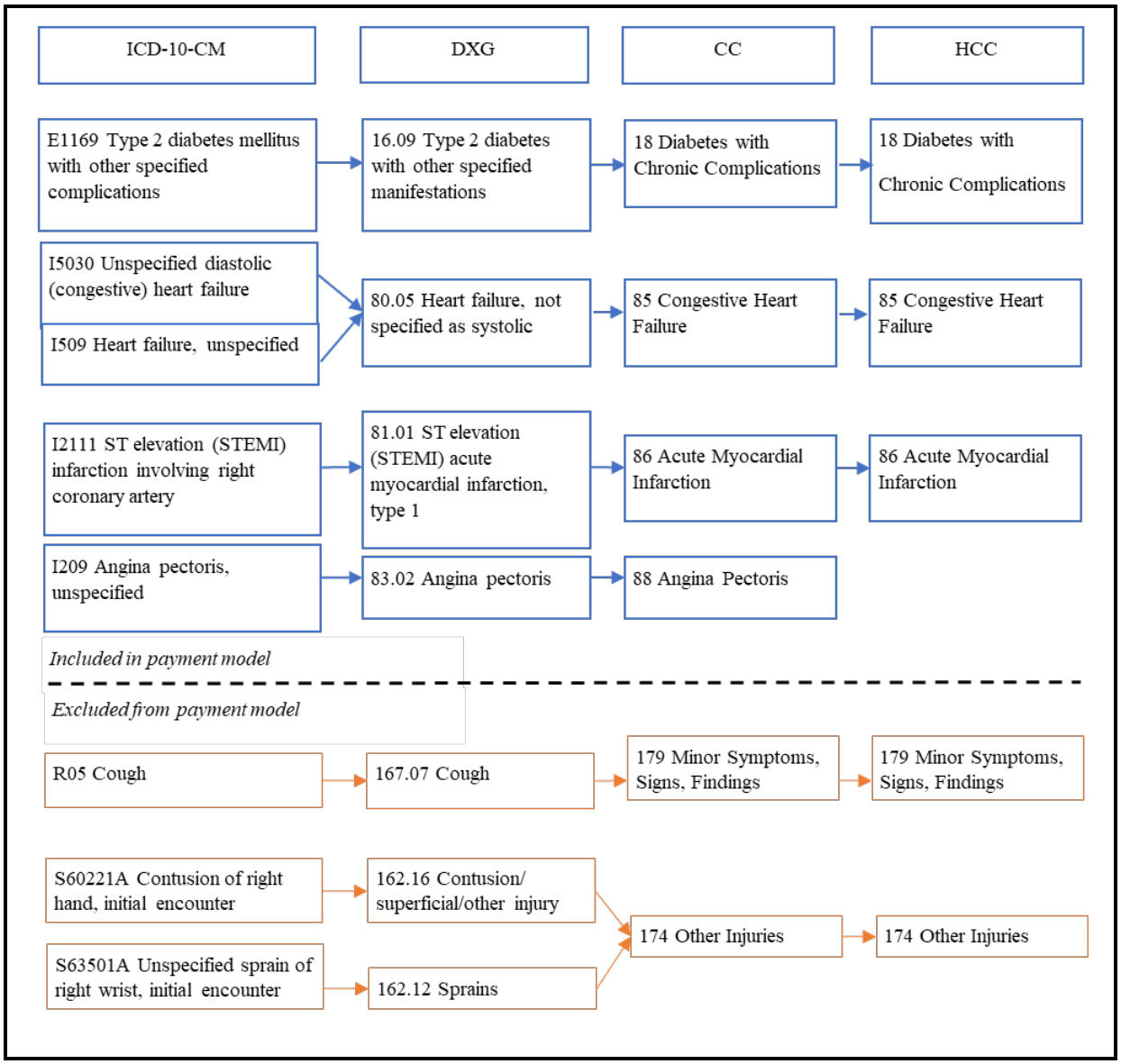
2.4.4 Clinical Vignette

To illustrate how the CMS-HCC model maps diagnoses to HCCs, we have created a hypothetical clinical vignette.[21] **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); angina pectoris; 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, Congestive heart failure, and AMI—that are used in risk adjusting Medicare Advantage payments. Two of the payment HCCs, Diabetes and Congestive 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 angina, he is not assigned the HCC for Angina, and the Medicare Advantage plan will receive no payment for angina, because AMI is a more severe manifestation of coronary artery disease, and thus excludes 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.

The predicted expenditures and risk score for the man in this hypothetical example are presented in **Table 2-2**. (Predicted FFS cost are from the Version 23 CMS-HCC model for the Full Benefit Dual Aged community segment, as estimated using 2014 diagnostic data and 2015 spending data, and are used here for illustrative purposes.) Along with the demographic factors of age 74 and male ($5,594), each of the three payment HCCs identified in the clinical vignette contributes additively to this person's risk profile (Diabetes with chronic complications $3,220; Congestive heart failure $3,323; AMI $3,843), and there is an additional disease interaction (Diabetes and Congestive heart failure $2,001). His total predicted expenditures are the sum of the individual increments, or $17,981. His total risk score is the total predicted FFS expenditure divided by the average predicted expenditure, or the sum of the individual relative factors, 1.920.

[21] We use ICD-10 codes here since that is how risk scores are calculated.

Figure 2-3
Clinical vignette for CMS-HCC (version 23) classification



NOTE: CC = condition category; DXG = diagnostic group; HCC = Hierarchical Condition Category; ICD-10-CM = International Classification of Diseases, Tenth Revision, Clinical Modification.

HCC 88 Angina Pectoris is a payment HCC. However, it is excluded from the clinical vignette for this patient since HCC 88 is in the same hierarchy as HCC 86, which is more severe.

SOURCE: RTI International

Table 2-2
Hypothetical example of CMS-HCC (version 23) Expenditure Predictions

Risk marker	Incremental prediction of FFS cost	Relative risk factor
Male, age 70–74	$5,594	0.597
Diabetes with chronic complications (HCC 18)	$3,220	0.344
Congestive heart failure (HCC 85)	$3,323	0.355
Acute myocardial infarction (HCC 86)	$3,843	0.410
Angina pectoris (HCC 88)[1]	$0	—
Cough (HCC 179)[2]	$0	—
Hand contusion and wrist sprain (HCC 174)[2]	$0	—
Diabetes and Congestive heart failure (interaction)	$2,001	0.214
Total raw risk score	$17,981	1.920

Notes:

[1.] HCC 88 Angina Pectoris has an incremental prediction, but the amount is not added because HCC 86 Acute Myocardial Infarction is within the same hierarchy and is the more severe manifestation of cardiovascular disease.

[2.] Cough (symptom associated with a variety of medical conditions from minor to serious) and contusion and sprain (typically transitory) are excluded from the payment model.

SOURCE: RTI International.

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

As discussed in Section 1.2, the 21st Century Cures Act requires several amendments, intended as improvements, to risk adjustment for Medicare Advantage, which must be completely phased in for payments beginning January 2022 and subsequent years. The PY2017 CMS-HCC risk adjustment model was based on V22 of the CMS-HCC classification, while the 2019 CMS-HCC risk adjustment model is based on V23. Changes in the CMS-HCC V23 model compared to the V22 segmented model include:

- *Classification of diagnoses into HCCs:* The 2019 model was updated to (1) include mappings for new Fiscal Year (FY) 2018 ICD-10 codes; (2) remap some existing codes; and (3) include additional payment HCCs in the model. The new payment HCCs are detailed in section 2.5.1.

- *Factors included in the model:* We developed and evaluated alternative specifications of a CMS-HCC count model. The versions of the model varied by which conditions were included in the count of conditions, either conditions in the model for payment or all conditions, and how the conditions were counted, either individually (1, 2, 3, 4, etc.), grouped into ranges (for example, 1 – 3, 4 – 6, 7 – 9, etc.), or as a single factor that allowed for any number of conditions (e.g., the number of conditions times the coefficient). In accordance with the 21st Century Cures Act, a version of the CMS-

HCC count model will be proposed for public comment and finalized after consideration of those comments for payment year 2020.

In addition to the 21st Century Cures Act changes, changes in CMS-HCC V23 compared to the V22 segmented model also include:

- *Data years used for calibration:* The PY 2017 CMS-HCC Risk Adjustment model was based on data years 2013–2014. The PY 2019 CMS-HCC risk adjustment model is based on data years 2014–2015.

- *Disease groups included in interaction variables:* The CMS-HCC classification was updated from V22 to V23, affecting the number of payment HCCs included in the model. To align with the V23 classification, three of the disease groups included in interaction terms in the community segments of the CMS-HCC risk adjustment model were updated.

- *Diagnosis filtering method:* The 2017 CMS-HCC risk adjustment model was based on a filtering method that used Specialty Codes to identify diagnoses suitable for risk adjustment purposes. For 2019, we finalized the updated version of the CMS-HCC risk adjustment model based on CPT/HCPCS filtering (see page 15 for additional discussion).

2.5.1 HCC Changes

Among the 21st Century Cures Act amendments to Section 1853(a)(1) of the Social Security 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.

CMS undertook these evaluations in accordance with the statute. Following this evaluation, changes were made to the CMS-HCC classification resulting in a new version 23 (2019 CMS-HCC model). Diagnoses were added to existing condition categories, condition categories were added to the model for payment, and hierarchies were revised to be more clinically meaningful better predict medical expenditures. The specific changes are outlined in the following list[22]:

[22] For more information see Part I of the 2019 Advance Notice: https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Advance2019Part1.pdf

1. Chronic Kidney Disease HCC 138 *Chronic Kidney Disease, Moderate (Stage 3)* was added to the payment model.

2017 CMS-HCC Payment Model (Chronic Kidney Disease)	2019 CMS-HCC Payment Model (Chronic Kidney Disease)
• HCC 136 Chronic Kidney Disease, Stage 5 • HCC 137 Chronic Kidney Disease, Severe (Stage 4)	• HCC 136 Chronic Kidney Disease, Stage 5 • HCC 137 Chronic Kidney Disease, Severe (Stage 4) • **HCC 138 Chronic Kidney Disease, Moderate (Stage 3)**

NOTE: New payment HCCs are shown in bold text.

2. Substance Use

    a. HCC 54 was relabeled to reflect current terminology.
    b. Selected drug and alcohol "poisoning" (overdose) codes were added to payment HCC 55. The label for HCC 55 was revised from *Drug/Alcohol Dependence* to *Substance Use Disorder, Moderate/Severe, or Substance Use with Complications* to reflect revised composition.
    c. HCC 56 *Substance Use Disorder, Mild, Except Alcohol and Cannabis* was added to the payment model.

2017 CMS-HCC Payment Model (Substance Use)	2019 CMS-HCC Payment Model (Substance Use)
• HCC 54 Drug/Alcohol Psychosis • HCC 55 Drug/Alcohol Dependence	• *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***

NOTE: New payment HCCs are shown in bold text. HCCs with label changes are shown in italics.

3. Mental Health

    a. HCC 58 Reactive and Unspecified Psychosis and HCC 60 Personality Disorders was added to the payment model.
    b. HCCs 58 and 59 were renumbered. HCC 59 (now HCC 58) Reactive and Unspecified Psychosis will be above HCC 58 (now HCC 59) Major Depressive, Bipolar, and Paranoid Disorders in the HCC hierarchy.

2017 CMS-HCC Payment Model (Mental Health)	2019 CMS-HCC Payment Model (Mental Health)
• HCC 57 Schizophrenia • HCC 58 Major Depressive, Bipolar, and Paranoid Disorders	• HCC 57 Schizophrenia • **HCC 58 Reactive and Unspecified Psychosis** • HCC 59 Major Depressive, Bipolar, and Paranoid Disorders • **HCC 60 Personality Disorders**

NOTE: New payment HCCs are shown in bold text. HCC renumbering is shown in underlined text.

4. Renal Disease Group

The V23 CMS-HCC classification includes a new payment HCC for Chronic Kidney Disease, which is part of the Renal disease group. We updated the renal disease group to include this HCC 138 Chronic Kidney Disease, Moderate (Stage 3). This change affects one of the interaction variables for the aged and disabled community continuing enrollee models (non-dual, full-benefit dual, and partial benefit dual): CHF (single HCC) x Renal (group of HCCs).

2017 CMS-HCC Renal Disease Group	2019 CMS-HCC Renal Disease Group
• HCC 134 Dialysis Status • HCC 135 Acute Renal Failure • HCC 136 Chronic Kidney Disease, Stage 5 • HCC 137 Chronic Kidney Disease, Severe (Stage 4)	• HCC 134 Dialysis Status • HCC 135 Acute Renal Failure • HCC 136 Chronic Kidney Disease, Stage 5 • HCC 137 Chronic Kidney Disease, Severe (Stage 4) • **HCC 138 Chronic Kidney Disease, Moderate (Stage 3)**

NOTE: HCCs that were added to the V23 disease group are shown in bold text.

5. Substance Use and Psychiatric Disease Interactions

Because new Substance Use and Psychiatric payment HCCs were added to the V23 CMS-HCC model, the affected interaction term for the disabled community continuing enrollee segments (non-dual, full-benefit dual, and partial-benefit dual) was updated to reflect these changes: Substance Use (group of HCCs) x Psychiatric (group of HCCs).

2.5.2 Count Variable

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." Two approaches to using a

count variable were proposed in the 2019 Advance Notice, Part I. We did not finalize a model with a count variable for 2019, but such a model will need to be implemented in payment year 2020 in order to meet the requirement that we phase in changes under 21st Century Cures over three years, with such changes being fully implemented for 2022 and subsequent years.

For analytic purposes, we estimated several HCC count models defined by an HCC variant (payment HCCs, and HCCs for all conditions, whether in the payment model or not) and a functional form (single continuous integer count variable [i.e., total number of HCCs], individual HCC count indicators [1 HCCs, 2 HCCs, 3 HCCs, etc.], grouped HCC count indicators [1–3, 4–6, 7–9, etc.], and a single indicator for more than a specified number of HCCs [e.g., 4+ HCCs]).

To compare model predictive accuracy, we generated predictive ratios under each variation of the CMS-HCC model with count variables. The CMS-HCC model that counted payment conditions, and utilized individual HCC count indicators, was proposed as it improved predictive accuracy across deciles of predicted expenditure compared to the model without counts among aged-disabled enrollees. The proposed count model adds to the base V23 specification a set of individual indicators (i.e., dummy variables) for counts of payment HCCs. The first dummy corresponds to the lowest positive and statistically significant payment HCC count dummy. The last dummy indicates 10 or more payment HCCs. To identify the lower threshold, separate regressions were run with individual HCC count dummies starting at 1, 2, 3 and so on up to the number that made the lowest dummy positive and statistically significant. This exercise was conducted independently for each population segment.

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 or disabled versus ESRD (end-stage renal disease), community-residing versus long-term institutional (nursing home), Medicare-Medicaid dual statuses (full-dual, partial-dual, and non-dual), and continuing enrollees versus new Medicare enrollees. Depending on the size and characteristics of the beneficiary sub-group, 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 the 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 Aged and Disabled Models — Community Dual versus Non-dual, and Institutional

Medicare beneficiaries differ along characteristics that are important for risk-adjustment. One such characteristic is community versus institutional residence. About 3 percent of Medicare beneficiaries are long-term residents in institutions, primarily nursing facilities (**Table 2-3**). Institutionalized beneficiaries are allowed to enroll, or remain enrolled, in Medicare Advantage plans. Another characteristic is Medicare-Medicaid dual eligibility. About 20 percent of Medicare FFS beneficiaries are dual eligible (Table 2-3). This group includes individuals who

enrolled in Medicare Part A and/or Part B and receive Medicaid benefits and/or assistance with Medicare premiums.

Table 2-3
2014/2015 model sample counts

Population Segment		Number	Percentage
Community			
	Non-dual aged	20,657,519	70.25
	Non-dual disabled	2,089,311	7.10
	Partial-dual aged	896,980	3.05
	Partial-dual disabled	840,221	2.86
	Full-dual aged	1,984,583	6.75
	Full-dual disabled	2,031,028	6.91
Institutional		906,802	3.08
Total Medicare FFS beneficiaries		**29,406,444**	

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 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, $19,466 in mean annual expenditures compared to $9,719 (2015 FFS expenditure data). Beneficiaries in facilities cost more because they have more medical problems. However, models that do not differentiate between the two groups result in over prediction of Medicare expenditures of institutional residents. This over prediction occurs due to differences in service utilizations patterns between people in the community and in institutions. To recognize the medical characteristics of the institutional population, institutional models include different sets of two-disease interactions and disease-disabled status interactions than community models. For example, starting with Version 21, institutional models contain a sepsis-pressure ulcer interaction term, indicating the presence of both conditions predicts higher spending than the sum of the individual increments among those residing in institutions. Similarly, the disabled-pressure ulcer interaction is unique to the institutional sample. In the V23 model finalized for PY2019, both community and institutional segments include 83 payment HCCs.

Separate CMS-HCC community models based on aged/disabled status and dual status exist since the implementation of Version 22 segmented CMS-HCC risk adjustment models in PY2017. 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 Medicare Advantage plans, which were increasingly specializing in dual eligible beneficiaries. The Version 22 single-segment community model under predicted spending among full dual eligible groups. Dual eligibility status is measured in the payment year, which is consistent with Medicare Advantage plans experiencing enrollment of dual eligible beneficiaries throughout the payment year.

2.6.2 Aged Disabled Model for 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 Medicare Advantage payment 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. 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 or are not enrolled in both Parts A and B until a later age. This latter group provides an example of new enrollees who are not new entrants to Medicare itself. 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 (physician insurance) premium at an older age.[23]

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 Medicare Advantage plans for which the continuing enrollee (community or institutional) segments are not applicable. The same demographic factors from the CMS-HCC model—age, sex, Medicaid, and originally disabled—are used to predict expenditures in the new enrollee model. Both community and institutional residents are included in the sample. The age-sex

[23] 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.

breakouts for the new enrollee model include individual years 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 Chronic Condition Special Needs Plans with New Enrollees

Under the Medicare Modernization Act of 2003 (MMA), Congress created a new type of Medicare Advantage plan focused on coordinating care for beneficiaries with special needs, called a Special Needs Plan (SNP). These plans are allowed to target one of three types of beneficiaries: 1) institutionalized (nursing home or nursing home certifiable); 2) dually eligible for both Medicaid and Medicare; and 3) individuals with 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 2-4**.[24]

Table 2-4
Chronic conditions covered by special needs plans

1 Chronic alcohol and other drug dependence	9 End-stage renal disease requiring dialysis
2 Autoimmune disorders	10 Severe hematologic disorders
3 Cancer, excluding pre-cancer conditions or in situ status	11 HIV/AIDS
4 Cardiovascular disorders	12 Chronic lung disorders
5 Chronic heart failure	13 Chronic and disabling mental health conditions
6 Dementia	14 Neurologic disorders
7 Diabetes mellitus	15 Stroke
8 End-stage liver disease	

SOURCE: Centers for Medicare & Medicaid Services, 2016 Special Needs Plan Chronic Condition Panel Final Report, November 2008. Available at https://www.cms.gov/Medicare/Health-Plans/SpecialNeedsPlans/C-SNPs.html

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

[24] 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.

expenditures to these C-SNPs. To account for these differences, CMS implemented in 2011 a C-SNP New Enrollee model. The 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 new enrollee demographic variables—108 mutually exclusive age-sex categories, Medicaid status, and originally disabled status. Only continuing enrollees were used in the sample because they had risk scores calculated with coefficients that reflected their morbidity. Relative 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 Medicare Advantage models. Relative risk scores are used to adjust Medicare Advantage capitation payments for new enrollees in C-SNP plans.

2.7 End Stage Renal Disease (ESRD) Models

People with ESRD (permanent kidney failure requiring dialysis or kidney transplant) may be 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 $81,945 (2015 FFS expenditure data). It is also been shown that the incremental costs of other medical conditions 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 (3 months), and functioning graft (from 4 months post-graft). Brief descriptions of each group and the models associated with them are described below. Previously, persons in dialysis status could not join a Medicare Advantage plan, except under certain circumstances, such as when it is a C-SNP specific to ESRD. Beneficiaries who were already enrolled in a Medicare Advantage 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 will have the option to enroll in Medicare Advantage plans of their choosing. Risk adjusting payment by ESRD treatment status avoids problematic incentives in specialty Medicare Advantage 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 regression-based; the kidney transplant factors are based on average costs of the transplant stay and post-graft months 2-3. Beneficiaries are assigned to a model based on the ESRD designation for each month of the Payment Year.

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 V21 CMS-HCC model and is calibrated on the population of ESRD continuing enrollees with qualifying dialysis months. It includes demographic variables (age-sex categories, Medicaid 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).[25]

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 3 years or less (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, Medicaid status, and originally-disabled status.

2.7.2 Kidney Transplant

The kidney transplant factors are based on average costs of ESRD beneficiaries (in 2015 for this model evaluation) 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).

2.7.3 ESRD Functioning Graft Models with Post-Graft Factors

There are three functioning graft model segments, 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, 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 community continuing enrollee functioning graft model starts with the previously estimated values for most risk factors (demographic variables, most HCCs, disease interactions, and disease-non-aged interactions) from a V21 CMS-HCC model estimated on the non-ESRD aged-disabled community population. The model is modified with the effects of only a few variables estimated to capture the extra costs of being in a post-graft period. Using a combined community and institutional post-graft ESRD modeling sample, it newly estimates the costs of two HCCs, which have sufficient sample size and predicted costs related to the post-transplant period: *HCC 176 Complications of Specified Implanted Device or Graft* and *HCC 186 Major Organ Transplant Status*. The model also estimates four post-graft factors (which are used in each of the functioning graft models) to capture the differing predicted costs of post-graft ESRD beneficiaries based on age and time since transplant.

[25] 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. The disease-non-aged interactions predict incremental cost differences of diseases for the non-aged (age < 65) subpopulation.

Post-graft factors:

- Age < 65, with duration since transplant of 4-9 months
- Age 65+, with duration since transplant of 4-9 months
- Age < 65, with duration since transplant of 10 months or more
- Age 65+, with duration since transplant of 10 months or more

Similarly, the functioning graft institutional continuing enrollee model segment uses most factors from a V21 CMS-HCC model estimated on the non-ESRD aged-disabled institutional population—demographic variables, most HCCs, disease interactions, and disease-non-aged interactions. It also includes the four post-graft factors to capture additional post-transplant costs, and it again substitutes the post-graft sample estimated values for HCCs 176 and 186.

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 estimated effects of factors from a V21 CMS-HCC model estimated on the non-ESRD aged-disabled new enrollee population—108 mutually exclusive demographic variables that encompass age-sex categories, Medicaid status, and originally disabled status. It then adds the same four post-graft factors from the functioning graft community continuing enrollee model segment to capture additional costs of functioning graft new enrollees.[26]

2.7.4 ESRD Model Statistics

Table 2-5 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 2019, the focus of this evaluation, used the V21 CMS-HCC model recalibrated on more recent (2014–2015) ESRD diagnosis and expenditure data. It increased the explanatory power of individual variation in beneficiaries' expenditures in each of the models—for example, to about 14 percent for the dialysis continuing enrollee model (compared to 11 percent in the 2007 calibration and 8 percent in the 2003 calibration).

[26] 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.

Table 2-5
ESRD risk adjustment model R^2 statistics[1]

Risk adjustment model	Payment years	R^2
ESRD CMS-HCC Models (2003 calibration)[2]		
	2007–2011	
Dialysis Continuing Enrollee		0.0796
Dialysis New Enrollee		0.0168
Functioning Graft Community Continuing Enrollee		0.0680
Version 21 ESRD CMS-HCC Models (2007 calibration)[2]		
	2012–2018	
Dialysis Continuing Enrollee		0.1134
Dialysis New Enrollee		0.0212
Functioning Graft Community Continuing Enrollee		0.0872
Version 21 ESRD CMS-HCC Models (2015 calibration)[2]		
	2019	
Dialysis Continuing Enrollee		0.1385
Dialysis New Enrollee		0.0264
Functioning Graft Community Continuing Enrollee		0.1039

Notes:

[1] The R^2 statistic refers to the percentage of variation in individual expenditures explained by the model.

[2] Each of the R^2 statistics is for the specific ESRD model listed based on the calibration year identified.

SOURCE: RTI analysis of Medicare claims and enrollment data—2002–2003, 2006–2007, and 2014–2015 full 100% ESRD samples.

2.8 Adjustments to the CMS-HCC Models

2.8.1 Frailty Adjustment

Section 1894(d)(2) of the Act requires CMS to take into account the frailty of the Program of All-Inclusive Care for the Elderly (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 adjustments 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.[27] CMS applied the frailty adjustment to specific demonstrations that ended in 2011. CMS started applying frailty adjustment to qualifying FIDE SNPs in 2012.

For this 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. Specifically, the CMS-HCC frailty adjuster uses a scale based on the number of ADL difficulties—5–6, 3–4, 1–2, and no difficulties. 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. To estimate the frailty factors, CMS regresses residual expenditures (actual Medicare expenditures minus expenditures predicted by the CMS-HCC model) on counts of ADLs in the previous year. Two sets of ADL categories are included for the Medicaid and non-Medicaid subpopulations. Frailty factors are obtained by dividing each ADL/Medicaid coefficient estimate by the weighted mean annualized expenditure for the entire 2008-2009 CAHPS sample ($9,190.15).[28]

The frailty adjustment applies to aged or disabled community beneficiaries age 55 or older enrolled in PACE organizations or qualifying FIDE SNPs. The adjustment is made at a contract level (for PACE) or Plan Benefit Package level (for FIDE SNPs), based on the proportion of beneficiaries in each ADL-count category as identified through the Health Outcomes Survey (HOS), stratified by Medicaid status. The 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. Compared to Medicare Advantage plans, PACE organizations typically will 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. Under section 18531853(a)(1)(B)(iv) of the Social Security Act, only FIDE SNPs with "similar average levels of frailty… as the PACE program," can receive frailty adjusted payments.

CMS conducted research to determine whether to apply the frailty adjustment to all Medicare Advantage plans. CMS concluded that applying the frailty adjuster would not improve payment accuracy primarily because of methodological concerns resulting from currently available data. First, to date, the HOS data currently used to determine frailty scores is sampled only for PACE organizations and FIDE SNPs, and therefore does not allow CMS to calculate accurate frailty scores at the plan benefit package (PBP) level across the Medicare Advantage program. Because bids and plan benefit designs are made at the PBP level, it would be necessary to sample all PBPs. Second, if frailty were applied program wide, Medicare Advantage organizations would need to project a frailty score in their plan bids. However, CMS pays plans using frailty scores calculated after the bid is submitted. Due to the changing nature of the marketplace and the different enrollment profiles of plans from year to year, this creates a risk that the level of frailty assumed by a plan in its bid would not reflect its actual frailty score in the

[27] Kautter, J., and Pope, G.C.: CMS Frailty Adjustment Model. Health Care Financing Review 26(2):1-19, Winter 2004-2005.

[28] For more information see Kautter, J., Ingber, M., and Pope, G.C.: Medicare Risk Adjustment for the Frail Elderly. Health Care Financing Review 30(2):83-93, Winter 2008-2009.

payment year (the payment methodology is different in the PACE program, including that PACE organizations do not submit bids; therefore PACE organizations are not affected by this issue). Third, the County ratebook would need to be standardized with risk scores that include the appropriate frailty adjustment, which would require that CMS obtain adequate ADLs at the county level. Between the need to sample at the PBP level to calculate the frailty scores, as well as at the county level in order to appropriately standardize the ratebook, CMS concluded that applying the frailty adjuster across the MA program would be burdensome to plans and beneficiaries and would not improve payment accuracy.

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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: the R^2 and predictive ratios. The R^2 measures the extent to which the model can explain differences in cost between individuals. Predictive ratios measure the ability of the model to predict average costs over entire groups or subgroups. Predictive ratios should be assessed in conjunction with the individual explanatory power (R^2). Models that explain little variation in cost between individuals may still accurately predict the cost for groups or subgroups of beneficiaries. For example, a simple risk adjustment model may accurately predict the average cost for a large group of beneficiaries (i.e., predictive ratio close to 1) because the prediction errors will average out. However, the model may fail to differentiate between high and low individual costs within the group. This is the case with the demographic risk adjustment model implemented in the AAPCC methodology, where the predictive ratios can be 1.0, or close to 1.0, for some subgroups of beneficiaries, but the model R^2 is very low, indicating there is significant unexplained variation among the beneficiaries within the group. Each segment of the CMS-HCC model, which has a considerably greater R^2 than the demographic model, may have predictive ratios that are not equal to 1.0, but this model is superior in its ability to distinguish high and low-cost individuals.

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, 3.3, and 3.4 cover 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 Section 3.

3.1 Methodology

3.1.1 Sample

The sample for each table is drawn independently. A beneficiary is included in the table specific sample for the months that the beneficiary met the table criteria. We calculate the average actual cost by first annualizing the costs of beneficiaries who have partial year enrollment, and then averaging annual costs across all beneficiaries in a subgroup; we annualize costs by weighting up the total for 12 months. The average predicted cost is an annual amount.

When calculating a predicted ratio for a subgroup of beneficiaries that includes multiple statuses (e.g., the group of community-dwelling beneficiaries includes all aged and disabled, and all dual statuses of community-residing beneficiaries), we calculate it as the sum of the cost predicted for the each status multiplied by the number of months they were in that particular status divided by the total number of qualifying months for the table sample. Actual cost is weighted by taking the sum of cost for the months that beneficiary qualified for the table sample divided by the number of qualifying months and multiplied by 12. The following example demonstrates how sample weights, actual expenditures, and predicted expenditures for each beneficiary were built. The examples are for a Part C eligible beneficiary: this person is aged,

spent 11 months in the community — partial dual 10 months, full dual 1 month — but was 1 month institutionalized.

In Table 5-1: Predictive Ratio by Deciles of Predicted Expenditures for All Aged-Disabled Enrollees, all beneficiaries are included in the predictive ratio regardless of dual or institutional status. Since the beneficiary was in the model sample for 12 months, total actual expenditure is the sum of payments for qualifying months (11 community + 1 institutional) multiplied by 12 and divided by 12. Total predicted expenditure is the sum of 10/12 multiplied by predicted expenditure from community partial dual segment and 1/12 multiplied by predicted expenditure from community full dual segment and 1/12 multiplied by predicted expenditure from the institutional segment.

In Table 5-4: Predictive Ratio by Deciles of Predicted Expenditures for Aged-Disabled Community Enrollees only community beneficiaries are included in the predictive ratio. Since the beneficiary was in the community for 11 out of 12 months in the year, annualized actual expenditure is the sum of actual payments for 11 community months divided by 11 and multiplied by 12, and predicted expenditure is the sum of 10/11 multiplied by predicted expenditure from the community partial dual segment and 1/11 multiplied by predicted expenditure from community full dual segment.

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. In order 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 longer than 12 months in most cases, sometimes 3 months duration or longer), functional limitations and ongoing medical care, and the absence of a cure.[29] The U.S. Department of Health and Human Services (HHS) defines chronic conditions as "lasting for a year or more and requiring ongoing medical attention and/or limiting activities of daily living. They include both physical conditions such as arthritis, cancer, and HIV infection. Also included are mental and cognitive disorders, such as ongoing depression, substance addiction, and dementia".[30] The World Health Organization 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".[31] The National Center for Health Statistics defines as chronic "[…] conditions that are not cured once acquired (such as heart disease, diabetes, and

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

[30] 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)

[31] WHO. Health topics, non-communicable diseases. Available from: http://www.who.int/topics/noncommunicable_diseases/en/

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".[32]

The lack of a unanimous definition for "chronic condition" required empirical analyses and clinical judgment to determine which conditions in the Part C CMS-HCC model's condition categories (HCCs) to count as chronic. With the methods outlined below, each unique condition and condition category – a grouping of clinically similar ICD-9 diagnosis codes – was classified as chronic or non-chronic.

1. First, we weighted each ICD-9 code in each unique hierarchical condition category by the number of beneficiaries in our model sample with that ICD-9 code. We then identified which diagnoses were chronic with the AHRQ HCUP Chronic Condition Indicator (CCI).[33] CCI categorizes each ICD-9-CM diagnosis code as either chronic or non-chronic. In some cases many diagnosis codes map to a single HCC, and while diagnoses within an HCC are clinically similar, not all diagnoses in an HCC were considered chronic by AHRQ's Chronic Condition Indicator. For each HCC we counted, the count of unique beneficiary-chronic ICD-9 code combinations was divided by the total count of unique beneficiary- ICD-9 code combinations within an HCC based on the Medicare 2014 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 2013–2014 sample) was divided by the number of individuals with the condition category in the base year, 2013. Condition categories were categorized as chronic when more than 51% of beneficiaries with the HCC were coded in 2013 and 2014.

3. The third empirical method compared the coefficient for the condition category using a prospective model to the coefficient using a concurrent model. Prospective models use demographic information and diagnoses collected in a base year (2014) to predict medical expenditures in the following year (2015). They tend to emphasize the influence of chronic conditions on costs, whereas concurrent models use diagnoses and expenditures from the same year (2015) and reflect the costs of acute health events. If the ratio of prospective to concurrent coefficient was larger than 0.8, a condition category was considered chronic.

4. 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.

This method resulted in our determination that 122 out of the 204 v23 HCCs were chronic. Seventy-six percent of the model sample was determined to have three or more chronic conditions and fifty-four percent of the model sample was determined to have five or more

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

[33] AHRQ. Chronic Condition Indicator (CCI) for ICD-9-CM. 4/11/2017], available at https://www.hcup-us.ahrq.gov/toolssoftware/chronic/chronic.jsp.

chronic conditions. In the proposed "Payment Condition Count" (PCC) model 64 of the 83 payment HCCs are considered chronic.

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 cost.[34] In the Payment Condition Count (PCC) model sample, the 10 percent of beneficiaries with the highest cost account for nearly 60 percent of the total cost, and many of these beneficiaries have one or more chronic conditions. However, given the objective of the risk adjustment model, interpreting predictive ratios arranged by actual cost is not a meaningful approach to determining the effectiveness of the model. Predictive ratios grouped by actual cost are not a meaningful evaluation measure because modeling of future medical spending can never exactly predict costs at an individual level, and sorting by actual cost is essentially testing to see if all people with high actual costs were predicted high and all those with low actual costs were predicted low. Insurance models are developed using information known prior to the insurance period and future medical events have both predictable and unpredictable, essentially random, components. An insurance model captures the predictable component and seeks to balance the over and under prediction errors so the average actual spending for a group equals the average predicted spending. Medicare Advantage organizations are licensed risk bearing entities that are determined to be capable of predicting cost from random adverse events impacting any one individual.

When beneficiaries in FFS Medicare without ESRD are grouped by actual cost, the beneficiaries in the lowest decile have average annual cost of $20.09 and beneficiaries in the highest decile have average annual cost of $64,547. 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 decile are under predicted, with the tenth decile under predicted by a substantial amount. This is because the model is not intended to predict the random costs that result in either high costs or low costs in a given year. Both the 2019 CMS-HCC model and the Payment Count model improve this over and under prediction. The 2019 CMS-HCC model reduces the over prediction by between 12 percent in the first decile to 1 percent in the 8th decile, maintains the under prediction in the ninth decile, and decreases the under prediction in the tenth decile by 1 percent. When the predictive ratio is calculated by predicted, or expected cost, the model accurately predicts the average cost with most deciles of risk better predicted by the PCC model compared to the model implemented in 2017 and the model we are beginning to phase-in in 2019.

3.2 Aged-Disabled CMS-HCC Model Predictive Ratios

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

- The CMS-HCC model finalized for PY2019

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

- The CMS-HCC model proposed for PY 2019 Payment Condition Count (PCC) model; and
- The PY 2017 CMS-HCC model.

The CMS-HCC model finalized for PY 2019, along with the PCC model that was proposed for PY2019, predict 2015 expenditures using 2014 diagnoses and demographic information. HCCs were created with diagnoses filtered using the same method CMS applies when calculating Medicare Advantage (Medicare Advantage) risk scores from diagnoses submitted to the encounter data system (EDS). The 2019 PCC model includes a count of conditions as required by the 21st Century Cures Act whereas the 2019 CMS-HCC model excludes explicit counting of conditions. The PY 2017 CMS-HCC model predicts 2014 expenditures based 2013 diagnoses and demographic information. Diagnoses were selected using the specialty code filtering method that Medicare Advantage plan sponsors apply when determining which diagnoses to submit to RAPS. Note that the 2017 and 2019 models were calibrated using different data years (2013–2014 versus 2014–2015, respectively) and different diagnosis filtering methodologies.

Predictive ratios are provided for the following population subsamples:

- 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 enrollees
- Aged and disabled new enrollees
- Aged community continuing enrollees
- Disabled community continuing enrollees, and
- The continuing enrollee community sub-segments:
  - Non-Dual Aged
  - Non-Dual Disabled
  - Partial-Dual Aged
  - Partial-Dual Disabled
  - Full-Dual Aged
  - Full-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 HCCs (including payment and eligible[35] non-payment 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 predictive ratio tables and aged-disabled models, the entire sample predictive ratio is equal to 1.0, indicating that the expected cost predicted by the models is, on average, accurate for the calibration sample. In each subsection, we highlight under-prediction and over-prediction trends, selected population groups with particularly accurate or inaccurate prediction, and we compare the predictive accuracy across the three aged-disabled models.

Improvement in the CMS-HCC models and the ESRD model is determined by whether predicted cost is closer to actual cost 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 is considered accurate. By this measure the CMS-HCC model with additional factors that take into account a beneficiary's number of conditions better predicts cost on average relative to the CMS-HCC model implemented in 2019 and the CMS-HCC model implemented in 2017 and 2018. The CMS-HCC model finalized for 2019 either slightly improves some deciles of predicted risk, or does not change, compared to the CMS-HCC model implemented in 2017.

3.2.1 Predictive Ratios by Deciles of Predicted Risk

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

Table 5-1 shows predictive ratios based on all aged-disabled enrollees comprised of the community and institutional continuing enrollee, and new enrollee subsamples. Across the three aged-disabled model segments, the lowest six deciles have slight under prediction (except decile 5 based on the 2019 PCC model that is almost 1.0) and the top four have slight over prediction. The deviations from 1 are between -0.05 and 0.02. Under prediction for the lowest predicted groups is related to the structure of the model. The lowest predicted groups are healthier; most have no HCCs included in the model. The predictions for people 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. The difference in dollars of the under prediction in the low deciles is relatively

[35] Eighteen non-payment HCCs were excluded as they captured symptoms or treatments, not diseases or conditions. The term "eligible HCCs" refers to payment HCCs and non-payment HCCs with the eighteen non-payment HCCs excluded.

small, as it is a percentage of a relatively small expenditure level. We observe that the 2019 CMS-HCC model slightly improves predictive accuracy compared to the 2017 CMS-HCC model in the lowest six deciles. Changes in predictive accuracy between the 2017 CMS-HCC model and the two 2019 CMS-HCC models calibrated on more recent data may be due to differences in the structure of the models or in data years. The PCC model slightly improves predictive accuracy across all deciles compared to the other two aged-disabled models. For example, for decile 4, predictive ratios equal 0.979, 0.990, and 0.995, respectively for the 2017 CMS-HCC model, 2019 CMS-HCC model, and 2019 PCC model.

Tables 5-2 displays predictive ratios for aged enrollees in the total sample constituting community and institutional continuing enrollees, and new enrollees. The PCC model shows predictive accuracy gains across all deciles but decile 5 (where the 2019 CMS-HCC model PR is 1.0) compared to the other aged-disabled models. The largest improvements are in the second decile and the top 1% quantile (0.984 to 1.0, and 0.979 to 0.995 for the 2019 CMS-HCC model and the PCC model respectively). Except for decile 3, the 2019 CMS-HCC model performs slightly better or at least the same as the 2017 CMS-HCC model.

Table 5-3 presents predictive ratios for disabled enrollees in the total sample constituting community and institutional continuing enrollees, and new enrollees. Both the 2019 CMS-HCC model and the 2017 CMS-HCC model show slight under prediction in deciles 1 to 5 and top 5%, 1% and 0.1%, and slight over prediction for the rest of the deciles. The former model slightly improves or maintains predictive accuracy compared to the 2017 CMS-HCC model except for decile 5. The PCC model results in gains in predictive accuracy across all deciles except decile 6, compared to the 2019 CMS-HCC model.

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. The first two tables show under prediction in lower deciles and the top 5%, 1% and 0.1% quantiles, and over prediction in higher deciles. The magnitude of the deviations from 1 is relatively small in Table 5-4, particularly for the 2019 PCC model (they range from -0.037 to 0.07). However, decile one in Table 5-5, the institutional continuing enrollee segment, indicates relatively large under prediction, with predictive ratios of 0.859, 0.874, and 0.840 for the three aged-disabled models. None of the other predictive ratios deviate from one by more than 0.06 in Table 5-5. In Table 5-6 slight under prediction and over prediction alternate across deciles and models. Note that the PRs for the 2019 model and the PCC model are the same. The specification for the new enrollee segment is identical since only demographic factors are included as regressors in the new enrollee model. Changes in PRs between the 2019 and 2017 CMS-HCC models reflect different calibration data years (2014–2015 versus 2013–2014) as the 2017 CMS-HCC and 2019 new enrollee model specifications are also identical.

Table 5-7 presents predictive ratios for aged community continuing enrollees. The PRs for the first three deciles show the largest deviations from 1, which are smaller with the PCC model. For example, for decile 1 the PRs are equal to 0.948, 0.954, and 0.973 for the 2017 CMS-HCC, 2019 CMS-HCC, and PCC models respectively.

Table 5-8 offers predictive ratios for disabled community continuing enrollees. The third deciles in the 2019 CMS-HCC model and 2017 CMS-HCC model show relatively large under prediction, with predictive ratios of 0.894 and 0.880 respectively. Note that the PCC model still under predicts decile three, but to a lesser extent (PR=0.963).

Tables 5-9 and 5-10 look at full benefit dual aged and full benefit disabled enrollees. In both tables, the 2017 CMS-HCC, the 2019 CMS-HCC, and the PCC models show slight under prediction for lower or mid-range deciles and top quantiles (top 5%, 1% and 0.1%) and over prediction for higher deciles, except decile 10 for the 2019 CMS-HCC model (PR=0.998) for the full benefit dual aged enrollees (Table 5-9). In Table 5-9, the PCC model under predicts decile 1 (PR=0.958), but shows PRs very close to 1.0 for the rest of the deciles, alternating with minor under- and over-prediction. In Table 5-10, expenditures of beneficiaries in the third decile are particularly under predicted across the three aged-disabled models (PRs of 0.853, 0.863, and 0.892 for the 2017 CMS-HCC, 2019 CMS-HCC, and PCC models respectively). Under prediction of a similar magnitude is observed among the most expensive beneficiaries in the top 0.1% quantile, but the 2017 CMS-HCC model performs much better than the 2019 model and the PCC model in this case (based on a relatively small sample size).

Tables 5-11 and 5-12 show predictive ratios for partial benefit dual aged and partial benefit dual disabled enrollees. The first decile for the partial benefit dual disabled enrollees for the 2019 CMS-HCC and 2017 CMS-HCC segmented models have predictive ratios of 0.861 and 0.866 respectively, substantially lower than any other decile (Table 5-12). The first decile based on the PCC model still indicates under prediction, but of a smaller magnitude (PR=0.933).

Tables 5-13 and 5-14 illustrate predictive ratios for the non-dual aged and non-dual disabled enrollees. Decile 1 and the top 0.1% quantile show moderate under prediction in Table 3.13, particularly for the 2017 CMS-HCC model (0.940 and 0.929 respectively). The 2019 model and PCC model reduce this under prediction (0.962 and 0.963). Under prediction is also observed in decile 2 (PR=0.906) and the top 1% quantile (0.966) under the 2019 model among the non-dual disabled enrollees (Table 5-14).

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. Over prediction occurs across all deciles for beneficiaries without any chronic conditions (Table 5-15). Over prediction attenuates among beneficiaries with 1–3 chronic conditions. For this group, under prediction is observed in decile 1 and top 0.1% quantile (PR=0.896 and 0.844 respectively for the 2019 CMS-HCC model). For beneficiaries with more than 4 chronic conditions, under prediction is observed in the first three deciles (particularly in decile one). The PRs in the first decile are equal to 0.698, 0.607, and 0.670 for beneficiaries with 4–6, 7–9, and more than 10 chronic conditions, respectively. The 2019 PCC model shows a similar under prediction. Beneficiaries in these groups may have chronic non-payment HCCs, which are not included in the CMS-HCC models, thus resulting in under prediction of their expenditures.

3.2.2 Predictive Ratios for All HCCs

Table 5-20 presents predictive ratios by individual eligible HCCs for all aged and disabled community and institutional enrollees. It provides an evaluation of the three aged-disabled models' predictive accuracy for groups of beneficiaries with each of the 201 2017 CMS-HCC model HCCs or 204 HCCs in the 2019 model or PCC model. Most payment HCCs show predictive ratios close to 1.0 across the three aged-disabled models. Only beneficiaries with HCC 134 dialysis status have a noticeable under prediction (PR=0.842). Under prediction is caused by a constraint setting HCC 134 equal to HCC 135 acute renal failure. Most non-payment HCCs show some under prediction. The most drastic examples of under prediction result from small sample size issues. For example, HCC 150, ectopic and molar pregnancy, has severe under prediction in all three models, but only 951 enrollees are in the sample. With such a small sample, predictive ratios can be affected by outliers and random variations in expenditures. Most non-payment HCCs though have predictive ratios above 0.85. Only a few HCCs are over predicted (for example, non-payment HCC 64 Profound Intellectual Disability and payment HCC 166 Severe Head Injury). Over prediction in HCC 166 results from a constraint that addresses a hierarchy violation.

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 enrollees. Body systems are defined based on individual HCCs. For example, the Gastrointestinal group includes HCC 33 Intestinal Obstruction/Perforation, HCC 34 Chronic Pancreatitis, and HCC 35 Inflammatory Bowel Disease. All 2017 CMS-HCC model and 2019 model body systems are based on payment HCCs, except for the Cognitive group. The three aged-disabled models show almost 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, except the cognitive disease group, with a predictive ratio of 0.895. The cognitive disease group includes some non-payment HCCs—notably Dementia—which are not part of the CMS-HCC payment model. This explains the observed under prediction.

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 payment HCCs in the CMS-HCC models are considered chronic (64/84 and 61/79 in 2019 and 2017 models respectively). Tables 5-22 through 5-26 display predictive ratios for aged, disabled, full-dual, partial-dual, and non-dual beneficiaries by count of chronic conditions grouped into 0, 1–3, 4–6, 7–9, and 10+ categories. The count of chronic conditions includes chronic non-payment HCCs (54 in the 2019 models and 56 in the 2017 CMS-HCC model) as well as chronic payment HCCs (64 in the 2019 models and 61 in the 2017 CMS-HCC model). Besides the full-dual group, in the rest of the subsamples the three aged-disabled models show noticeable over prediction among beneficiaries with zero chronic HCCs (e.g., PR=1.480 for the non-dual sample in the 2019 PCC model). For individuals without chronic HCCs, cost prediction 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 without chronic

HCCs. Categories 1–3 and 4–6 show slight over prediction. Higher counts of HCCs, 7–9 and 10+, typically indicate slight under prediction.

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:

- Diabetes
- HIV/AIDs
- Substance Use/Disorders
- Mental Health
- COPD
- CHF
- Vascular Disorders
- Cancer
- CKD.

We observe some over prediction in subgroups who have up to 10 chronic HCCs. For beneficiaries with 10 or more chronic HCCs, under prediction is detected. The HIV/AIDS and Mental Health groups particularly have sizeable under prediction (PR= 0.840 and 0.931 respectively) for 10 or more chronic HCCs, and over prediction (PR=1.280 and 1.509 respectively) for less than 10 chronic HCCs.

3.2.5 Predictive Ratios by Count of Payment Conditions

Tables 5-36 through 5-40 report predictive ratios by count of payment conditions. Separate tables exist for aged, disabled, full-dual eligible, partial-dual eligible, and non-dual eligible enrollees. As previously discussed, we observe some under prediction among individuals with zero payment HCCs. Beneficiaries in this group may have non-payment HCCs, which are not accounted for in the payment CMS-HCC models. Predictive ratios of all five subsamples are relatively close to 1.0 across all three aged-disabled models. Note that the PCC model clearly shows better predictive accuracy than the other two models, which was expected as the model itself includes counts of payment HCCs. For the 2019 CMS-HCC and 2017 CMS-HCC models, the 10+ payment HCCs category tends to have the largest under prediction, but the lowest predictive ratio in any of the five tables is 0.951. The 4–6 payment HCCs category consistently has the highest over prediction, but the deviation from 1.0 is fairly negligible (the largest PR is equal to 1.028 for the disabled enrollees group).

3.3 ESRD Dialysis Model Predictive Ratios

This section discusses tables and 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. All ESRD predictive ratios are calculated from a 2014–2015 sample and the 2019 ESRD models, which include two dialysis model segments (dialysis continuing enrollee and dialysis new enrollee), transplant factors, and three functioning graft model segments.

3.3.1 Predictive Ratios by Deciles of Predicted Risk

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

- 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. This combined sample is slightly over predicted because of the new enrollee subpopulation. 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 (325,235) to estimate a full regression model on its population. The decile breakouts for this model show it is quite accurate for predicting expenditures, with most deciles at or 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 3 years or less to increase its sample size for modeling purposes. Table 5-45 presents predictive ratios for the true subset of dialysis new enrollees. Its overall sample predictive ratio is 1.149, representing approximately 15 percent over prediction, with decile breakouts showing over prediction ranging from 11 to 21 percent. This indicates that true dialysis new enrollees have lower costs on average than the continuing enrollees in that modeling sample.

Tables 5-48, 5-49, and 5-50 present predictive ratios for the dialysis continuing enrollee sample by dual status (full-dual, partial-dual, non-dual). These predictive ratios indicate slight under prediction overall for the full benefit and non-dual subpopulations and over prediction for the partial benefit duals. Because of small sample size, the dialysis continuing enrollee model does not distinguish by dual status type as is done in the Part C aged-disabled models. Instead, it includes a Medicaid marker interacted with age and sex indicating any Medicaid eligibility

during the year. (Tables 5-56 and 5-57, described below, feature Medicaid breakouts that correspond to the model design, any Medicaid versus no Medicaid, and thus have overall perfect prediction.)

3.3.2 Predictive Ratios for all HCCs

Table 5-51 presents 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. 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.

3.3.3 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 extremely accurate, with under prediction or over prediction less than 2 percent. The 2019 ESRD model disease groups consist of HCCs included in the model. The kidney disease group is excluded in this set because it defines the dialysis population.

3.3.4 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 eligible, partial benefit dual eligible, and non-dual eligible. For all subpopulations, the largest populated breakout is "10 or more chronic conditions," indicating the dialysis population has multiple comorbidities in addition to the underlying renal disease. The counts include chronic conditions beyond those in the model, and are indicated in Table 5-51. 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 enrollees with multiple chronic conditions, demonstrating that the dialysis continuing enrollee performs well in accounting for these costs.

3.3.5 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 these dialysis continuing enrollee subsamples: aged, non-aged, full benefit dual eligible, partial benefit dual eligible, and non-dual eligible. The predictive accuracy of these predictive ratios appears quite strong. 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.

3.4 ESRD Functioning Graft Model and Kidney Transplant Predictive Ratios

These predictive ratios are calculated using predicted expenditures from the 2019 ESRD Post-graft models, which include:

- three functioning graft models which predict costs for post-graft months 4 and beyond:
  - community continuing enrollee
  - 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

The functioning graft model predictive ratios presented here have the same five category sets as those of 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.

3.4.1 Predictive Ratios by Deciles of Predicted Risk

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

- 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 functioning graft community continuing enrollees
- non-aged 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. This combined sample as a whole is slightly under predicted because of under prediction of the institutional and new

enrollee subpopulations. Tables 5-69, 5-70, and 5-71 present predictive ratios for each of the three functioning graft model samples: community, institutional, and new enrollee. The community continuing enrollee functioning graft model with its overall predictive ratio of 1.002 has better predictive accuracy than the institutional model (0.836; 16 percent under prediction) and the new enrollee model (0.806; 19 percent under prediction). At the decile level, the community continuing enrollee functioning graft model appears to over predict at the lower deciles, predict fairly accurately for the fifth through ninth deciles, and under predict at the highest decile.

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 approximately only 105,000, of which 93 percent are community continuing enrollees, 1 percent are institutional, and 6 percent are new enrollees. None of these subsamples is large enough to reliably estimate a full regression model. Instead, as was described in Section 2.7.3, the model's community and institutional segments use most factors from a CMS-HCC model calibrated with the non-ESRD age/disabled population, and then supplements them with a few variables modeled on the post-graft continuing enrollee sample, including four post-graft factors that capture the differing predicted costs of post-graft beneficiaries based on age and time since transplant. Because the community subsample 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 other subsamples

Tables 5-72 and 5-73 present predictive ratios for aged and non-aged breakouts of the functioning graft community continuing enrollee sample. The aged subset shows greater variation, with substantial 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.

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-dual, partial-dual, or non-dual). As noted earlier in the dialysis discussion (Section 3.2.1), the ESRD models do not distinguish by type of dual status. The functioning graft community continuing enrollee model includes a Medicaid marker interacted with age and sex (and the institutional model uses a single Medicaid marker), indicating any Medicaid eligibility during the year.

3.4.2 Predictive Ratios for all HCCs

Table 5-77 illustrates 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 sample has a perfect predictive ratio of 1.0, 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. Table 5-77 confirms this—with most HCCs over predicted or under predicted, including payment HCCs. Although sample sizes are too small to estimate HCC coefficients specific to each of the functioning graft populations, the HCC coefficients 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.

3.4.3 Predictive Ratios by Body Systems or Disease Groups

Table 5-78 presents predictive ratios for body systems or disease groups for functioning graft continuing enrollees. 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.

3.4.4 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+) for the following functioning graft continuing enrollee samples: all continuing enrollees, aged, non-aged, any Medicaid, non-Medicaid, full benefit dual eligible, partial benefit dual eligible, and non-dual eligible. For all subsamples, most functioning graft enrollees have 4 or more chronic conditions and the 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 subsample is indicating that there is something unusual about functioning graft patients with no recorded chronic comorbidities of the full set in table 5-51. They are very small proportion of the population. The overall sample predictive ratios in Tables 5-82 and 5-83 indicate the functioning graft models under predict the Medicaid population by about 7 percent and over predict the non-Medicaid population by about 5 percent.

3.4.5 Predictive Ratios by Count of Payment Conditions

Tables 5-87 through 5-91 provide predictive ratios by count of payment conditions for these functioning graft continuing enrollee subsamples: aged, non-aged, full benefit dual eligible, partial benefit dual eligible, and non-dual eligible. These tables follow a similar pattern to the previous set of tables by count of chronic conditions, but the magnitude of over prediction is smaller for those with 0 payment conditions and the under prediction is slightly greater for those with 10 or more conditions. This group is relatively small. The predictive ratios indicate that in general the models predict best for enrollees with 4–6 payment conditions.

3.4.6 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. Table 5-92 indicates that the model for the functioning graft community continuing enrollees, whom as noted earlier are 93 percent of the functioning graft population, provides a highly accurate estimate of expected costs. The entire sample predictive ratio is 1.002, and the four post-graft factor breakouts never deviate from 1.0 by more than 0.003.

As expected, because the small sample size of institutional enrollees (906) limits their impact within the modeling sample, the predictive ratios for this population indicate the post-

graft factors are not fully capturing their additional post-transplant costs (Table 5-93). Two of the four post-graft factors (*aged < 65, 10+ months since transplant* and *aged 65+, 4-9 months since transplant*) do not have a large enough sample size to calculate a reliable predictive ratio (sample size below 30). The remaining two factors show significant under prediction.

Table 5-94 illustrates that the post-graft factors (which are estimated to pick up the additional costs not attributed to HCCs in the functioning graft *continuing enrollee* models) are not sufficiently capturing the predicted costs of functioning graft new enrollees in their demographic model. Specifically, the predictive ratios for the new enrollee population show greater under prediction for the two post-graft factors with time since transplant of 10 months or more (roughly 20-25 percent) than for the post-graft factors for 4-9 months since transplant (roughly 9 percent).

3.4.7 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. Its predictive ratio shows perfect prediction (1.0) because month 1 is intended to capture only those costs. The amount is paid 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 months are averaged together weighted by enrollee population.[36] 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 the months. The population on which the combined Kidney Transplant Months 2 and 3 predictive ratio is calculated (8,481) is a subset of the populations used for the individual month calculations (9,405 and 9,246, respectively). It is slightly smaller because it contains individuals who had *both* Month 2 and Month 3 in the expenditure year (2015 for this evaluation). With this slightly different population, the predictive ratio for Kidney Transplant Months 2 and 3 shows accurate (1.013), but not perfect, prediction.

[36] Weighted average = ([Month 2 count x Month 2 costs] + [Month 3 count x Month 3 costs]) / [Month 2 count + Month 3 count]) = ([9,405 x $7,274.64] + [9,246 x $4,958.20]) / [9,405 + 9,246] = $6,126.29 per month

SECTION 4.
ONGOING RESEARCH

4.1 ICD-10

Although ICD-10-CM diagnosis codes have been in use by U.S. providers since October 2015, the current risk adjustment model calibrations are based on ICD-9-CM diagnosis codes. Moving from ICD-9-CM to ICD-10-CM was a major classification change in the U.S., both in terms of the volume of diagnosis codes and in the structure and clinical specificity of codes, as well as changes in clinical concepts for some conditions. Given that the challenge of implementing the new coding system by providers and payers was substantial, and the time needed to attain proficiency in coding with the new system likely varied by size, experience, and resources available to individual providers, hospitals, and health systems, extensive analysis is needed to assess the stability of using ICD-10 diagnosis codes for risk adjustment model calibration.

Since initial ICD-10 implementation, CMS has been conducting analyses to identify and understand ICD-10-CM coding patterns and how changes between the ICD-9 and ICD-10 coding systems affect HCC composition and frequency in the model sample. CMS-HCC model calibrations require two full years of Medicare claims data. CMS will evaluate and compare ICD-9 and ICD-10 based calibrations to determine when coding has stabilized sufficiently and what additional clinical reclassification changes may be needed to the CMS-HCC model to be able to implement an ICD-10 based calibration for payment purposes.

CMS is currently conducting ICD-10 research analyses on the CMS-HCC models for reclassification purposes and in preparation for changing to risk adjustment payment models calibrated on ICD-10-CM diagnoses. The CMS-HCC classification and risk adjustment models were developed and calibrated using ICD-9-CM diagnosis codes. The ICD-10-CM code set, implemented in the U.S. in October 2015, differs from the ICD-9 classification in four key aspects: (1) structure—ICD-10 codes are longer and use more alpha characters, which allows for greater clinical detail and specificity (e.g., laterality); (2) multiple concepts—ICD-10 codes have many more combination codes with two or more clinical concepts within the same code; (3) quantity—there are ~70,000 ICD-10 diagnosis codes and ~14,000 ICD-9 diagnosis codes; and (4) clinical currency—terminology and disease classifications have been updated to be consistent with current clinical practice.

The ICD-10 reclassification analyses CMS is conducting examine several areas, including these:

- disease groups with extensive ICD-10 code classification changes (e.g., substance use disorder; AMI);
- ICD-10 combination codes that map to two or more HCCs (e.g., diabetes);
- ICD-10 codes that include episode of care (initial, subsequent, sequela);
- ICD-10 codes whose initial mappings when based on General Equivalence Mappings (GEMS)-suggested ICD-10 backward mappings to ICD-9 codes resulted in large

changes in HCC counts, both increases and decreases depending on the HCC(e.g., type 2 diabetes with hyperglycemia);

- diagnoses with new severity breakouts that may affect HCC placement or consolidation (e.g., pressure ulcer and chronic skin ulcer codes);
- diagnoses related to chronic conditions that are not currently in the payment model and whose new ICD-10 specificity could assist in distinguishing persistence and severity (e.g., asthma);
- diagnoses related to social determinants of health (e.g., homelessness or extreme poverty); and
- ICD-10 diagnosis code reassignments based on initial coding patterns

The most recent CMS-HCC payment model calibrations (for Payment Years 2019 and 2020) were conducted using 2014–2015 Medicare FFS claims data, with 2014 being the final full calendar year of ICD-9-CM diagnosis code data. ***Table 4-1*** identifies calibration years and the corresponding diagnosis code versions. For research purposes, years in which the diagnosis year features a single ICD classification system (i.e., *not* 2015) are preferred to minimize coding anomalies related to the classification differences described earlier. Making major classification changes or payment model changes based on mixed sets of diagnosis codes (e.g., 2015–2016) versus a year with a single code set (e.g., 2016–2017) could have different impacts on the various risk adjustment models (e.g. CMS-HCC versus RxHCC models).

Full 2017 calendar year FFS claims data (with a 6-month claims run-out to allow sufficient time for claims processing) became available in August 2018, enabling comprehensive ICD-10 based 2016–2017 model year reclassification and calibration analyses to begin.

Table 4-1
Model calibration data years and diagnosis code classification

Model year calibration	Diagnosis year	ICD classification version	Expenditure year
2014–2015	2014	ICD-9	2015
2015–2016	2015	ICD-9 (9 months) and ICD-10 (3 months)	2016
2016–2017	2016	ICD-10	2017
2017–2018	2017	ICD-10	2018

Similar to previous clinical reclassifications, the ICD-10 based 2016-2107 CMS-HCC analyses begin by calculating the frequency, mean annualized expenditures, and predictive ratios (PRs) for each ICD-10 code, DXG, CC, and HCC. Regression analyses are conducted on the V23 CMS-HCC model (segmented and combined) with the dependent variable being total allowed charges per beneficiary. Multiple variations of the V23 CMS-HCC model are analyzed,

including the full classification, the base payment model, payment count models, as well as exploratory reconfigurations to determine the appropriate set of HCCs to be included in an ICD-10-based model. Additional regression analyses will be conducted on the ESRD models, both using the current V21 model, an updated V23 ESRD model and the RxHCC model. Consideration will also be given to how well HCCs calibrated on ICD-10 codes conform to our established principles of risk adjustment.

The ICD-10 model research process is iterative and includes clinician input. Clinical review calls are conducted to inform potential changes and review results. Questions posed to clinicians relate to (1) criteria and usual practice for diagnosing conditions; (2) prevalence and severity of conditions; (3) face validity and clinical interpretation of empirical results; (4) clinical similarities and differences of specific diseases; (5) diagnosis and treatment differences by subpopulation; (6) severity and chronicity of illness; (7) criteria, discretion, and variability in diagnosis; and (8) degree of definitiveness of specific diagnoses or disease groups.

Although the CMS-HCC models are prospective (use base year diagnoses to predict the next year's spending), we are also conducting concurrent model analyses (current year diagnoses to predict current year spending) of 2016 and 2017 data. These will enable us to compare diagnosis code reporting and HCC rates for two years of data, which may provide preliminary insight into the stability of coding. For example, analyses focused on code frequencies can help determine to what extent providers are coding to the highest specificity or using unspecified codes and in what settings. If there is great variability between diagnosis years in coding, it may indicate providers (and the EHR systems they use) are still adapting to the new classification system. Making major classification changes or payment model changes based on a single model year calibration (e.g., 2016–2017) could be problematic—especially if coding has not stabilized and a later 2017–2018 calibration results in significant differences in some HCC rates.

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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
2017 CMS-HCC Model				
Entire Sample	30,962,502	9,511.81	9,511.81	1.000
First (lowest) decile	3,096,251	2,832.84	2,684.09	0.947
Second decile	3,096,251	3,637.34	3,456.82	0.950
Third decile	3,096,250	4,427.84	4,335.07	0.979
Fourth decile	3,096,250	5,128.94	5,023.11	0.979
Fifth decile	3,096,250	6,183.12	6,160.22	0.996
Sixth decile	3,096,250	7,594.75	7,530.24	0.992
Seventh decile	3,096,250	9,250.59	9,311.68	1.007
Eighth decile	3,096,250	11,582.18	11,724.05	1.012
Ninth decile	3,096,250	15,636.00	15,963.92	1.021
Tenth (highest)	3,096,250	30,769.79	30,876.08	1.003
Top 5%	1,548,125	39,470.44	39,304.22	0.996
Top 1%	309,625	61,597.82	60,183.53	0.977
Top 0.1%	30,962	96,172.26	91,295.17	0.949
2019 CMS-HCC Model				
Entire Sample	30,863,674	9,701.43	9,701.43	1.000
First (lowest) decile	3,086,368	2,897.05	2,763.08	0.954
Second decile	3,086,368	3,715.59	3,557.84	0.958
Third decile	3,086,368	4,537.73	4,416.38	0.973
Fourth decile	3,086,368	5,165.35	5,114.84	0.990
Fifth decile	3,086,367	6,284.45	6,262.48	0.997
Sixth decile	3,086,367	7,744.65	7,672.29	0.991
Seventh decile	3,086,367	9,446.94	9,482.93	1.004
Eighth decile	3,086,367	11,857.20	11,961.86	1.009
Ninth decile	3,086,367	16,041.24	16,362.78	1.020
Tenth (highest)	3,086,367	31,448.68	31,569.01	1.004
Top 5%	1,543,183	40,376.31	40,139.17	0.994
Top 1%	308,636	62,450.72	61,185.07	0.980
Top 0.1%	30,863	95,959.90	92,109.02	0.960

(continued)

Table 5-1 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	30,863,674	9,701.43	9,701.43	1.000
First (lowest) decile	3,086,368	2,893.46	2,846.27	0.984
Second decile	3,086,368	3,718.39	3,652.00	0.982
Third decile	3,086,368	4,525.64	4,481.49	0.990
Fourth decile	3,086,368	5,185.24	5,157.13	0.995
Fifth decile	3,086,367	6,249.93	6,308.45	1.009
Sixth decile	3,086,367	7,753.92	7,692.75	0.992
Seventh decile	3,086,367	9,447.34	9,454.84	1.001
Eighth decile	3,086,367	11,855.36	11,877.30	1.002
Ninth decile	3,086,367	16,060.77	16,149.31	1.006
Tenth (highest)	3,086,367	31,455.09	31,536.43	1.003
Top 5%	1,543,183	40,385.05	40,380.11	1.000
Top 1%	308,636	62,499.23	62,354.17	0.998
Top 0.1%	30,863	95,528.61	93,358.47	0.977

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	25,687,343	9,463.26	9,463.26	1.000
First (lowest) decile	2,568,735	3,056.20	2,881.38	0.943
Second decile	2,568,735	3,749.97	3,601.41	0.960
Third decile	2,568,735	4,446.52	4,413.31	0.993
Fourth decile	2,568,734	5,084.56	5,029.20	0.989
Fifth decile	2,568,734	6,142.90	6,134.87	0.999
Sixth decile	2,568,734	7,561.46	7,480.24	0.989
Seventh decile	2,568,734	9,250.25	9,290.76	1.004
Eighth decile	2,568,734	11,631.53	11,729.69	1.008
Ninth decile	2,568,734	15,770.10	16,028.61	1.016
Tenth (highest)	2,568,734	29,986.33	30,114.09	1.004
Top 5%	1,284,367	38,022.16	37,947.12	0.998
Top 1%	256,873	58,260.36	56,905.30	0.977
Top 0.1%	25,687	88,952.51	84,465.63	0.950
2019 CMS-HCC Model				
Entire Sample	25,739,689	9,658.46	9,659.08	1.000
First (lowest) decile	2,573,969	3,098.52	2,940.16	0.949
Second decile	2,573,969	3,753.98	3,693.81	0.984
Third decile	2,573,969	4,612.13	4,503.92	0.977
Fourth decile	2,573,969	5,151.12	5,123.49	0.995
Fifth decile	2,573,969	6,245.48	6,247.46	1.000
Sixth decile	2,573,969	7,707.24	7,630.00	0.990
Seventh decile	2,573,969	9,459.99	9,469.28	1.001
Eighth decile	2,573,969	11,926.78	11,985.52	1.005
Ninth decile	2,573,969	16,193.16	16,448.51	1.016
Tenth (highest)	2,573,968	30,701.34	30,837.70	1.004
Top 5%	1,286,984	38,941.47	38,814.97	0.997
Top 1%	257,396	59,222.74	57,973.81	0.979
Top 0.1%	25,739	89,680.40	85,371.64	0.952

(continued)

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

Deciles	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2019 Payment Condition Count (PCC) Model				
Entire Sample	25,739,689	9,658.46	9,659.08	1.000
First (lowest) decile	2,573,969	3,098.51	2,996.50	0.967
Second decile	2,573,969	3,756.61	3,757.14	1.000
Third decile	2,573,969	4,598.72	4,552.05	0.990
Fourth decile	2,573,969	5,177.66	5,163.35	0.997
Fifth decile	2,573,969	6,234.35	6,290.42	1.009
Sixth decile	2,573,969	7,680.29	7,653.77	0.997
Seventh decile	2,573,969	9,469.75	9,454.75	0.998
Eighth decile	2,573,969	11,928.43	11,920.40	0.999
Ninth decile	2,573,969	16,211.70	16,273.77	1.004
Tenth (highest)	2,573,968	30,698.71	30,812.14	1.004
Top 5%	1,286,984	38,941.32	39,012.64	1.002
Top 1%	257,396	59,257.74	58,959.44	0.995
Top 0.1%	25,739	89,472.70	86,449.64	0.966

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	5,275,159	9,749.44	9,749.44	1.000
First (lowest) decile	527,516	2,211.86	2,080.30	0.941
Second decile	527,516	3,070.07	2,837.40	0.924
Third decile	527,516	4,006.43	3,611.12	0.901
Fourth decile	527,516	5,213.42	4,885.56	0.937
Fifth decile	527,516	6,438.06	6,306.19	0.980
Sixth decile	527,516	7,702.21	7,754.68	1.007
Seventh decile	527,516	9,229.94	9,388.94	1.017
Eighth decile	527,516	11,388.62	11,728.26	1.030
Ninth decile	527,516	14,944.34	15,638.65	1.046
Tenth (highest)	527,515	34,428.10	34,432.30	1.000
Top 5%	263,757	46,077.18	45,427.07	0.986
Top 1%	52,751	74,001.80	72,028.80	0.973
Top 0.1%	5,275	114,610.86	107,747.66	0.940
2019 CMS-HCC Model				
Entire Sample	5,123,985	9,919.12	9,915.98	1.000
First (lowest) decile	512,399	2,222.22	2,120.86	0.954
Second decile	512,399	3,214.54	2,975.56	0.926
Third decile	512,399	4,058.17	3,722.07	0.917
Fourth decile	512,399	5,262.22	4,936.47	0.938
Fifth decile	512,399	6,482.98	6,344.29	0.979
Sixth decile	512,398	7,943.62	7,886.03	0.993
Seventh decile	512,398	9,368.82	9,523.83	1.017
Eighth decile	512,398	11,594.94	11,893.52	1.026
Ninth decile	512,398	15,202.23	15,902.80	1.046
Tenth (highest)	512,398	35,044.40	35,085.90	1.001
Top 5%	256,199	47,135.05	46,326.59	0.983
Top 1%	51,239	74,789.23	73,068.63	0.977
Top 0.1%	5,123	113,057.73	108,969.83	0.964

(continued)

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

Deciles	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2019 Payment Condition Count (PCC) Model				
Entire Sample	5,123,985	9,919.12	9,915.98	1.000
First (lowest) decile	512,399	2,244.47	2,290.59	1.021
Second decile	512,399	3,166.72	3,181.37	1.005
Third decile	512,399	4,086.77	3,902.95	0.955
Fourth decile	512,399	5,259.09	5,058.24	0.962
Fifth decile	512,399	6,446.79	6,407.54	0.994
Sixth decile	512,398	7,950.02	7,883.91	0.992
Seventh decile	512,398	9,369.63	9,441.27	1.008
Eighth decile	512,398	11,602.26	11,731.43	1.011
Ninth decile	512,398	15,237.90	15,495.76	1.017
Tenth (highest)	512,398	35,058.84	35,007.08	0.999
Top 5%	256,199	47,156.26	46,787.27	0.992
Top 1%	51,239	74,872.48	74,856.09	1.000
Top 0.1%	5,123	112,818.02	110,058.04	0.976

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	27,621,738	9,516.08	9,516.08	1.000
First (lowest) decile	2,762,174	2,848.04	2,662.44	0.935
Second decile	2,762,174	3,487.92	3,327.06	0.954
Third decile	2,762,174	4,252.32	4,071.79	0.958
Fourth decile	2,762,174	5,196.30	5,050.98	0.972
Fifth decile	2,762,174	6,232.74	6,218.57	0.998
Sixth decile	2,762,174	7,570.47	7,535.48	0.995
Seventh decile	2,762,174	9,214.23	9,329.25	1.012
Eighth decile	2,762,174	11,656.52	11,861.19	1.018
Ninth decile	2,762,173	15,935.27	16,307.52	1.023
Tenth (highest)	2,762,173	31,300.88	31,355.27	1.002
Top 5%	1,381,086	40,158.10	39,881.09	0.993
Top 1%	276,217	62,893.40	61,067.04	0.971
Top 0.1%	27,621	99,491.19	93,214.52	0.937
2019 CMS-HCC Model				
Entire Sample	27,574,242	9,719.21	9,719.21	1.000
First (lowest) decile	2,757,425	2,908.25	2,739.80	0.942
Second decile	2,757,425	3,590.03	3,439.89	0.958
Third decile	2,757,424	4,293.99	4,148.75	0.966
Fourth decile	2,757,424	5,296.93	5,131.50	0.969
Fifth decile	2,757,424	6,352.05	6,332.45	0.997
Sixth decile	2,757,424	7,709.93	7,685.75	0.997
Seventh decile	2,757,424	9,434.94	9,528.66	1.010
Eighth decile	2,757,424	11,964.58	12,136.63	1.014
Ninth decile	2,757,424	16,361.15	16,724.33	1.022
Tenth (highest)	2,757,424	31,990.67	32,061.55	1.002
Top 5%	1,378,712	41,095.49	40,724.49	0.991
Top 1%	275,742	63,727.70	62,068.14	0.974
Top 0.1%	27,574	98,855.74	93,944.99	0.950

(continued)

Table 5-4 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	27,574,242	9,719.21	9,719.21	1.000
First (lowest) decile	2,757,425	2,896.86	2,823.49	0.975
Second decile	2,757,425	3,590.98	3,530.48	0.983
Third decile	2,757,424	4,305.45	4,233.21	0.983
Fourth decile	2,757,424	5,294.93	5,192.66	0.981
Fifth decile	2,757,424	6,334.78	6,380.64	1.007
Sixth decile	2,757,424	7,714.67	7,706.10	0.999
Seventh decile	2,757,424	9,431.56	9,494.09	1.007
Eighth decile	2,757,424	11,969.37	12,031.25	1.005
Ninth decile	2,757,424	16,379.80	16,490.03	1.007
Tenth (highest)	2,757,424	31,991.12	32,039.51	1.002
Top 5%	1,378,712	41,099.04	40,999.18	0.998
Top 1%	275,742	63,736.59	63,360.75	0.994
Top 0.1%	27,574	99,016.69	95,368.88	0.963

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
		2017 CMS-HCC Model		
Entire Sample	955,174	18,714.21	18,714.21	1.000
First (lowest) decile	95,518	8,180.66	6,869.38	0.840
Second decile	95,518	9,969.30	9,365.32	0.939
Third decile	95,518	11,221.42	11,203.80	0.998
Fourth decile	95,518	12,725.29	12,887.20	1.013
Fifth decile	95,517	14,323.43	14,661.54	1.024
Sixth decile	95,517	16,498.19	16,746.91	1.015
Seventh decile	95,517	18,739.41	19,381.66	1.034
Eighth decile	95,517	22,595.40	23,073.91	1.021
Ninth decile	95,517	28,931.38	29,237.62	1.011
Tenth (highest)	95,517	47,185.11	46,869.84	0.993
Top 5%	47,758	57,490.43	56,166.52	0.977
Top 1%	9,551	81,201.62	77,838.58	0.959
Top 0.1%	955	109,553.09	103,543.97	0.945
		2019 CMS-HCC Model		
Entire Sample	906,802	19,465.55	19,465.55	1.000
First (lowest) decile	90,681	8,684.45	7,460.46	0.859
Second decile	90,681	10,404.56	9,989.04	0.960
Third decile	90,680	11,871.71	11,807.16	0.995
Fourth decile	90,680	13,478.72	13,479.07	1.000
Fifth decile	90,680	14,966.46	15,298.17	1.022
Sixth decile	90,680	17,034.29	17,425.80	1.023
Seventh decile	90,680	19,601.88	20,142.37	1.028
Eighth decile	90,680	23,531.01	23,982.12	1.019
Ninth decile	90,680	29,905.07	30,339.85	1.015
Tenth (highest)	90,680	48,767.02	48,231.00	0.989
Top 5%	45,340	58,328.20	57,511.73	0.986
Top 1%	9,068	81,571.84	78,826.34	0.966
Top 0.1%	906	108,600.75	104,231.93	0.960

(continued)

Table 5-5 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	906,802	19,465.55	19,465.55	1.000
First (lowest) decile	90,681	8,705.43	7,607.73	0.874
Second decile	90,681	10,412.76	10,078.66	0.968
Third decile	90,680	11,827.21	11,864.42	1.003
Fourth decile	90,680	13,518.10	13,496.19	0.998
Fifth decile	90,680	14,945.48	15,257.48	1.021
Sixth decile	90,680	16,995.52	17,321.64	1.019
Seventh decile	90,680	19,620.93	19,988.86	1.019
Eighth decile	90,680	23,524.90	23,829.31	1.013
Ninth decile	90,680	29,909.54	30,290.00	1.013
Tenth (highest)	90,680	48,769.24	48,425.93	0.993
Top 5%	45,340	58,390.70	57,765.35	0.989
Top 1%	9,068	81,506.72	78,689.99	0.965
Top 0.1%	906	108,341.33	103,426.96	0.955

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	2,642,917	6,686.24	6,686.24	1.000
First (lowest) decile	264,292	4,816.07	4,698.00	0.975
Second decile	264,292	4,657.89	4,720.82	1.014
Third decile	264,292	4,756.95	4,773.53	1.003
Fourth decile	264,292	4,827.27	4,798.23	0.994
Fifth decile	264,292	4,759.93	4,808.01	1.010
Sixth decile	264,292	5,199.78	5,214.84	1.003
Seventh decile	264,292	6,790.57	6,794.98	1.001
Eighth decile	264,291	8,703.00	8,707.85	1.001
Ninth decile	264,291	10,206.79	10,248.33	1.004
Tenth (highest)	264,291	12,774.31	12,739.67	0.997
Top 5%	132,145	13,520.74	13,420.65	0.993
Top 1%	26,429	15,315.23	15,200.77	0.993
Top 0.1%	2,642	18,486.57	19,389.70	1.049
2019 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)	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

(continued)

Table 5-6 (continued)
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
2019 Payment Condition Count (PCC) 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)	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

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
		2017 CMS-HCC Model		
Entire Sample	23,022,197	9,526.07	9,526.07	1.000
First (lowest) decile	2,302,220	2,973.32	2,819.20	0.948
Second decile	2,302,220	3,643.77	3,484.53	0.956
Third decile	2,302,220	4,340.85	4,215.25	0.971
Fourth decile	2,302,220	5,282.08	5,196.75	0.984
Fifth decile	2,302,220	6,383.29	6,348.26	0.995
Sixth decile	2,302,220	7,667.47	7,668.47	1.000
Seventh decile	2,302,220	9,380.25	9,450.03	1.007
Eighth decile	2,302,219	11,788.50	11,952.94	1.014
Ninth decile	2,302,219	16,021.26	16,316.27	1.018
Tenth (highest)	2,302,219	30,471.15	30,523.65	1.002
Top 5%	1,151,109	38,673.90	38,453.58	0.994
Top 1%	230,221	59,538.52	57,711.34	0.969
Top 0.1%	23,022	92,124.72	86,120.91	0.935
		2017 CMS-HCC Model		
Entire Sample	23,075,236	9,735.05	9,735.05	1.000
First (lowest) decile	2,307,524	3,030.89	2,892.71	0.954
Second decile	2,307,524	3,722.61	3,577.27	0.961
Third decile	2,307,524	4,399.73	4,288.04	0.975
Fourth decile	2,307,524	5,385.38	5,280.02	0.980
Fifth decile	2,307,524	6,475.36	6,466.16	0.999
Sixth decile	2,307,524	7,839.46	7,825.82	0.998
Seventh decile	2,307,523	9,597.27	9,660.88	1.007
Eighth decile	2,307,523	12,111.86	12,244.44	1.011
Ninth decile	2,307,523	16,478.65	16,763.61	1.017
Tenth (highest)	2,307,523	31,209.17	31,276.76	1.002
Top 5%	1,153,761	39,628.47	39,343.27	0.993
Top 1%	230,752	60,528.07	58,802.00	0.971
Top 0.1%	23,075	92,413.42	86,928.10	0.941

(continued)

Table 5-7 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	23,075,236	9,735.05	9,735.05	1.000
First (lowest) decile	2,307,524	3,030.49	2,948.08	0.973
Second decile	2,307,524	3,719.95	3,641.63	0.979
Third decile	2,307,524	4,398.49	4,354.71	0.990
Fourth decile	2,307,524	5,386.72	5,329.25	0.989
Fifth decile	2,307,524	6,474.55	6,505.48	1.005
Sixth decile	2,307,524	7,828.41	7,848.28	1.003
Seventh decile	2,307,523	9,593.91	9,641.11	1.005
Eighth decile	2,307,523	12,121.12	12,163.58	1.004
Ninth decile	2,307,523	16,494.30	16,574.21	1.005
Tenth (highest)	2,307,523	31,205.05	31,259.22	1.002
Top 5%	1,153,761	39,619.15	39,566.00	0.999
Top 1%	230,752	60,501.03	59,866.46	0.990
Top 0.1%	23,075	92,512.64	88,181.44	0.953

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	4,599,541	9,465.89	9,465.89	1.000
First (lowest) decile	459,955	2,116.44	2,016.15	0.953
Second decile	459,954	3,013.38	2,734.19	0.907
Third decile	459,954	3,743.83	3,293.46	0.880
Fourth decile	459,954	4,647.27	4,293.25	0.924
Fifth decile	459,954	5,731.65	5,525.55	0.964
Sixth decile	459,954	6,893.29	6,822.22	0.990
Seventh decile	459,954	8,457.35	8,617.67	1.019
Eighth decile	459,954	10,879.45	11,341.82	1.042
Ninth decile	459,954	15,429.67	16,262.26	1.054
Tenth (highest)	459,954	35,310.08	35,331.29	1.001
Top 5%	229,977	47,091.37	46,416.22	0.986
Top 1%	45,995	75,986.16	73,389.62	0.966
Top 0.1%	4,599	119,178.01	110,484.86	0.927
2019 CMS-HCC Model				
Entire Sample	4,499,006	9,637.30	9,637.30	1.000
First (lowest) decile	449,901	2,145.20	2,056.81	0.959
Second decile	449,901	3,055.91	2,860.68	0.936
Third decile	449,901	3,853.27	3,446.10	0.894
Fourth decile	449,901	4,771.08	4,374.82	0.917
Fifth decile	449,901	5,832.83	5,608.45	0.962
Sixth decile	449,901	7,035.31	6,923.00	0.984
Seventh decile	449,900	8,635.39	8,771.09	1.016
Eighth decile	449,900	11,099.78	11,519.68	1.038
Ninth decile	449,900	15,704.61	16,498.86	1.051
Tenth (highest)	449,900	35,818.19	35,910.96	1.003
Top 5%	224,950	48,085.81	47,236.77	0.982
Top 1%	44,990	76,558.28	74,334.65	0.971
Top 0.1%	4,499	118,633.25	111,661.72	0.941

(continued)

Table 5-8 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	4,499,006	9,637.30	9,637.30	1.000
First (lowest) decile	449,901	2,130.66	2,222.36	1.043
Second decile	449,901	3,079.73	3,062.10	0.994
Third decile	449,901	3,790.25	3,649.11	0.963
Fourth decile	449,901	4,812.12	4,534.27	0.942
Fifth decile	449,901	5,834.89	5,688.65	0.975
Sixth decile	449,901	7,023.04	6,971.26	0.993
Seventh decile	449,900	8,646.28	8,694.59	1.006
Eighth decile	449,900	11,098.99	11,277.90	1.016
Ninth decile	449,900	15,689.95	15,994.00	1.019
Tenth (highest)	449,900	35,845.23	35,863.92	1.001
Top 5%	224,950	48,057.60	47,788.96	0.994
Top 1%	44,990	76,794.76	76,355.32	0.994
Top 0.1%	4,499	117,930.48	112,765.95	0.956

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
		2017 CMS-HCC Model		
Entire Sample	2,125,574	15,203.97	15,203.97	1.000
First (lowest) decile	212,558	4,791.30	4,520.96	0.944
Second decile	212,558	5,928.89	5,875.27	0.991
Third decile	212,558	7,476.90	7,387.35	0.988
Fourth decile	212,558	9,148.70	8,998.10	0.984
Fifth decile	212,557	10,782.43	10,676.98	0.990
Sixth decile	212,557	12,869.80	12,857.72	0.999
Seventh decile	212,557	15,628.24	15,730.34	1.007
Eighth decile	212,557	19,667.00	19,905.19	1.012
Ninth decile	212,557	26,616.38	26,993.10	1.014
Tenth (highest)	212,557	46,482.34	46,497.92	1.000
Top 5%	106,278	57,474.68	57,084.75	0.993
Top 1%	21,255	84,152.33	81,870.11	0.973
Top 0.1%	2,125	130,553.75	117,076.23	0.897
		2019 CMS-HCC Model		
Entire Sample	1,984,583	15,707.58	15,707.58	1.000
First (lowest) decile	198,459	4,919.04	4,648.90	0.945
Second decile	198,459	6,155.31	6,103.32	0.992
Third decile	198,459	7,825.22	7,697.21	0.984
Fourth decile	198,458	9,526.70	9,354.32	0.982
Fifth decile	198,458	11,123.27	11,127.44	1.000
Sixth decile	198,458	13,360.25	13,367.99	1.001
Seventh decile	198,458	16,216.23	16,332.63	1.007
Eighth decile	198,458	20,333.59	20,639.35	1.015
Ninth decile	198,458	27,661.26	27,966.81	1.011
Tenth (highest)	198,458	47,972.27	47,891.01	0.998
Top 5%	99,229	58,825.32	58,511.23	0.995
Top 1%	19,845	85,773.55	82,841.25	0.966
Top 0.1%	1,984	126,743.60	116,423.67	0.919

(continued)

Table 5-9 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	1,984,583	15,707.58	15,707.58	1.000
First (lowest) decile	198,459	4,943.98	4,734.15	0.958
Second decile	198,459	6,129.70	6,197.72	1.011
Third decile	198,459	7,819.59	7,776.46	0.994
Fourth decile	198,458	9,427.27	9,433.30	1.001
Fifth decile	198,458	11,198.54	11,185.92	0.999
Sixth decile	198,458	13,401.65	13,384.02	0.999
Seventh decile	198,458	16,201.35	16,283.58	1.005
Eighth decile	198,458	20,351.51	20,475.02	1.006
Ninth decile	198,458	27,668.53	27,656.56	1.000
Tenth (highest)	198,458	47,947.27	47,974.77	1.001
Top 5%	99,229	58,796.69	59,042.30	1.004
Top 1%	19,845	85,699.70	84,087.06	0.981
Top 0.1%	1,984	127,221.19	116,757.03	0.918

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
		2017 CMS-HCC Model		
Entire Sample	2,125,197	10,684.07	10,684.07	1.000
First (lowest) decile	212,520	2,237.39	2,129.50	0.952
Second decile	212,520	3,292.48	2,889.10	0.877
Third decile	212,520	4,350.68	3,711.73	0.853
Fourth decile	212,520	5,333.00	4,818.62	0.904
Fifth decile	212,520	6,388.66	6,248.70	0.978
Sixth decile	212,520	7,633.32	7,654.71	1.003
Seventh decile	212,520	9,461.87	9,839.03	1.040
Eighth decile	212,519	12,428.95	12,937.87	1.041
Ninth decile	212,519	17,810.72	18,766.18	1.054
Tenth (highest)	212,519	40,954.15	40,932.59	0.999
Top 5%	106,259	54,358.49	53,679.99	0.988
Top 1%	21,251	87,542.29	83,334.83	0.952
Top 0.1%	2,125	122,757.36	121,753.04	0.992
		2019 CMS-HCC Model		
Entire Sample	2,031,028	10,834.33	10,834.33	1.000
First (lowest) decile	203,103	2,243.03	2,182.66	0.973
Second decile	203,103	3,394.06	3,058.56	0.901
Third decile	203,103	4,448.51	3,839.77	0.863
Fourth decile	203,103	5,354.67	4,927.91	0.920
Fifth decile	203,103	6,509.42	6,297.13	0.967
Sixth decile	203,103	7,774.70	7,770.70	0.999
Seventh decile	203,103	9,686.18	9,983.78	1.031
Eighth decile	203,103	12,489.74	13,055.57	1.045
Ninth decile	203,102	18,132.86	18,905.35	1.043
Tenth (highest)	203,102	41,381.89	41,431.34	1.001
Top 5%	101,551	55,431.67	54,450.84	0.982
Top 1%	20,310	87,459.78	84,428.66	0.965
Top 0.1%	2,031	141,184.75	123,327.67	0.874

(continued)

Table 5-10 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	2,031,028	10,834.33	10,834.33	1.000
First (lowest) decile	203,103	2,243.13	2,428.30	1.083
Second decile	203,103	3,255.79	3,324.84	1.021
Third decile	203,103	4,558.81	4,064.48	0.892
Fourth decile	203,103	5,377.20	5,098.56	0.948
Fifth decile	203,103	6,503.07	6,386.12	0.982
Sixth decile	203,103	7,818.56	7,795.19	0.997
Seventh decile	203,103	9,653.32	9,830.19	1.018
Eighth decile	203,103	12,460.50	12,737.75	1.022
Ninth decile	203,102	18,131.89	18,317.76	1.010
Tenth (highest)	203,102	41,418.73	41,449.36	1.001
Top 5%	101,551	55,452.18	55,165.62	0.995
Top 1%	20,310	87,823.47	86,538.79	0.985
Top 0.1%	2,031	141,649.64	123,853.14	0.874

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
		2017 CMS-HCC Model		
Entire Sample	919,791	10,688.96	10,688.96	1.000
First (lowest) decile	91,980	3,544.97	3,307.08	0.933
Second decile	91,979	4,200.42	4,108.52	0.978
Third decile	91,979	5,110.57	4,878.56	0.955
Fourth decile	91,979	6,298.94	6,115.14	0.971
Fifth decile	91,979	7,536.86	7,444.96	0.988
Sixth decile	91,979	8,775.11	8,853.81	1.009
Seventh decile	91,979	10,666.13	10,873.53	1.019
Eighth decile	91,979	13,469.04	13,710.91	1.018
Ninth decile	91,979	18,138.16	18,564.52	1.024
Tenth (highest)	91,979	32,740.11	32,641.14	0.997
Top 5%	45,989	40,570.16	40,093.98	0.988
Top 1%	9,197	60,911.92	57,321.49	0.941
Top 0.1%	919	87,258.94	80,699.95	0.925
		2019 CMS-HCC Model		
Entire Sample	896,980	10,791.10	10,791.10	1.000
First (lowest) decile	89,698	3,551.19	3,430.70	0.966
Second decile	89,698	4,262.69	4,182.85	0.981
Third decile	89,698	5,130.74	4,950.86	0.965
Fourth decile	89,698	6,299.22	6,140.75	0.975
Fifth decile	89,698	7,516.83	7,454.76	0.992
Sixth decile	89,698	8,901.36	8,871.54	0.997
Seventh decile	89,698	10,782.67	10,886.05	1.010
Eighth decile	89,698	13,539.10	13,770.79	1.017
Ninth decile	89,698	18,403.24	18,762.30	1.020
Tenth (highest)	89,698	33,101.89	33,057.87	0.999
Top 5%	44,849	41,205.59	40,631.02	0.986
Top 1%	8,969	59,629.59	57,851.08	0.970
Top 0.1%	896	82,390.98	80,504.27	0.977

(continued)

Table 5-11 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	896,980	10,791.10	10,791.10	1.000
First (lowest) decile	89,698	3,548.44	3,511.06	0.989
Second decile	89,698	4,265.54	4,271.57	1.001
Third decile	89,698	5,140.21	5,041.14	0.981
Fourth decile	89,698	6,279.78	6,209.36	0.989
Fifth decile	89,698	7,501.85	7,512.45	1.001
Sixth decile	89,698	8,912.16	8,898.33	0.998
Seventh decile	89,698	10,798.25	10,857.99	1.006
Eighth decile	89,698	13,538.45	13,639.10	1.007
Ninth decile	89,698	18,421.86	18,477.91	1.003
Tenth (highest)	89,698	33,066.86	33,059.96	1.000
Top 5%	44,849	41,199.44	41,050.19	0.996
Top 1%	8,969	59,685.26	59,516.66	0.997
Top 0.1%	896	82,744.82	81,780.67	0.988

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
		2017 CMS-HCC Model		
Entire Sample	849,302	9,649.22	9,649.22	1.000
First (lowest) decile	84,931	3,107.15	2,690.58	0.866
Second decile	84,931	3,448.93	3,232.89	0.937
Third decile	84,930	4,098.56	3,838.38	0.937
Fourth decile	84,930	5,261.95	5,032.82	0.956
Fifth decile	84,930	6,138.66	6,085.90	0.991
Sixth decile	84,930	7,220.94	7,246.72	1.004
Seventh decile	84,930	8,820.74	9,058.92	1.027
Eighth decile	84,930	11,087.95	11,650.07	1.051
Ninth decile	84,930	15,694.47	16,314.25	1.039
Tenth (highest)	84,930	33,537.83	33,267.27	0.992
Top 5%	42,465	43,954.17	42,879.04	0.976
Top 1%	8,493	66,324.94	65,280.16	0.984
Top 0.1%	849	95,233.82	95,117.80	0.999
		2019 CMS-HCC Model		
Entire Sample	840,221	9,851.89	9,851.89	1.000
First (lowest) decile	84,023	3,143.85	2,707.33	0.861
Second decile	84,022	3,480.26	3,456.80	0.993
Third decile	84,022	4,265.96	3,890.27	0.912
Fourth decile	84,022	5,272.38	5,030.57	0.954
Fifth decile	84,022	6,305.16	6,111.61	0.969
Sixth decile	84,022	7,367.76	7,299.26	0.991
Seventh decile	84,022	8,905.19	9,168.30	1.030
Eighth decile	84,022	11,266.59	11,844.85	1.051
Ninth decile	84,022	15,942.58	16,639.64	1.044
Tenth (highest)	84,022	34,406.00	34,223.92	0.995
Top 5%	42,011	45,545.30	44,298.54	0.973
Top 1%	8,402	68,569.14	67,525.22	0.985
Top 0.1%	840	93,328.36	98,526.84	1.056

(continued)

Table 5-12 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	840,221	9,851.89	9,851.89	1.000
First (lowest) decile	84,023	3,143.60	2,932.48	0.933
Second decile	84,022	3,482.14	3,684.21	1.058
Third decile	84,022	4,283.21	4,086.88	0.954
Fourth decile	84,022	5,206.40	5,151.25	0.989
Fifth decile	84,022	6,336.05	6,200.01	0.979
Sixth decile	84,022	7,346.12	7,316.28	0.996
Seventh decile	84,022	8,931.71	9,049.47	1.013
Eighth decile	84,022	11,279.92	11,541.11	1.023
Ninth decile	84,022	15,897.68	16,103.66	1.013
Tenth (highest)	84,022	34,446.29	34,294.66	0.996
Top 5%	42,011	45,586.98	45,019.99	0.988
Top 1%	8,402	69,232.99	69,146.54	0.999
Top 0.1%	840	92,671.91	99,481.79	1.073

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	20,466,057	8,968.36	8,968.36	1.000
First (lowest) decile	2,046,606	2,987.62	2,809.71	0.940
Second decile	2,046,606	3,521.42	3,385.75	0.961
Third decile	2,046,606	4,122.52	4,021.95	0.976
Fourth decile	2,046,606	5,006.59	4,890.94	0.977
Fifth decile	2,046,606	6,039.90	6,041.37	1.000
Sixth decile	2,046,606	7,258.80	7,247.42	0.998
Seventh decile	2,046,606	8,813.24	8,900.42	1.010
Eighth decile	2,046,605	11,103.19	11,236.09	1.012
Ninth decile	2,046,605	14,944.84	15,233.81	1.019
Tenth (highest)	2,046,605	28,261.25	28,313.12	1.002
Top 5%	1,023,302	35,957.87	35,678.82	0.992
Top 1%	204,660	54,983.16	53,069.46	0.965
Top 0.1%	20,466	82,911.21	77,061.97	0.929
2019 CMS-HCC Model				
Entire Sample	20,657,519	9,203.56	9,203.56	1.000
First (lowest) decile	2,065,752	3,057.24	2,884.50	0.943
Second decile	2,065,752	3,621.54	3,486.40	0.963
Third decile	2,065,752	4,195.19	4,107.40	0.979
Fourth decile	2,065,752	5,083.33	4,988.05	0.981
Fifth decile	2,065,752	6,162.92	6,159.41	0.999
Sixth decile	2,065,752	7,425.06	7,419.94	0.999
Seventh decile	2,065,752	9,050.80	9,117.49	1.007
Eighth decile	2,065,752	11,437.89	11,546.55	1.010
Ninth decile	2,065,752	15,445.74	15,716.51	1.018
Tenth (highest)	2,065,751	29,094.52	29,171.70	1.003
Top 5%	1,032,875	36,968.54	36,700.79	0.993
Top 1%	206,575	56,428.31	54,433.12	0.965
Top 0.1%	20,657	83,845.99	79,056.25	0.943

(continued)

Table 5-13 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	20,657,519	9,203.56	9,203.56	1.000
First (lowest) decile	2,065,752	3,057.24	2,939.88	0.962
Second decile	2,065,752	3,621.54	3,549.16	0.980
Third decile	2,065,752	4,195.45	4,171.42	0.994
Fourth decile	2,065,752	5,082.82	5,047.16	0.993
Fifth decile	2,065,752	6,160.66	6,194.97	1.006
Sixth decile	2,065,752	7,420.39	7,438.83	1.002
Seventh decile	2,065,752	9,041.57	9,096.51	1.006
Eighth decile	2,065,752	11,436.43	11,470.27	1.003
Ninth decile	2,065,752	15,464.34	15,528.85	1.004
Tenth (highest)	2,065,751	29,094.08	29,148.47	1.002
Top 5%	1,032,875	36,949.87	36,920.19	0.999
Top 1%	206,575	56,362.51	55,539.20	0.985
Top 0.1%	20,657	83,469.92	80,414.23	0.963

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	2,110,276	8,151.70	8,151.70	1.000
First (lowest) decile	211,028	1,892.41	1,821.23	0.962
Second decile	211,028	2,726.55	2,474.46	0.908
Third decile	211,028	3,067.28	2,866.08	0.934
Fourth decile	211,028	3,806.09	3,600.12	0.946
Fifth decile	211,028	5,004.03	4,747.07	0.949
Sixth decile	211,028	6,063.70	5,972.26	0.985
Seventh decile	211,027	7,557.79	7,533.78	0.997
Eighth decile	211,027	9,593.53	9,899.00	1.032
Ninth decile	211,027	13,357.58	14,170.82	1.061
Tenth (highest)	211,027	30,542.10	30,561.84	1.001
Top 5%	105,513	40,871.33	40,176.18	0.983
Top 1%	21,102	65,039.65	63,613.04	0.978
Top 0.1%	2,110	102,541.68	95,832.42	0.935
2019 CMS-HCC Model				
Entire Sample	2,089,311	8,373.23	8,373.23	1.000
First (lowest) decile	208,932	1,820.12	1,841.68	1.012
Second decile	208,931	2,802.81	2,539.96	0.906
Third decile	208,931	3,246.05	3,032.22	0.934
Fourth decile	208,931	3,961.44	3,730.28	0.942
Fifth decile	208,931	5,121.75	4,846.70	0.946
Sixth decile	208,931	6,226.59	6,105.32	0.981
Seventh decile	208,931	7,821.19	7,734.04	0.989
Eighth decile	208,931	9,865.61	10,117.81	1.026
Ninth decile	208,931	13,701.88	14,523.25	1.060
Tenth (highest)	208,931	31,147.36	31,290.42	1.005
Top 5%	104,465	41,948.58	41,136.69	0.981
Top 1%	20,893	66,838.91	64,579.35	0.966
Top 0.1%	2,089	99,234.91	96,333.37	0.971

(continued)

Table 5-14 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	2,089,311	8,373.23	8,373.23	1.000
First (lowest) decile	208,932	1,818.65	1,967.08	1.082
Second decile	208,931	2,798.99	2,679.63	0.957
Third decile	208,931	3,239.67	3,178.82	0.981
Fourth decile	208,931	3,948.75	3,868.22	0.980
Fifth decile	208,931	5,133.16	4,922.64	0.959
Sixth decile	208,931	6,184.84	6,146.37	0.994
Seventh decile	208,931	7,841.91	7,702.32	0.982
Eighth decile	208,931	9,858.14	9,964.07	1.011
Ninth decile	208,931	13,728.73	14,111.97	1.028
Tenth (highest)	208,931	31,145.84	31,177.46	1.001
Top 5%	104,465	41,976.25	41,603.18	0.991
Top 1%	20,893	66,882.62	66,645.38	0.996
Top 0.1%	2,089	100,690.98	98,065.65	0.974

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	2,644,357	2,783.76	3,739.79	1.343
First (lowest) decile	264,436	1,534.60	2,015.32	1.313
Second decile	264,436	2,107.10	2,719.40	1.291
Third decile	264,436	1,916.17	2,769.56	1.445
Fourth decile	264,436	1,824.53	2,860.15	1.568
Fifth decile	264,436	2,495.20	3,241.09	1.299
Sixth decile	264,436	2,306.96	3,470.57	1.504
Seventh decile	264,436	2,937.18	3,864.59	1.316
Eighth decile	264,435	3,055.78	4,295.98	1.406
Ninth decile	264,435	3,931.09	5,130.79	1.305
Tenth (highest)	264,435	5,838.83	7,147.68	1.224
Top 5%	132,217	6,290.68	8,030.27	1.277
Top 1%	26,443	7,489.12	9,870.74	1.318
Top 0.1%	2,644	8,891.79	12,732.46	1.432
2019 CMS-HCC Model				
Entire Sample	2,697,830	2,840.11	3,846.48	1.354
First (lowest) decile	269,783	1,602.72	2,069.95	1.292
Second decile	269,783	2,070.74	2,790.32	1.347
Third decile	269,783	2,037.80	2,865.75	1.406
Fourth decile	269,783	1,823.75	2,956.39	1.621
Fifth decile	269,783	2,516.33	3,373.20	1.341
Sixth decile	269,783	2,401.34	3,609.80	1.503
Seventh decile	269,783	2,818.37	3,944.59	1.400
Eighth decile	269,783	3,183.42	4,377.43	1.375
Ninth decile	269,783	4,039.40	5,228.27	1.294
Tenth (highest)	269,783	6,040.75	7,387.10	1.223
Top 5%	134,891	6,555.62	8,370.77	1.277
Top 1%	26,978	8,134.75	10,420.97	1.281
Top 0.1%	2,697	9,215.47	13,390.23	1.453

(continued)

Table 5-15 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	2,697,830	2,840.11	3,943.38	1.388
First (lowest) decile	269,783	1,602.28	2,229.64	1.392
Second decile	269,783	2,008.04	2,873.37	1.431
Third decile	269,783	1,949.73	2,932.65	1.504
Fourth decile	269,783	2,025.59	3,040.70	1.501
Fifth decile	269,783	2,398.48	3,507.13	1.462
Sixth decile	269,783	2,408.26	3,678.49	1.527
Seventh decile	269,783	2,853.47	4,048.97	1.419
Eighth decile	269,783	3,273.57	4,464.53	1.364
Ninth decile	269,783	3,955.26	5,317.13	1.344
Tenth (highest)	269,783	6,057.92	7,482.19	1.235
Top 5%	134,891	6,613.07	8,466.23	1.280
Top 1%	26,978	8,496.38	10,491.96	1.235
Top 0.1%	2,697	9,325.74	13,327.52	1.429

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
		2017 CMS-HCC Model		
Entire Sample	7,035,117	4,911.10	5,404.68	1.101
First (lowest) decile	703,512	2,850.26	2,565.66	0.900
Second decile	703,512	2,806.74	2,854.49	1.017
Third decile	703,512	3,180.36	3,355.18	1.055
Fourth decile	703,512	3,397.74	3,590.58	1.057
Fifth decile	703,512	3,836.42	4,175.51	1.088
Sixth decile	703,512	4,212.62	4,791.90	1.138
Seventh decile	703,512	4,885.64	5,582.91	1.143
Eighth decile	703,511	5,698.24	6,536.04	1.147
Ninth decile	703,511	7,170.89	8,016.36	1.118
Tenth (highest)	703,511	11,408.76	12,974.53	1.137
Top 5%	351,755	13,975.08	15,876.81	1.136
Top 1%	70,351	24,610.37	26,208.37	1.065
Top 0.1%	7,035	44,832.42	41,540.49	0.927
		2019 CMS-HCC Model		
Entire Sample	7,074,549	5,074.96	5,553.79	1.094
First (lowest) decile	707,455	2,931.01	2,627.51	0.896
Second decile	707,455	2,893.89	2,954.91	1.021
Third decile	707,455	3,284.14	3,462.69	1.054
Fourth decile	707,455	3,500.38	3,687.40	1.053
Fifth decile	707,455	3,943.00	4,275.37	1.084
Sixth decile	707,455	4,298.73	4,867.92	1.132
Seventh decile	707,455	4,938.71	5,682.45	1.151
Eighth decile	707,455	5,859.66	6,684.52	1.141
Ninth decile	707,455	7,465.40	8,280.08	1.109
Tenth (highest)	707,454	12,045.83	13,489.04	1.120
Top 5%	353,727	14,762.48	16,535.84	1.120
Top 1%	70,745	25,879.57	27,261.31	1.053
Top 0.1%	7,074	51,711.03	43,638.76	0.844

(continued)

Table 5-16 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	7,074,549	5,074.96	5,608.17	1.105
First (lowest) decile	707,455	2,925.98	2,727.36	0.932
Second decile	707,455	2,906.63	3,019.31	1.039
Third decile	707,455	3,254.29	3,564.74	1.095
Fourth decile	707,455	3,509.55	3,773.84	1.075
Fifth decile	707,455	3,946.21	4,350.58	1.102
Sixth decile	707,455	4,288.12	4,947.40	1.154
Seventh decile	707,455	4,905.84	5,738.13	1.170
Eighth decile	707,455	5,881.84	6,745.26	1.147
Ninth decile	707,455	7,466.78	8,304.98	1.112
Tenth (highest)	707,454	12,079.70	13,378.86	1.108
Top 5%	353,727	14,826.42	16,341.43	1.102
Top 1%	70,745	25,859.18	26,898.92	1.040
Top 0.1%	7,074	51,552.86	43,076.20	0.836

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	9,568,325	7,963.97	8,154.48	1.024
First (lowest) decile	956,833	4,316.87	3,005.20	0.696
Second decile	956,833	4,654.07	3,803.32	0.817
Third decile	956,833	5,195.22	4,651.37	0.895
Fourth decile	956,833	5,753.59	5,565.94	0.967
Fifth decile	956,833	6,374.82	6,436.44	1.010
Sixth decile	956,832	7,186.23	7,414.90	1.032
Seventh decile	956,832	8,054.41	8,605.29	1.068
Eighth decile	956,832	9,351.82	10,156.41	1.086
Ninth decile	956,832	11,364.44	12,545.55	1.104
Tenth (highest)	956,832	18,165.58	20,315.55	1.118
Top 5%	478,416	22,409.83	24,938.44	1.113
Top 1%	95,683	35,074.58	37,364.36	1.065
Top 0.1%	9,568	53,650.16	55,026.17	1.026
2019 CMS-HCC Model				
Entire Sample	9,581,219	8,229.13	8,395.34	1.020
First (lowest) decile	958,122	4,447.19	3,104.21	0.698
Second decile	958,122	4,809.10	3,922.05	0.816
Third decile	958,122	5,343.10	4,783.02	0.895
Fourth decile	958,122	5,827.71	5,710.21	0.980
Fifth decile	958,122	6,539.55	6,607.40	1.010
Sixth decile	958,122	7,319.63	7,609.68	1.040
Seventh decile	958,122	8,336.95	8,844.19	1.061
Eighth decile	958,122	9,682.84	10,469.17	1.081
Ninth decile	958,122	11,831.96	12,973.19	1.096
Tenth (highest)	958,121	19,075.14	21,041.18	1.103
Top 5%	479,060	23,467.55	25,806.63	1.100
Top 1%	95,812	36,881.10	38,548.70	1.045
Top 0.1%	9,581	56,070.14	56,826.00	1.013

(continued)

Table 5-17 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	9,581,219	8,229.13	8,377.55	1.018
First (lowest) decile	958,122	4,441.42	3,181.86	0.716
Second decile	958,122	4,813.14	3,996.90	0.830
Third decile	958,122	5,342.60	4,850.15	0.908
Fourth decile	958,122	5,806.44	5,750.85	0.990
Fifth decile	958,122	6,533.53	6,644.88	1.017
Sixth decile	958,122	7,329.30	7,634.06	1.042
Seventh decile	958,122	8,315.71	8,835.13	1.062
Eighth decile	958,122	9,693.03	10,425.39	1.076
Ninth decile	958,122	11,850.06	12,852.94	1.085
Tenth (highest)	958,121	19,098.89	20,697.53	1.084
Top 5%	479,060	23,494.70	25,361.55	1.079
Top 1%	95,812	36,910.35	38,048.17	1.031
Top 0.1%	9,581	56,253.85	56,028.01	0.996

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	5,729,110	13,338.14	12,981.80	0.973
First (lowest) decile	572,911	6,961.71	4,202.58	0.604
Second decile	572,911	7,955.71	6,280.98	0.789
Third decile	572,911	8,975.39	7,704.05	0.858
Fourth decile	572,911	9,901.57	9,088.34	0.918
Fifth decile	572,911	10,924.10	10,480.94	0.959
Sixth decile	572,911	12,183.47	12,054.94	0.989
Seventh decile	572,911	13,696.54	13,926.91	1.017
Eighth decile	572,911	15,743.35	16,376.17	1.040
Ninth decile	572,911	19,067.25	20,234.73	1.061
Tenth (highest)	572,911	29,992.80	31,852.34	1.062
Top 5%	286,455	36,141.21	38,115.11	1.055
Top 1%	57,291	51,937.50	53,039.89	1.021
Top 0.1%	5,729	83,335.44	74,011.30	0.888
2019 CMS-HCC Model				
Entire Sample	5,670,564	13,780.49	13,396.06	0.972
First (lowest) decile	567,057	7,179.18	4,355.93	0.607
Second decile	567,057	8,183.86	6,467.76	0.790
Third decile	567,057	9,243.53	7,929.27	0.858
Fourth decile	567,057	10,161.88	9,355.53	0.921
Fifth decile	567,056	11,286.30	10,805.29	0.957
Sixth decile	567,056	12,578.48	12,444.29	0.989
Seventh decile	567,056	14,216.98	14,408.57	1.013
Eighth decile	567,056	16,411.96	16,977.92	1.034
Ninth decile	567,056	19,811.20	20,995.88	1.060
Tenth (highest)	567,056	31,032.84	32,929.85	1.061
Top 5%	283,528	37,320.18	39,336.42	1.054
Top 1%	56,705	52,563.02	54,564.18	1.038
Top 0.1%	5,670	75,022.12	75,797.92	1.010

(continued)

Table 5-18 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	5,670,564	13,780.49	13,275.74	0.963
First (lowest) decile	567,057	7,169.93	4,416.27	0.616
Second decile	567,057	8,175.17	6,490.67	0.794
Third decile	567,057	9,247.43	7,925.32	0.857
Fourth decile	567,057	10,149.42	9,314.67	0.918
Fifth decile	567,056	11,269.36	10,732.54	0.952
Sixth decile	567,056	12,594.43	12,326.94	0.979
Seventh decile	567,056	14,219.44	14,236.60	1.001
Eighth decile	567,056	16,450.87	16,738.31	1.017
Ninth decile	567,056	19,826.96	20,666.88	1.042
Tenth (highest)	567,056	31,008.70	32,583.00	1.051
Top 5%	283,528	37,288.74	39,052.68	1.047
Top 1%	56,705	52,478.06	54,544.80	1.039
Top 0.1%	5,670	74,672.89	76,579.14	1.026

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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
2017 CMS-HCC Model				
Entire Sample	3,342,676	25,263.01	23,434.64	0.928
First (lowest) decile	334,268	11,399.22	7,593.32	0.666
Second decile	334,268	13,886.22	11,265.20	0.811
Third decile	334,268	16,013.93	13,877.01	0.867
Fourth decile	334,268	18,171.94	16,391.77	0.902
Fifth decile	334,268	20,535.25	19,048.45	0.928
Sixth decile	334,268	23,321.66	22,060.96	0.946
Seventh decile	334,267	26,914.17	25,750.21	0.957
Eighth decile	334,267	31,651.74	30,680.50	0.969
Ninth decile	334,267	39,154.27	38,168.06	0.975
Tenth (highest)	334,267	59,192.55	57,366.07	0.969
Top 5%	167,133	69,481.19	67,263.77	0.968
Top 1%	33,426	92,855.43	89,788.17	0.967
Top 0.1%	3,342	125,382.01	120,499.52	0.961
2019 CMS-HCC Model				
Entire Sample	3,208,185	25,989.17	24,164.86	0.930
First (lowest) decile	320,819	11,698.88	7,843.57	0.670
Second decile	320,819	14,278.62	11,635.52	0.815
Third decile	320,819	16,482.82	14,357.91	0.871
Fourth decile	320,819	18,705.19	16,990.86	0.908
Fifth decile	320,819	21,171.27	19,771.79	0.934
Sixth decile	320,818	24,089.50	22,912.56	0.951
Seventh decile	320,818	27,643.91	26,734.44	0.967
Eighth decile	320,818	32,837.05	31,794.89	0.968
Ninth decile	320,818	40,675.49	39,438.08	0.970
Tenth (highest)	320,818	60,671.32	58,771.54	0.969
Top 5%	160,409	70,889.38	68,671.85	0.969
Top 1%	32,081	95,013.82	91,087.21	0.959
Top 0.1%	3,208	131,383.87	121,680.83	0.926

(continued)

Table 5-19 (continued)
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
2019 Payment Condition Count (PCC) Model				
Entire Sample	3,208,185	25,989.17	24,229.31	0.932
First (lowest) decile	320,819	11,678.95	7,821.38	0.670
Second decile	320,819	14,291.00	11,525.69	0.806
Third decile	320,819	16,483.92	14,201.17	0.862
Fourth decile	320,819	18,725.30	16,804.28	0.897
Fifth decile	320,819	21,217.65	19,576.77	0.923
Sixth decile	320,818	24,058.72	22,737.64	0.945
Seventh decile	320,818	27,650.63	26,614.16	0.963
Eighth decile	320,818	32,804.86	31,825.64	0.970
Ninth decile	320,818	40,639.13	39,858.56	0.981
Tenth (highest)	320,818	60,644.67	60,115.03	0.991
Top 5%	160,409	70,862.58	70,194.99	0.991
Top 1%	32,081	94,957.37	92,365.59	0.973
Top 0.1%	3,208	131,475.78	121,848.52	0.927

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all deciles using weights based on sample size may not equal the average predicted or actual cost 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 ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
Entire Sample				28,319,585	9,749.78	9,749.78	1.000
HCC1	HIV/AIDS	Y	Y	101,960	15,272.87	15,272.87	1.000
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		551,997	35,820.41	35,820.41	1.000
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			40,197	29,200.27	26,492.44	0.907
HCC4	Viral and Late Effects Central Nervous System Infections			50,163	18,660.82	16,970.35	0.909
HCC5	Tuberculosis			16,820	21,450.08	19,824.52	0.924
HCC6	Opportunistic Infections	Y		84,785	28,956.53	28,956.53	1.000
HCC7	Other Infectious Diseases			6,100,108	16,049.96	15,035.72	0.937
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	288,908	40,164.72	40,164.72	1.000
HCC9	Lung and Other Severe Cancers	Y	Y	312,576	24,724.03	24,724.03	1.000
HCC10	Lymphoma and Other Cancers	Y	Y	397,031	19,003.70	19,003.70	1.000
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	593,180	14,865.43	14,865.43	1.000
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	1,716,349	11,078.89	11,078.89	1.000
HCC13	Other Respiratory and Heart Neoplasms			46,504	17,094.03	15,123.97	0.885
HCC14	Other Digestive and Urinary Neoplasms			1,423,837	10,096.54	9,725.93	0.963
HCC15	Other Neoplasms			2,134,050	10,015.78	9,432.99	0.942
HCC16	Benign Neoplasms of Skin, Breast, Eye			1,966,468	8,673.32	8,439.38	0.973
HCC17	Diabetes with Acute Complications	Y	Y	87,305	26,999.30	24,312.52	0.900
HCC18	Diabetes with Chronic Complications	Y	Y	2,791,199	17,544.79	17,626.68	1.005
HCC19	Diabetes without Complication	Y	Y	4,303,531	11,353.76	11,353.76	1.000
HCC20	Type I Diabetes Mellitus		Y	.	.	.	.
HCC21	Protein-Calorie Malnutrition	Y		401,891	36,618.68	36,618.68	1.000
HCC22	Morbid Obesity	Y	Y	911,618	19,826.76	19,826.76	1.000

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	700,332	19,151.87	19,151.87	1.000
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			3,111,004	23,084.10	21,085.20	0.913
HCC25	Disorders of Lipoid Metabolism		Y	15,426,176	11,006.61	11,006.91	1.000
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	8,309,780	13,090.04	12,583.83	0.961
HCC27	End-Stage Liver Disease	Y	Y	92,239	32,786.94	32,786.94	1.000
HCC28	Cirrhosis of Liver	Y	Y	120,437	21,741.58	21,772.98	1.001
HCC29	Chronic Hepatitis	Y	Y	128,139	17,054.41	17,025.74	0.998
HCC30	Acute Liver Failure/Disease			34,187	28,054.93	28,109.43	1.002
HCC31	Other Hepatitis and Liver Disease		Y	406,906	16,840.05	15,296.65	0.908
HCC32	Gallbladder and Biliary Tract Disorders			321,713	18,056.38	17,390.21	0.963
HCC33	Intestinal Obstruction/Perforation	Y		407,019	25,379.27	25,379.27	1.000
HCC34	Chronic Pancreatitis	Y	Y	60,366	24,606.12	24,606.12	1.000
HCC35	Inflammatory Bowel Disease	Y	Y	251,070	17,062.07	17,062.07	1.000
HCC36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			1,806,534	19,624.82	17,816.76	0.908
HCC37	Appendicitis			34,892	15,362.08	16,435.39	1.070
HCC38	Other Gastrointestinal Disorders			10,747,696	13,724.90	12,917.21	0.941
HCC39	Bone/Joint/Muscle Infections/Necrosis	Y		249,724	30,095.65	30,095.65	1.000
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	Y	Y	1,557,886	16,130.11	16,130.11	1.000
HCC41	Disorders of the Vertebrae and Spinal Discs		Y	4,571,699	14,234.85	12,304.58	0.864
HCC42	Osteoarthritis of Hip or Knee		Y	3,005,166	14,205.87	11,787.25	0.830
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	3,926,967	12,711.75	12,206.90	0.960

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	25,750	16,262.53	14,550.93	0.895
HCC45	Other Musculoskeletal and Connective Tissue Disorders			16,391,290	12,339.57	11,622.76	0.942
HCC46	Severe Hematological Disorders	Y	Y	138,466	36,959.69	36,959.69	1.000
HCC47	Disorders of Immunity	Y	Y	316,645	33,109.99	33,109.99	1.000
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	1,084,269	21,851.15	21,851.15	1.000
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			3,993,838	17,675.92	15,915.22	0.900
HCC50	Delirium and Encephalopathy			737,784	28,474.98	25,031.54	0.879
HCC51	Dementia With Complications		Y	492,007	21,888.09	18,905.71	0.864
HCC52	Dementia Without Complication		Y	1,573,584	18,472.21	16,538.40	0.895
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	239,205	16,086.30	14,650.29	0.911
HCC54	Drug/Alcohol Psychosis	Y	Y	174,391	25,778.70	26,054.58	1.011
HCC55	Drug/Alcohol Dependence	Y	Y	406,259	19,568.18	19,452.09	0.994
HCC56	Drug/Alcohol Abuse, Without Dependence		Y	2,035,160	14,398.16	13,415.15	0.932
HCC57	Schizophrenia	Y	Y	532,663	15,335.89	15,342.25	1.000
HCC58	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	1,700,886	15,395.06	15,393.06	1.000
HCC59	Reactive and Unspecified Psychosis			285,629	21,700.79	18,715.28	0.862
HCC60	Personality Disorders		Y	29,498	14,566.25	12,651.72	0.869
HCC61	Depression		Y	2,425,938	15,188.42	13,476.66	0.887
HCC62	Anxiety Disorders		Y	406,188	10,612.63	10,077.65	0.950
HCC63	Other Psychiatric Disorders		Y	1,528,501	12,088.34	11,390.98	0.942
HCC64	Profound Intellectual Disability/ Developmental Disorder		Y	27,414	13,766.40	15,078.77	1.095

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	24,779	11,597.72	13,839.14	1.193
HCC66	Moderate Intellectual Disability/ Developmental Disorder		Y	37,726	9,239.31	11,129.40	1.205
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	219,703	9,288.50	10,536.16	1.134
HCC68	Other Developmental Disorders		Y	45,733	13,169.92	12,848.44	0.976
HCC69	Attention Deficit Disorder		Y	123,393	11,103.15	10,471.35	0.943
HCC70	Quadriplegia	Y	Y	54,316	35,492.37	35,492.37	1.000
HCC71	Paraplegia	Y	Y	56,549	31,241.43	31,241.43	1.000
HCC72	Spinal Cord Disorders/Injuries	Y	Y	167,254	20,877.69	21,053.52	1.008
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	Y	Y	14,336	26,514.72	26,514.72	1.000
HCC74	Cerebral Palsy	Y	Y	88,176	12,917.38	13,646.21	1.056
HCC75	Myasthenia Gravis/Myoneural Disorders and Guillain-Barre Syndrome/Inflammatory and Toxic Neuropathy	Y	Y	229,557	21,707.88	21,707.88	1.000
HCC76	Muscular Dystrophy	Y	Y	17,071	19,197.12	19,197.12	1.000
HCC77	Multiple Sclerosis	Y	Y	149,801	17,571.44	17,602.02	1.002
HCC78	Parkinson's and Huntington's Diseases	Y	Y	416,358	20,206.74	20,206.74	1.000
HCC79	Seizure Disorders and Convulsions	Y	Y	887,198	18,137.05	18,137.05	1.000
HCC80	Coma, Brain Compression/Anoxic Damage	Y	Y	54,932	34,421.72	34,110.10	0.991
HCC81	Polyneuropathy, Mononeuropathy, and Other Neurological Conditions/Injuries		Y	4,075,508	15,620.76	14,057.88	0.900
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	59,712	50,472.51	50,472.51	1.000
HCC83	Respiratory Arrest	Y		8,478	40,540.11	40,750.49	1.005
HCC84	Cardio-Respiratory Failure and Shock	Y		723,390	32,303.98	32,301.59	1.000
HCC85	Congestive Heart Failure	Y	Y	3,219,163	22,440.15	22,440.15	1.000

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC86	Acute Myocardial Infarction	Y	Y	282,874	26,271.80	26,376.87	1.004
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	501,814	20,252.67	20,210.27	0.998
HCC88	Angina Pectoris	Y	Y	599,708	15,625.28	15,613.70	0.999
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	4,793,507	15,344.59	14,147.88	0.922
HCC90	Heart Infection/Inflammation, Except Rheumatic			144,061	26,307.82	24,392.96	0.927
HCC91	Valvular and Rheumatic Heart Disease		Y	3,291,581	17,262.71	15,992.80	0.926
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	8,311	18,080.04	16,249.81	0.899
HCC93	Other Congenital Heart/Circulatory Disease		Y	74,058	16,370.69	15,494.67	0.946
HCC94	Hypertensive Heart Disease		Y	875,160	12,184.73	11,225.62	0.921
HCC95	Hypertension		Y	14,425,771	9,601.44	9,311.03	0.970
HCC96	Specified Heart Arrhythmias	Y	Y	3,845,451	18,069.30	18,069.30	1.000
HCC97	Other Heart Rhythm and Conduction Disorders		Y	1,691,403	15,805.09	14,194.22	0.898
HCC98	Other and Unspecified Heart Disease		Y	1,841,425	18,863.88	17,566.83	0.931
HCC99	Cerebral Hemorrhage	Y	Y	131,648	23,823.58	24,062.51	1.010
HCC100	Ischemic or Unspecified Stroke	Y	Y	940,009	20,016.37	19,983.57	0.998
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	1,679,475	14,483.07	13,561.40	0.936
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	214,597	17,062.17	15,154.98	0.888
HCC103	Hemiplegia/Hemiparesis	Y	Y	332,004	25,056.89	25,087.03	1.001
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	34,059	21,600.36	21,314.57	0.987
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	500,620	19,180.60	17,318.10	0.903

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	Y	Y	129,939	38,173.22	38,173.22	1.000
HCC107	Vascular Disease with Complications	Y		547,446	23,001.98	23,001.98	1.000
HCC108	Vascular Disease	Y	Y	3,725,635	17,222.26	17,222.26	1.000
HCC109	Other Circulatory Disease			1,928,052	15,357.37	13,813.98	0.900
HCC110	Cystic Fibrosis	Y	Y	4,660	36,683.25	36,810.80	1.003
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	3,733,156	18,882.84	18,883.13	1.000
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	233,159	16,208.02	16,201.03	1.000
HCC113	Asthma		Y	1,194,547	11,059.35	9,871.59	0.893
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		249,715	38,455.86	38,466.06	1.000
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		78,248	25,998.85	25,968.40	0.999
HCC116	Viral and Unspecified Pneumonia, Pleurisy			1,225,035	23,345.13	20,767.19	0.890
HCC117	Pleural Effusion/Pneumothorax			385,878	32,279.12	29,686.25	0.920
HCC118	Other Respiratory Disorders			5,219,587	15,125.53	14,166.59	0.937
HCC119	Legally Blind		Y	99,308	20,505.71	18,865.60	0.920
HCC120	Major Eye Infections/Inflammations			63,741	15,211.50	13,264.22	0.872
HCC121	Retinal Detachment			154,780	11,575.17	11,080.96	0.957
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	Y	Y	196,871	17,998.13	17,998.13	1.000
HCC123	Diabetic and Other Vascular Retinopathies		Y	1,351,678	14,572.46	13,894.76	0.953
HCC124	Exudative Macular Degeneration	Y	Y	528,310	16,718.36	16,718.36	1.000
HCC125	Other Retinal Disorders		Y	2,611,384	10,816.90	10,632.62	0.983
HCC126	Glaucoma		Y	3,707,607	10,917.80	10,779.77	0.987
HCC127	Cataract		Y	7,533,058	9,887.54	9,888.45	1.000
HCC128	Other Eye Disorders			9,046,302	10,954.08	10,713.74	0.978
HCC129	Significant Ear, Nose, and Throat Disorders			358,007	14,726.28	13,351.84	0.907

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC130	Hearing Loss		Y	1,845,824	12,957.60	12,320.08	0.951
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			9,187,350	11,490.84	11,036.25	0.960
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status	Y	Y	19,830	41,590.49	34,829.09	0.837
HCC135	Acute Renal Failure	Y		1,042,779	30,678.50	30,798.77	1.004
HCC136	Chronic Kidney Disease, Stage 5	Y	Y	96,442	18,262.82	18,640.89	1.021
HCC137	Chronic Kidney Disease, Severe (Stage 4)	Y	Y	185,757	18,230.98	18,036.59	0.989
HCC138	Chronic Kidney Disease, Moderate (Stage 3)		Y	1,005,814	14,425.15	13,504.97	0.936
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)		Y	794,529	15,385.92	14,088.60	0.916
HCC140	Unspecified Renal Failure		Y	63,710	15,424.92	13,797.62	0.895
HCC141	Nephritis		Y	49,479	15,672.35	14,840.59	0.947
HCC142	Urinary Obstruction and Retention			1,840,038	17,521.12	15,668.13	0.894
HCC143	Urinary Incontinence		Y	1,903,552	15,970.57	13,919.73	0.872
HCC144	Urinary Tract Infection			3,509,055	17,806.39	15,873.20	0.891
HCC145	Other Urinary Tract Disorders			2,515,371	17,562.25	16,081.62	0.916
HCC146	Female Infertility		Y	4,019	14,026.93	11,869.68	0.846
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	616,689	11,718.99	10,900.26	0.930
HCC148	Other Female Genital Disorders		Y	1,646,196	10,190.80	9,723.62	0.954
HCC149	Male Genital Disorders		Y	3,350,018	12,359.93	11,840.65	0.958
HCC150	Ectopic and Molar Pregnancy			1,092	13,936.50	10,851.32	0.779
HCC151	Miscarriage/Terminated Pregnancy			4,062	10,296.28	8,740.87	0.849
HCC152	Completed Pregnancy With Major Complications			1,718	17,943.00	16,561.64	0.923
HCC153	Completed Pregnancy With Complications			10,387	7,266.09	8,069.98	1.111
HCC154	Completed Pregnancy With No or Minor Complications			4,594	7,246.33	7,540.83	1.041

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC155	Uncompleted Pregnancy With Complications			4,145	16,682.07	10,960.43	0.657
HCC156	Uncompleted Pregnancy With No or Minor Complications			7,567	13,180.21	9,770.76	0.741
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	Y	Y	35,762	57,339.78	57,339.78	1.000
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	76,730	41,136.02	41,136.02	1.000
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss		Y	86,298	36,207.13	30,000.15	0.829
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage		Y	193,754	30,278.09	25,109.15	0.829
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	662,655	22,890.69	22,890.69	1.000
HCC162	Severe Skin Burn or Condition	Y		4,208	25,198.53	25,198.53	1.000
HCC163	Moderate Skin Burn or Condition			8,924	22,348.12	19,280.60	0.863
HCC164	Cellulitis, Local Skin Infection			2,456,495	18,165.85	16,351.58	0.900
HCC165	Other Dermatological Disorders			10,311,386	11,775.34	11,317.13	0.961
HCC166	Severe Head Injury	Y		3,904	22,724.13	26,775.60	1.178
HCC167	Major Head Injury	Y		167,235	20,457.42	20,501.91	1.002
HCC168	Concussion or Unspecified Head Injury			475,421	19,466.96	15,923.90	0.818
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		325,415	21,339.17	21,247.13	0.996
HCC170	Hip Fracture/Dislocation	Y		346,939	22,446.23	22,457.92	1.001
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			366,341	17,515.27	15,313.49	0.874
HCC172	Internal Injuries			95,765	27,579.82	26,405.51	0.957
HCC173	Traumatic Amputations and Complications	Y		86,162	30,068.44	30,068.44	1.000
HCC174	Other Injuries			6,624,736	14,679.08	13,231.22	0.901
HCC175	Poisonings and Allergic and Inflammatory Reactions			1,444,264	21,327.09	19,201.66	0.900

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Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC176	Complications of Specified Implanted Device or Graft	Y		429,803	27,407.43	27,407.43	1.000
HCC177	Other Complications of Medical Care			1,129,864	24,490.86	23,139.88	0.945
HCC178	Major Symptoms, Abnormalities			.	.	.	.
HCC179	Minor Symptoms, Signs, Findings			.	.	.	.
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	5,808	18,340.19	16,397.79	0.894
HCC183	Other Perinatal Problems Affecting Newborn			7,956	16,756.01	15,416.58	0.920
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	52,047	33,412.49	33,412.49	1.000
HCC187	Other Organ Transplant Status/Replacement		Y	99,717	17,590.33	14,806.04	0.842
HCC188	Artificial Openings for Feeding or Elimination	Y	Y	237,148	35,256.10	35,256.10	1.000
HCC189	Amputation Status, Lower Limb/Amputation Complications	Y	Y	86,607	29,419.74	29,419.74	1.000
HCC190	Amputation Status, Upper Limb			11,351	22,239.30	20,761.25	0.934
HCC191	Post-Surgical States/Aftercare/Elective			.	.	.	.
HCC192	Radiation Therapy			.	.	.	.
HCC193	Chemotherapy			.	.	.	.
HCC194	Rehabilitation			.	.	.	.
HCC195	Screening/Observation/Special Exams			.	.	.	.

(continued)

Table 5-20a (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2017 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC196	History of Disease			.	.	.	.
HCC197	Supplemental Oxygen			.	.	.	.
HCC198	CPAP/IPPB/Nebulizers			.	.	.	.
HCC199	Patient Lifts, Power Operated Vehicles, Beds			.	.	.	.
HCC200	Wheelchairs, Commodes			.	.	.	.
HCC201	Walkers			.	.	.	.

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Table 5-20b
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
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	26,797.59	0.905
HCC4	Viral and Late Effects Central Nervous System Infections			47,526	19,155.98	17,157.43	0.896
HCC5	Tuberculosis			14,968	23,103.63	20,361.74	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	15,376.87	0.936
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	13,742.40	0.869
HCC14	Other Digestive and Urinary Neoplasms			1,386,589	10,147.58	9,767.96	0.963
HCC15	Other Neoplasms			2,131,151	10,149.95	9,579.52	0.944
HCC16	Benign Neoplasms of Skin, Breast, Eye			2,011,707	8,902.99	8,604.27	0.966
HCC17	Diabetes with Acute Complications	Y	Y	83,346	27,081.68	24,501.25	0.905
HCC18	Diabetes with Chronic Complications	Y	Y	2,785,407	17,818.45	17,893.42	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	.	.	.	.
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	21,675.24	0.917

(continued)

Table 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC25	Disorders of Lipoid Metabolism		Y	15,334,459	11,284.50	11,270.06	0.999
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	8,456,488	13,344.34	12,844.40	0.963
HCC27	End-Stage Liver Disease	Y	Y	94,747	32,760.70	32,760.02	1.000
HCC28	Cirrhosis of Liver	Y	Y	120,412	22,136.71	22,158.26	1.001
HCC29	Chronic Hepatitis	Y	Y	131,745	16,975.69	16,956.56	0.999
HCC30	Acute Liver Failure/Disease			33,724	28,805.40	29,000.45	1.007
HCC31	Other Hepatitis and Liver Disease		Y	414,696	16,948.90	15,367.53	0.907
HCC32	Gallbladder and Biliary Tract Disorders			302,054	18,475.37	17,727.72	0.960
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	18,282.43	0.905
HCC37	Appendicitis			32,607	14,759.24	16,045.27	1.087
HCC38	Other Gastrointestinal Disorders			10,688,403	14,028.54	13,199.22	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	12,531.95	0.867
HCC42	Osteoarthritis of Hip or Knee		Y	2,988,229	14,281.96	11,895.34	0.833
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	3,655,876	13,224.89	12,654.57	0.957
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	24,975	16,575.41	14,411.30	0.869
HCC45	Other Musculoskeletal and Connective Tissue Disorders			16,390,878	12,553.26	11,828.28	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 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
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	16,405.51	0.904
HCC50	Delirium and Encephalopathy			750,505	29,286.29	26,114.81	0.892
HCC51	Dementia With Complications		Y	470,051	22,432.96	19,577.42	0.873
HCC52	Dementia Without Complication		Y	1,516,764	19,006.55	17,147.51	0.902
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	252,650	16,656.86	15,107.67	0.907
HCC54	Substance Use with Psychotic Complications	Y	Y	171,308	26,292.02	26,553.70	1.010
HCC55	Substance Use Disorder, Moderate/Severe, or Substance Use with Complications	Y	Y	460,436	19,779.91	19,745.99	0.998
HCC56	Substance Use Disorder, Mild, Except Alcohol and Cannabis	Y	Y	96,693	19,723.28	19,429.63	0.985
HCC57	Schizophrenia	Y	Y	511,487	15,390.74	15,472.00	1.005
HCC58	Reactive and Unspecified Psychosis	Y		410,214	23,672.96	23,610.88	0.997
HCC59	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	1,630,996	14,810.53	14,802.61	0.999
HCC60	Personality Disorders	Y	Y	29,177	15,243.15	15,096.64	0.990
HCC61	Depression		Y	2,479,274	15,304.56	13,554.72	0.886
HCC62	Anxiety Disorders		Y	424,004	10,742.49	10,220.48	0.951
HCC63	Other Psychiatric Disorders		Y	1,581,954	12,360.85	11,566.36	0.936
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	26,256	13,954.02	15,527.00	1.113
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	24,340	12,250.29	14,332.31	1.170
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	37,330	9,347.49	11,303.02	1.209

(continued)

Table 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	220,997	9,265.22	10,535.12	1.137
HCC68	Other Developmental Disorders		Y	46,731	13,514.90	13,099.13	0.969
HCC69	Attention Deficit Disorder		Y	135,837	11,383.03	10,700.10	0.940
HCC70	Quadriplegia	Y	Y	56,216	36,596.24	36,607.24	1.000
HCC71	Paraplegia	Y	Y	55,588	32,072.92	32,062.15	1.000
HCC72	Spinal Cord Disorders/Injuries	Y	Y	159,566	21,036.71	21,254.96	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	13,797.64	1.028
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	20,089.44	1.000
HCC77	Multiple Sclerosis	Y	Y	148,801	17,966.05	17,966.05	1.000
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	34,244.54	0.997
HCC81	Polyneuropathy, Mononeuropathy, and Other Neurological Conditions/Injuries		Y	4,473,236	16,251.35	14,758.48	0.908
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	59,768	50,847.42	50,867.62	1.000
HCC83	Respiratory Arrest	Y		7,325	39,576.46	39,490.46	0.998
HCC84	Cardio-Respiratory Failure and Shock	Y		740,900	33,140.37	33,139.58	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	26,726.21	1.004
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	439,734	20,574.67	20,529.85	0.998
HCC88	Angina Pectoris	Y	Y	514,055	15,910.88	15,901.90	0.999

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Table 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	4,616,202	15,792.03	14,587.68	0.924
HCC90	Heart Infection/Inflammation, Except Rheumatic			143,595	26,377.58	24,591.77	0.932
HCC91	Valvular and Rheumatic Heart Disease		Y	3,279,221	17,717.11	16,352.07	0.923
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	8,368	19,041.55	16,472.18	0.865
HCC93	Other Congenital Heart/Circulatory Disease		Y	68,888	16,187.39	15,417.95	0.952
HCC94	Hypertensive Heart Disease		Y	784,741	12,207.19	11,371.67	0.932
HCC95	Hypertension		Y	14,387,218	9,903.56	9,595.07	0.969
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	14,155.46	0.911
HCC98	Other and Unspecified Heart Disease		Y	1,667,763	19,024.24	17,824.26	0.937
HCC99	Intracranial Hemorrhage	Y	Y	134,956	23,867.18	24,334.61	1.020
HCC100	Ischemic or Unspecified Stroke	Y	Y	891,848	20,530.37	20,460.97	0.997
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	1,286,957	15,116.65	14,116.30	0.934
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	203,465	17,491.97	15,599.67	0.892
HCC103	Hemiplegia/Hemiparesis	Y	Y	308,769	25,258.84	25,289.97	1.001
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	31,829	21,855.26	21,561.35	0.987
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	467,501	19,826.44	18,002.65	0.908
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	14,034.25	0.902
HCC110	Cystic Fibrosis	Y	Y	4,365	38,191.12	38,191.12	1.000

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Table 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
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	10,108.59	0.891
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		236,848	40,055.96	40,064.53	1.000
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		65,458	26,586.61	26,578.61	1.000
HCC116	Viral and Unspecified Pneumonia, Pleurisy			1,161,027	24,347.47	21,554.10	0.885
HCC117	Pleural Effusion/Pneumothorax			358,663	33,450.39	30,477.72	0.911
HCC118	Other Respiratory Disorders			5,041,594	15,453.10	14,403.71	0.932
HCC119	Legally Blind		Y	94,287	20,577.07	19,325.54	0.939
HCC120	Major Eye Infections/Inflammations			62,466	15,347.00	13,466.53	0.877
HCC121	Retinal Detachment			160,106	11,792.28	11,228.13	0.952
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	14,127.62	0.947
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	10,837.14	0.983
HCC126	Glaucoma		Y	3,709,096	11,163.66	11,000.05	0.985
HCC127	Cataract		Y	7,502,928	10,067.78	10,059.67	0.999
HCC128	Other Eye Disorders			9,236,346	11,162.84	10,917.83	0.978
HCC129	Significant Ear, Nose, and Throat Disorders			362,743	14,958.14	13,514.29	0.903
HCC130	Hearing Loss		Y	1,879,751	13,340.58	12,661.30	0.949
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			9,115,196	11,729.95	11,252.11	0.959
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status	Y	Y	20,011	44,594.26	37,542.59	0.842

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Table 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC135	Acute Renal Failure	Y		1,076,267	31,174.52	31,297.11	1.004
HCC136	Chronic Kidney Disease, Stage 5	Y	Y	82,796	18,677.33	19,047.60	1.020
HCC137	Chronic Kidney Disease, Severe (Stage 4)	Y	Y	191,770	18,622.87	18,465.74	0.992
HCC138	Chronic Kidney Disease, Moderate (Stage 3)	Y	Y	1,124,211	14,582.37	14,594.28	1.001
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)		Y	778,050	15,390.28	14,050.87	0.913
HCC140	Unspecified Renal Failure		Y	56,342	15,898.69	13,850.03	0.871
HCC141	Nephritis		Y	52,352	15,120.14	14,617.27	0.967
HCC142	Urinary Obstruction and Retention			1,865,270	17,801.24	15,999.42	0.899
HCC143	Urinary Incontinence		Y	1,914,672	16,326.02	14,271.86	0.874
HCC144	Urinary Tract Infection			3,421,599	18,193.08	16,262.08	0.894
HCC145	Other Urinary Tract Disorders			2,421,229	17,815.78	16,389.84	0.920
HCC146	Female Infertility		Y	3,745	14,121.26	12,092.37	0.856
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	575,300	12,061.85	11,203.91	0.929
HCC148	Other Female Genital Disorders		Y	1,484,866	10,645.81	10,078.96	0.947
HCC149	Male Genital Disorders		Y	3,342,279	12,671.37	12,147.58	0.959
HCC150	Ectopic and Molar Pregnancy			951	12,852.12	10,102.01	0.786
HCC151	Miscarriage/Terminated Pregnancy			3,609	10,538.29	9,149.24	0.868
HCC152	Completed Pregnancy With Major Complications			1,709	17,555.99	16,383.72	0.933
HCC153	Completed Pregnancy With Complications			9,895	7,365.05	8,156.05	1.107
HCC154	Completed Pregnancy With No or Minor Complications			4,358	7,793.52	7,592.24	0.974
HCC155	Uncompleted Pregnancy With Complications			3,630	17,792.28	11,796.17	0.663
HCC156	Uncompleted Pregnancy With No or Minor Complications			6,949	13,244.34	9,705.19	0.733
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 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	74,696	42,079.44	42,084.86	1.000
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss		Y	73,846	37,361.44	31,279.40	0.837
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage		Y	181,075	31,306.77	25,935.34	0.828
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	639,852	23,763.35	23,762.79	1.000
HCC162	Severe Skin Burn or Condition	Y		4,241	24,980.23	25,101.76	1.005
HCC163	Moderate Skin Burn or Condition			8,627	21,764.41	19,555.70	0.899
HCC164	Cellulitis, Local Skin Infection			2,366,362	18,585.24	16,763.43	0.902
HCC165	Other Dermatological Disorders			10,373,365	11,983.14	11,501.65	0.960
HCC166	Severe Head Injury	Y		3,566	23,253.29	27,350.19	1.176
HCC167	Major Head Injury	Y		167,986	20,437.31	20,507.87	1.003
HCC168	Concussion or Unspecified Head Injury			536,052	19,809.17	16,214.44	0.819
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		323,965	22,195.57	22,085.69	0.995
HCC170	Hip Fracture/Dislocation	Y		337,196	23,033.57	23,046.61	1.001
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			363,936	17,879.60	15,602.48	0.873
HCC172	Internal Injuries			91,720	27,938.52	26,779.45	0.959
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	13,153.14	0.899
HCC175	Poisonings and Allergic and Inflammatory Reactions			866,107	16,885.78	15,258.75	0.904
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	22,811.29	0.942
HCC178	Major Symptoms, Abnormalities			.	.	.	.
HCC179	Minor Symptoms, Signs, Findings			.	.	.	.

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Table 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
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	19,981.56	0.910
HCC183	Other Perinatal Problems Affecting Newborn			6,874	17,809.41	15,713.49	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	15,182.43	0.843
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	21,702.21	0.940
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			.	.	.	.

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Table 5-20b (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 CMS-HCC Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC203	Alcohol/Cannabis Use or Use Disorder, Mild or Uncomplicated; Non-Psychoactive Substance Abuse; Nicotine Dependence		Y	1,981,142	14,231.31	13,339.18	0.937
HCC204	External Causes of Morbidity, Except Self-Inflicted Injury			.	.	.	.

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Table 5-20c
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
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	26,948.86	0.910
HCC4	Viral and Late Effects Central Nervous System Infections			47,526	19,155.98	17,146.97	0.895
HCC5	Tuberculosis			14,968	23,103.63	20,347.21	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	15,364.01	0.935
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	13,706.16	0.866
HCC14	Other Digestive and Urinary Neoplasms			1,386,589	10,147.58	9,749.75	0.961
HCC15	Other Neoplasms			2,131,151	10,149.95	9,567.14	0.943
HCC16	Benign Neoplasms of Skin, Breast, Eye			2,011,707	8,902.99	8,599.31	0.966
HCC17	Diabetes with Acute Complications	Y	Y	83,346	27,081.68	24,567.24	0.907
HCC18	Diabetes with Chronic Complications	Y	Y	2,785,407	17,818.45	17,891.51	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	.	.	.	.
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	21,645.96	0.916

(continued)

Table 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC25	Disorders of Lipoid Metabolism		Y	15,334,459	11,284.50	11,260.17	0.998
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	8,456,488	13,344.34	12,830.97	0.962
HCC27	End-Stage Liver Disease	Y	Y	94,747	32,760.70	32,757.71	1.000
HCC28	Cirrhosis of Liver	Y	Y	120,412	22,136.71	22,158.27	1.001
HCC29	Chronic Hepatitis	Y	Y	131,745	16,975.69	16,956.55	0.999
HCC30	Acute Liver Failure/Disease			33,724	28,805.40	29,118.53	1.011
HCC31	Other Hepatitis and Liver Disease		Y	414,696	16,948.90	15,340.23	0.905
HCC32	Gallbladder and Biliary Tract Disorders			302,054	18,475.37	17,699.28	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	18,281.17	0.905
HCC37	Appendicitis			32,607	14,759.24	15,981.13	1.083
HCC38	Other Gastrointestinal Disorders			10,688,403	14,028.54	13,174.84	0.939
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	12,519.47	0.866
HCC42	Osteoarthritis of Hip or Knee		Y	2,988,229	14,281.96	11,880.20	0.832
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	3,655,876	13,224.89	12,644.37	0.956
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	24,975	16,575.41	14,371.27	0.867
HCC45	Other Musculoskeletal and Connective Tissue Disorders			16,390,878	12,553.26	11,811.86	0.941
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 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
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	16,350.38	0.901
HCC50	Delirium and Encephalopathy			750,505	29,286.29	26,208.73	0.895
HCC51	Dementia With Complications		Y	470,051	22,432.96	19,574.96	0.873
HCC52	Dementia Without Complication		Y	1,516,764	19,006.55	17,137.60	0.902
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	252,650	16,656.86	15,073.94	0.905
HCC54	Substance Use with Psychotic Complications	Y	Y	171,308	26,292.02	26,587.02	1.011
HCC55	Substance Use Disorder, Moderate/Severe, or Substance Use with Complications	Y	Y	460,436	19,779.91	19,735.19	0.998
HCC56	Substance Use Disorder, Mild, Except Alcohol and Cannabis	Y	Y	96,693	19,723.28	19,423.21	0.985
HCC57	Schizophrenia	Y	Y	511,487	15,390.74	15,458.06	1.004
HCC58	Reactive and Unspecified Psychosis	Y		410,214	23,672.96	23,628.44	0.998
HCC59	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	1,630,996	14,810.53	14,802.86	0.999
HCC60	Personality Disorders	Y	Y	29,177	15,243.15	15,105.58	0.991
HCC61	Depression		Y	2,479,274	15,304.56	13,519.31	0.883
HCC62	Anxiety Disorders		Y	424,004	10,742.49	10,205.26	0.950
HCC63	Other Psychiatric Disorders		Y	1,581,954	12,360.85	11,541.60	0.934
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	26,256	13,954.02	15,409.92	1.104
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	24,340	12,250.29	14,218.92	1.161
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	37,330	9,347.49	11,265.84	1.205
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	220,997	9,265.22	10,515.79	1.135

(continued)

Table 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC68	Other Developmental Disorders		Y	46,731	13,514.90	13,083.25	0.968
HCC69	Attention Deficit Disorder		Y	135,837	11,383.03	10,663.72	0.937
HCC70	Quadriplegia	Y	Y	56,216	36,596.24	36,607.76	1.000
HCC71	Paraplegia	Y	Y	55,588	32,072.92	32,061.64	1.000
HCC72	Spinal Cord Disorders/Injuries	Y	Y	159,566	21,036.71	21,228.74	1.009
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	13,828.79	1.031
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	20,090.47	1.000
HCC77	Multiple Sclerosis	Y	Y	148,801	17,966.05	17,966.05	1.000
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	34,293.28	0.998
HCC81	Polyneuropathy, Mononeuropathy, and Other Neurological Conditions/Injuries		Y	4,473,236	16,251.35	14,747.80	0.907
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	59,768	50,847.42	50,867.14	1.000
HCC83	Respiratory Arrest	Y		7,325	39,576.46	39,522.49	0.999
HCC84	Cardio-Respiratory Failure and Shock	Y		740,900	33,140.37	33,139.32	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	26,780.48	1.006
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	439,734	20,574.67	20,498.65	0.996
HCC88	Angina Pectoris	Y	Y	514,055	15,910.88	15,901.14	0.999
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	4,616,202	15,792.03	14,565.11	0.922
HCC90	Heart Infection/Inflammation, Except Rheumatic			143,595	26,377.58	24,671.98	0.935

(continued)

Table 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC91	Valvular and Rheumatic Heart Disease		Y	3,279,221	17,717.11	16,339.76	0.922
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	8,368	19,041.55	16,411.51	0.862
HCC93	Other Congenital Heart/Circulatory Disease		Y	68,888	16,187.39	15,389.42	0.951
HCC94	Hypertensive Heart Disease		Y	784,741	12,207.19	11,347.71	0.930
HCC95	Hypertension		Y	14,387,218	9,903.56	9,578.77	0.967
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	14,112.06	0.908
HCC98	Other and Unspecified Heart Disease		Y	1,667,763	19,024.24	17,823.80	0.937
HCC99	Intracranial Hemorrhage	Y	Y	134,956	23,867.18	24,404.74	1.023
HCC100	Ischemic or Unspecified Stroke	Y	Y	891,848	20,530.37	20,450.55	0.996
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	1,286,957	15,116.65	14,095.00	0.932
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	203,465	17,491.97	15,567.47	0.890
HCC103	Hemiplegia/Hemiparesis	Y	Y	308,769	25,258.84	25,291.98	1.001
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	31,829	21,855.26	21,560.90	0.987
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	467,501	19,826.44	17,993.98	0.908
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	13,970.69	0.898
HCC110	Cystic Fibrosis	Y	Y	4,365	38,191.12	38,191.12	1.000
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	10,074.28	0.888
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		236,848	40,055.96	40,064.12	1.000

(continued)

Table 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		65,458	26,586.61	26,622.14	1.001
HCC116	Viral and Unspecified Pneumonia, Pleurisy			1,161,027	24,347.47	21,535.59	0.885
HCC117	Pleural Effusion/Pneumothorax			358,663	33,450.39	30,573.44	0.914
HCC118	Other Respiratory Disorders			5,041,594	15,453.10	14,389.09	0.931
HCC119	Legally Blind		Y	94,287	20,577.07	19,328.31	0.939
HCC120	Major Eye Infections/Inflammations			62,466	15,347.00	13,461.77	0.877
HCC121	Retinal Detachment			160,106	11,792.28	11,220.53	0.952
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	14,118.23	0.946
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	10,831.58	0.983
HCC126	Glaucoma		Y	3,709,096	11,163.66	10,995.60	0.985
HCC127	Cataract		Y	7,502,928	10,067.78	10,054.93	0.999
HCC128	Other Eye Disorders			9,236,346	11,162.84	10,911.66	0.977
HCC129	Significant Ear, Nose, and Throat Disorders			362,743	14,958.14	13,502.57	0.903
HCC130	Hearing Loss		Y	1,879,751	13,340.58	12,651.91	0.948
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			9,115,196	11,729.95	11,241.14	0.958
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status	Y	Y	20,011	44,594.26	37,766.98	0.847
HCC135	Acute Renal Failure	Y		1,076,267	31,174.52	31,293.21	1.004
HCC136	Chronic Kidney Disease, Stage 5	Y	Y	82,796	18,677.33	19,061.03	1.021
HCC137	Chronic Kidney Disease, Severe (Stage 4)	Y	Y	191,770	18,622.87	18,460.05	0.991
HCC138	Chronic Kidney Disease, Moderate (Stage 3)	Y	Y	1,124,211	14,582.37	14,594.80	1.001
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)		Y	778,050	15,390.28	14,020.20	0.911
HCC140	Unspecified Renal Failure		Y	56,342	15,898.69	13,824.18	0.870

(continued)

Table 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC141	Nephritis		Y	52,352	15,120.14	14,572.46	0.964
HCC142	Urinary Obstruction and Retention			1,865,270	17,801.24	15,991.63	0.898
HCC143	Urinary Incontinence		Y	1,914,672	16,326.02	14,262.13	0.874
HCC144	Urinary Tract Infection			3,421,599	18,193.08	16,251.39	0.893
HCC145	Other Urinary Tract Disorders			2,421,229	17,815.78	16,389.62	0.920
HCC146	Female Infertility		Y	3,745	14,121.26	12,100.73	0.857
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	575,300	12,061.85	11,188.03	0.928
HCC148	Other Female Genital Disorders		Y	1,484,866	10,645.81	10,069.84	0.946
HCC149	Male Genital Disorders		Y	3,342,279	12,671.37	12,138.09	0.958
HCC150	Ectopic and Molar Pregnancy			951	12,852.12	10,035.69	0.781
HCC151	Miscarriage/Terminated Pregnancy			3,609	10,538.29	9,125.18	0.866
HCC152	Completed Pregnancy With Major Complications			1,709	17,555.99	16,254.79	0.926
HCC153	Completed Pregnancy With Complications			9,895	7,365.05	8,109.36	1.101
HCC154	Completed Pregnancy With No or Minor Complications			4,358	7,793.52	7,646.44	0.981
HCC155	Uncompleted Pregnancy With Complications			3,630	17,792.28	11,767.67	0.661
HCC156	Uncompleted Pregnancy With No or Minor Complications			6,949	13,244.34	9,718.22	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
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	74,696	42,079.44	42,089.35	1.000
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss		Y	73,846	37,361.44	31,444.87	0.842
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage		Y	181,075	31,306.77	26,002.73	0.831
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	639,852	23,763.35	23,762.34	1.000
HCC162	Severe Skin Burn or Condition	Y		4,241	24,980.23	25,122.30	1.006

(continued)

Table 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC163	Moderate Skin Burn or Condition			8,627	21,764.41	19,545.17	0.898
HCC164	Cellulitis, Local Skin Infection			2,366,362	18,585.24	16,758.10	0.902
HCC165	Other Dermatological Disorders			10,373,365	11,983.14	11,492.76	0.959
HCC166	Severe Head Injury	Y		3,566	23,253.29	27,167.16	1.168
HCC167	Major Head Injury	Y		167,986	20,437.31	20,523.77	1.004
HCC168	Concussion or Unspecified Head Injury			536,052	19,809.17	16,214.20	0.819
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		323,965	22,195.57	22,098.89	0.996
HCC170	Hip Fracture/Dislocation	Y		337,196	23,033.57	23,058.73	1.001
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			363,936	17,879.60	15,598.51	0.872
HCC172	Internal Injuries			91,720	27,938.52	26,868.92	0.962
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	13,143.09	0.898
HCC175	Poisonings and Allergic and Inflammatory Reactions			866,107	16,885.78	15,260.70	0.904
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	22,840.30	0.943
HCC178	Major Symptoms, Abnormalities			.	.	.	.
HCC179	Minor Symptoms, Signs, Findings			.	.	.	.
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	19,955.22	0.909
HCC183	Other Perinatal Problems Affecting Newborn			6,874	17,809.41	15,710.39	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

(continued)

Table 5-20c (continued)
Predictive ratio for all eligible HCCs: All aged-disabled enrollees
2019 Payment Condition Count (PCC) Model

HCC	HCC Label	In Payment Model	Chronic	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
HCC187	Other Organ Transplant Status/Replacement		Y	105,957	18,004.64	15,176.03	0.843
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	21,688.26	0.939
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			.	.	.	.
HCC203	Alcohol/Cannabis Use or Use Disorder, Mild or Uncomplicated; Non-Psychoactive Substance Abuse; Nicotine Dependence		Y	1,981,142	14,231.31	13,285.00	0.934
HCC204	External Causes of Morbidity, Except Self-Inflicted Injury			.	.	.	.

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Table 5-21
Predictive Ratio by Body Systems/Disease Groups: All aged-disabled enrollees

Body System Label	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	28,319,585	9,749.78	9,749.78	1.000
Infection	717,227	31,371.15	31,487.30	1.004
Neoplasm	3,308,044	16,153.38	16,153.38	1.000
Diabetes	7,182,035	13,920.98	13,920.98	1.000
Metabolic	1,899,637	21,625.56	21,660.90	1.002
Liver	340,815	22,772.94	22,772.94	1.000
Gastrointestinal	686,663	21,850.71	21,902.67	1.002
Musculoskeletal	1,772,411	17,692.25	17,706.53	1.001
Blood	1,425,541	24,023.93	24,167.93	1.006
Cognitive	2,065,591	19,258.85	17,083.56	0.887
Substance Use	580,650	21,407.51	21,407.51	1.000
Psychiatric	2,233,549	15,380.92	15,380.92	1.000
Spinal	278,119	25,775.03	25,881.55	1.004
Neurological	1,711,081	18,581.34	18,620.06	1.002
Arrest	791,580	33,738.57	33,738.57	1.000
Heart	6,141,657	17,990.98	17,985.94	1.000
Cerebrovascular Disease	1,215,094	20,505.40	20,499.57	1.000
Vascular	4,403,020	18,522.97	18,522.97	1.000
Lung	4,110,583	19,058.46	19,075.93	1.001
Eye	712,002	17,002.17	16,983.59	0.999
Kidney	1,344,808	28,138.02	28,138.02	1.000
Skin	778,762	25,927.81	25,927.85	1.000
Injury	867,025	21,985.98	21,885.40	0.995
Complications	429,803	27,407.43	27,407.43	1.000
Transplant	52,047	33,412.49	33,412.49	1.000
Openings	237,148	35,256.10	35,256.10	1.000
Amputation	86,607	29,419.74	29,419.74	1.000

(continued)

Table 5-21 (continued)
Predictive Ratio by Body Systems/Disease Groups: All aged-disabled enrollees

Body System Label	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2019 CMS-HCC Model				
Entire Sample	28,232,347	9,949.14	9,949.14	1.000
Infection	754,729	31,714.80	31,821.58	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	21,494.98	1.002
Liver	346,904	22,883.31	22,883.13	1.000
Gastrointestinal	670,868	22,292.93	22,321.55	1.001
Musculoskeletal	1,792,421	18,000.60	18,014.00	1.001
Blood	1,411,249	24,311.55	24,462.87	1.006
Cognitive	1,986,815	19,786.03	17,700.30	0.895
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	26,545.01	1.005
Neurological	1,645,393	18,938.77	18,947.20	1.000
Arrest	807,993	34,486.88	34,486.88	1.000
Heart	5,909,290	18,497.37	18,494.71	1.000
Cerebrovascular Disease	1,160,629	20,950.39	20,935.16	0.999
Vascular	4,091,132	19,228.00	19,228.00	1.000
Lung	3,958,742	19,604.69	19,616.99	1.001
Eye	708,657	17,669.69	17,650.58	0.999
Kidney	2,495,055	22,103.42	22,109.01	1.000
Skin	752,910	26,784.79	26,784.06	1.000
Injury	855,633	22,485.34	22,365.22	0.995
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 Ratio by Body Systems/Disease Groups: All aged-disabled enrollees

Body System Label	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2019 Payment Condition Count (PCC) Model				
Entire Sample	28,232,347	9,949.14	9,949.14	1.000
Infection	754,729	31,714.80	31,808.00	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	21,462.82	1.000
Liver	346,904	22,883.31	22,882.53	1.000
Gastrointestinal	670,868	22,292.93	22,307.52	1.001
Musculoskeletal	1,792,421	18,000.60	18,007.41	1.000
Blood	1,411,249	24,311.55	24,439.55	1.005
Cognitive	1,986,815	19,786.03	17,692.09	0.894
Substance Use	728,437	21,280.50	21,280.50	1.000
Psychiatric	2,581,874	16,250.98	16,251.34	1.000
Spinal	271,370	26,415.19	26,529.41	1.004
Neurological	1,645,393	18,938.77	18,930.81	1.000
Arrest	807,993	34,486.88	34,486.88	1.000
Heart	5,909,290	18,497.37	18,478.04	0.999
Cerebrovascular Disease	1,160,629	20,950.39	20,917.66	0.998
Vascular	4,091,132	19,228.00	19,228.00	1.000
Lung	3,958,742	19,604.69	19,611.13	1.000
Eye	708,657	17,669.69	17,648.36	0.999
Kidney	2,495,055	22,103.42	22,109.26	1.000
Skin	752,910	26,784.79	26,783.73	1.000
Injury	855,633	22,485.34	22,355.13	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

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	23,650,907	9,753.46	9,753.46	1.000
0 chronic eligible HCCs	2,019,874	2,977.42	4,078.03	1.370
1–3 chronic eligible HCCs	5,586,456	4,921.34	5,419.34	1.101
4–6 chronic eligible HCCs	8,166,877	7,833.93	8,018.17	1.024
7–9 chronic eligible HCCs	4,979,643	13,042.36	12,698.80	0.974
10+ chronic eligible HCCs	2,898,057	24,422.29	22,663.83	0.928
2019 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	4,160.01	1.378
1–3 chronic eligible HCCs	5,663,293	5,086.83	5,570.50	1.095
4–6 chronic eligible HCCs	8,194,931	8,109.06	8,275.08	1.020
7–9 chronic eligible HCCs	4,932,479	13,525.75	13,140.80	0.972
10+ chronic eligible HCCs	2,782,186	25,208.07	23,447.29	0.930
2019 Payment Condition Count (PCC) Model				
Entire Sample	23,668,355	9,959.32	9,959.32	1.000
0 chronic eligible HCCs	2,095,466	3,019.17	4,230.95	1.401
1–3 chronic eligible HCCs	5,663,293	5,086.83	5,616.61	1.104
4–6 chronic eligible HCCs	8,194,931	8,109.06	8,269.43	1.020
7–9 chronic eligible HCCs	4,932,479	13,525.75	13,045.01	0.964
10+ chronic eligible HCCs	2,782,186	25,208.07	23,485.51	0.932

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: Disabled enrollees

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	4,668,678	9,731.10	9,731.10	1.000
0 chronic eligible HCCs	624,483	2,151.19	2,634.97	1.225
1–3 chronic eligible HCCs	1,448,661	4,871.20	5,347.55	1.098
4–6 chronic eligible HCCs	1,401,448	8,727.15	8,954.45	1.026
7–9 chronic eligible HCCs	749,467	15,304.27	14,862.97	0.971
10+ chronic eligible HCCs	444,619	30,656.73	28,379.82	0.926
2019 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	2,741.22	1.241
1–3 chronic eligible HCCs	1,411,256	5,026.61	5,485.75	1.091
4–6 chronic eligible HCCs	1,386,288	8,946.61	9,114.00	1.019
7–9 chronic eligible HCCs	738,085	15,489.54	15,108.64	0.975
10+ chronic eligible HCCs	425,999	31,021.85	28,788.13	0.928
2014–2015 HCPCS filtered, V23 Payment HCC count model				
Entire Sample	4,563,992	9,896.02	9,896.02	1.000
0 chronic eligible HCCs	602,364	2,208.90	2,929.64	1.326
1–3 chronic eligible HCCs	1,411,256	5,026.61	5,573.82	1.109
4–6 chronic eligible HCCs	1,386,288	8,946.61	9,023.59	1.009
7–9 chronic eligible HCCs	738,085	15,489.54	14,823.73	0.957
10+ chronic eligible HCCs	425,999	31,021.85	29,021.56	0.936

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: Full dual eligible enrollees

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	4,250,771	12,876.12	12,876.12	1.000
0 chronic eligible HCCs	377,544	3,907.30	4,019.08	1.029
1–3 chronic eligible HCCs	1,073,442	5,946.94	6,444.12	1.084
4–6 chronic eligible HCCs	1,304,604	10,108.06	10,513.50	1.040
7–9 chronic eligible HCCs	854,394	16,831.56	16,715.45	0.993
10+ chronic eligible HCCs	640,787	31,713.12	30,001.17	0.946
2019 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	4,150.21	1.018
1–3 chronic eligible HCCs	1,017,264	6,145.86	6,637.69	1.080
4–6 chronic eligible HCCs	1,249,419	10,451.47	10,802.03	1.034
7–9 chronic eligible HCCs	810,911	17,242.43	17,165.13	0.996
10+ chronic eligible HCCs	588,370	32,421.91	30,746.51	0.948
2019 Payment Condition Count (PCC) Model				
Entire Sample	4,015,611	13,154.40	13,154.40	1.000
0 chronic eligible HCCs	349,647	4,077.39	4,350.35	1.067
1–3 chronic eligible HCCs	1,017,264	6,145.86	6,737.21	1.096
4–6 chronic eligible HCCs	1,249,419	10,451.47	10,751.00	1.029
7–9 chronic eligible HCCs	810,911	17,242.43	16,966.50	0.984
10+ chronic eligible HCCs	588,370	32,421.91	30,839.84	0.951

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: Partial dual eligible enrollees

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	1,769,093	10,195.40	10,195.40	1.000
0 chronic eligible HCCs	179,080	3,156.70	3,658.66	1.159
1–3 chronic eligible HCCs	454,952	5,177.30	5,729.10	1.107
4–6 chronic eligible HCCs	571,794	8,491.87	8,741.77	1.029
7–9 chronic eligible HCCs	348,812	14,070.76	13,787.36	0.980
10+ chronic eligible HCCs	214,455	25,941.76	24,025.85	0.926
2019 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	3,807.34	1.182
1–3 chronic eligible HCCs	449,316	5,379.46	5,879.56	1.093
4–6 chronic eligible HCCs	565,260	8,752.10	8,943.23	1.022
7–9 chronic eligible HCCs	340,566	14,334.50	14,069.32	0.982
10+ chronic eligible HCCs	201,652	26,420.82	24,587.37	0.931
2019 Payment Condition Count (PCC) Model				
Entire Sample	1,737,201	10,342.22	10,342.22	1.000
0 chronic eligible HCCs	180,407	3,221.22	3,957.70	1.229
1–3 chronic eligible HCCs	449,316	5,379.46	5,960.95	1.108
4–6 chronic eligible HCCs	565,260	8,752.10	8,903.44	1.017
7–9 chronic eligible HCCs	340,566	14,334.50	13,880.72	0.968
10+ chronic eligible HCCs	201,652	26,420.82	24,708.57	0.935

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: Non-dual eligible enrollees

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	22,576,333	8,898.35	8,898.35	1.000
0 chronic eligible HCCs	2,195,390	2,554.46	3,684.05	1.442
1–3 chronic eligible HCCs	5,686,490	4,653.33	5,140.17	1.105
4–6 chronic eligible HCCs	7,770,857	7,489.33	7,624.00	1.018
7–9 chronic eligible HCCs	4,498,867	12,511.07	12,071.88	0.965
10+ chronic eligible HCCs	2,424,729	23,257.09	21,368.61	0.919
2019 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	3,788.43	1.450
1–3 chronic eligible HCCs	5,780,615	4,823.10	5,295.38	1.098
4–6 chronic eligible HCCs	7,843,224	7,761.89	7,879.19	1.015
7–9 chronic eligible HCCs	4,492,369	12,995.21	12,519.61	0.963
10+ chronic eligible HCCs	2,360,766	24,078.39	22,197.40	0.922
2019 Payment Condition Count (PCC) Model				
Entire Sample	22,746,830	9,133.84	9,133.84	1.000
0 chronic eligible HCCs	2,269,856	2,613.21	3,867.12	1.480
1–3 chronic eligible HCCs	5,780,615	4,823.10	5,339.85	1.107
4–6 chronic eligible HCCs	7,843,224	7,761.89	7,866.62	1.013
7–9 chronic eligible HCCs	4,492,369	12,995.21	12,414.83	0.955
10+ chronic eligible HCCs	2,360,766	24,078.39	22,255.37	0.924

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio 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
2017 CMS-HCC Model				
Entire Sample	7,182,035	13,920.98	13,920.98	1.000
1–3 chronic eligible HCCs	669,464	5,464.98	6,257.88	1.145
4–6 chronic eligible HCCs	2,513,321	7,929.25	8,678.41	1.094
7–9 chronic eligible HCCs	2,220,204	13,401.20	13,606.34	1.015
10+ chronic eligible HCCs	1,779,046	26,841.44	25,148.88	0.937
2019 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	6,383.71	1.146
4–6 chronic eligible HCCs	2,496,601	8,090.85	8,845.72	1.093
7–9 chronic eligible HCCs	2,217,271	13,708.87	13,885.08	1.013
10+ chronic eligible HCCs	1,736,541	27,410.56	25,709.28	0.938
2019 Payment Condition Count (PCC) Model				
Entire Sample	7,104,165	14,168.47	14,168.47	1.000
1–3 chronic eligible HCCs	653,752	5,572.23	6,443.76	1.156
4–6 chronic eligible HCCs	2,496,601	8,090.85	8,834.69	1.092
7–9 chronic eligible HCCs	2,217,271	13,708.87	13,770.82	1.005
10+ chronic eligible HCCs	1,736,541	27,410.56	25,854.06	0.943

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio 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
2017 CMS-HCC Model				
Entire Sample	101,960	15,272.87	15,272.87	1.000
1–3 chronic eligible HCCs	26,529	5,975.09	7,922.00	1.326
4–6 chronic eligible HCCs	36,996	10,344.10	11,719.35	1.133
7–9 chronic eligible HCCs	22,440	18,874.63	17,940.74	0.951
10+ chronic eligible HCCs	15,995	38,168.30	32,802.70	0.859
2019 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	7,875.97	1.280
4–6 chronic eligible HCCs	37,021	10,612.40	11,705.90	1.103
7–9 chronic eligible HCCs	22,147	17,639.18	17,976.14	1.019
10+ chronic eligible HCCs	15,452	39,249.51	32,987.09	0.840
2019 Payment Condition Count (PCC) Model				
Entire Sample	100,346	15,248.52	15,248.52	1.000
1–3 chronic eligible HCCs	25,726	6,151.23	7,873.21	1.280
4–6 chronic eligible HCCs	37,021	10,612.40	11,554.77	1.089
7–9 chronic eligible HCCs	22,147	17,639.18	17,793.21	1.009
10+ chronic eligible HCCs	15,452	39,249.51	33,643.18	0.857

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio 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
2017 CMS-HCC Model				
Entire Sample	580,650	21,407.51	21,407.51	1.000
1–3 chronic eligible HCCs	67,474	7,783.59	9,947.57	1.278
4–6 chronic eligible HCCs	158,441	12,503.00	13,747.50	1.100
7–9 chronic eligible HCCs	159,268	19,346.17	19,639.78	1.015
10+ chronic eligible HCCs	195,467	35,649.74	33,560.25	0.941
2019 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	9,959.68	1.240
4–6 chronic eligible HCCs	203,327	12,611.90	13,795.67	1.094
7–9 chronic eligible HCCs	200,785	19,526.67	19,808.33	1.014
10+ chronic eligible HCCs	233,448	36,168.07	34,049.63	0.941
2019 Payment Condition Count (PCC) Model				
Entire Sample	728,437	21,280.50	21,280.50	1.000
1–3 chronic eligible HCCs	90,877	8,033.67	9,794.97	1.219
4–6 chronic eligible HCCs	203,327	12,611.90	13,495.74	1.070
7–9 chronic eligible HCCs	200,785	19,526.67	19,533.50	1.000
10+ chronic eligible HCCs	233,448	36,168.07	34,635.32	0.958

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: All aged-disabled enrollees with mental health

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	2,233,549	15,380.92	15,380.92	1.000
0 chronic eligible HCCs	.	.	.	.
1–3 chronic eligible HCCs	441,401	5,590.69	7,090.92	1.268
4–6 chronic eligible HCCs	692,286	9,691.50	10,673.94	1.101
7–9 chronic eligible HCCs	565,809	15,945.31	15,909.07	0.998
10+ chronic eligible HCCs	534,053	31,042.06	28,436.45	0.916
2019 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	6,721.81	1.509
1–3 chronic eligible HCCs	478,647	5,925.07	7,365.27	1.243
4–6 chronic eligible HCCs	795,609	10,316.51	11,195.04	1.085
7–9 chronic eligible HCCs	673,157	16,923.34	16,793.10	0.992
10+ chronic eligible HCCs	630,274	31,905.77	29,691.68	0.931
2019 Payment Condition Count (PCC) Model				
Entire Sample	2,581,874	16,250.98	16,251.34	1.000
0 chronic eligible HCCs	4,187	4,455.58	6,707.89	1.506
1–3 chronic eligible HCCs	478,647	5,925.07	7,373.39	1.244
4–6 chronic eligible HCCs	795,609	10,316.51	11,073.25	1.073
7–9 chronic eligible HCCs	673,157	16,923.34	16,614.68	0.982
10+ chronic eligible HCCs	630,274	31,905.77	30,046.79	0.942

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: All aged-disabled enrollees with COPD

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	3,970,975	18,744.48	18,744.48	1.000
1–3 chronic eligible HCCs	312,796	7,698.13	8,720.08	1.133
4–6 chronic eligible HCCs	1,074,553	10,912.86	11,851.40	1.086
7–9 chronic eligible HCCs	1,244,224	16,577.76	17,053.77	1.029
10+ chronic eligible HCCs	1,339,402	30,218.12	28,708.60	0.950
2019 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	9,043.25	1.118
4–6 chronic eligible HCCs	1,052,464	11,403.58	12,277.03	1.077
7–9 chronic eligible HCCs	1,209,125	17,204.93	17,668.80	1.027
10+ chronic eligible HCCs	1,258,671	31,167.56	29,681.46	0.952
2019 Payment Condition Count (PCC) Model				
Entire Sample	3,826,031	19,259.78	19,259.78	1.000
1–3 chronic eligible HCCs	305,771	8,085.86	9,076.24	1.122
4–6 chronic eligible HCCs	1,052,464	11,403.58	12,206.21	1.070
7–9 chronic eligible HCCs	1,209,125	17,204.93	17,506.20	1.018
10+ chronic eligible HCCs	1,258,671	31,167.56	29,898.58	0.959

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: All aged-disabled enrollees with CHF

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	3,219,163	22,440.15	22,440.15	1.000
1–3 chronic eligible HCCs	131,348	9,845.31	10,573.14	1.074
4–6 chronic eligible HCCs	701,378	13,015.27	14,277.11	1.097
7–9 chronic eligible HCCs	1,061,020	18,639.06	19,453.18	1.044
10+ chronic eligible HCCs	1,325,417	32,208.00	30,746.06	0.955
2019 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	10,786.94	1.067
4–6 chronic eligible HCCs	688,269	13,482.04	14,689.57	1.090
7–9 chronic eligible HCCs	1,031,750	19,334.28	20,146.01	1.042
10+ chronic eligible HCCs	1,261,150	33,260.46	31,793.36	0.956
2019 Payment Condition Count (PCC) Model				
Entire Sample	3,111,271	23,079.39	23,079.39	1.000
1–3 chronic eligible HCCs	130,102	10,109.59	10,953.09	1.083
4–6 chronic eligible HCCs	688,269	13,482.04	14,619.55	1.084
7–9 chronic eligible HCCs	1,031,750	19,334.28	19,939.79	1.031
10+ chronic eligible HCCs	1,261,150	33,260.46	31,991.84	0.962

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio 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
2017 CMS-HCC Model				
Entire Sample	4,403,020	18,522.97	18,522.97	1.000
0 chronic eligible HCCs	2,159	6,654.97	8,253.16	1.240
1–3 chronic eligible HCCs	225,492	8,292.20	9,676.35	1.167
4–6 chronic eligible HCCs	1,050,516	10,710.17	11,976.49	1.118
7–9 chronic eligible HCCs	1,486,593	15,426.33	15,993.78	1.037
10+ chronic eligible HCCs	1,638,260	28,153.46	26,570.65	0.944
2019 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	8,395.72	1.199
1–3 chronic eligible HCCs	216,448	8,755.63	10,105.34	1.154
4–6 chronic eligible HCCs	992,870	11,307.45	12,490.68	1.105
7–9 chronic eligible HCCs	1,379,679	16,146.16	16,726.25	1.036
10+ chronic eligible HCCs	1,499,980	29,255.48	27,676.21	0.946
2019 Payment Condition Count (PCC) Model				
Entire Sample	4,091,132	19,228.00	19,228.00	1.000
0 chronic eligible HCCs	2,155	7,004.92	8,267.77	1.180
1–3 chronic eligible HCCs	216,448	8,755.63	10,032.12	1.146
4–6 chronic eligible HCCs	992,870	11,307.45	12,378.98	1.095
7–9 chronic eligible HCCs	1,379,679	16,146.16	16,587.34	1.027
10+ chronic eligible HCCs	1,499,980	29,255.48	27,897.50	0.954

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio 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
2017 CMS-HCC Model				
Entire Sample	3,308,044	16,153.38	16,153.38	1.000
1–3 chronic eligible HCCs	388,468	8,367.68	9,132.47	1.091
4–6 chronic eligible HCCs	1,089,304	10,783.84	11,330.87	1.051
7–9 chronic eligible HCCs	1,010,061	15,821.07	15,879.53	1.004
10+ chronic eligible HCCs	820,211	28,103.19	26,868.40	0.956
2019 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	9,469.38	1.086
4–6 chronic eligible HCCs	1,086,166	11,179.02	11,747.00	1.051
7–9 chronic eligible HCCs	1,003,161	16,424.05	16,424.93	1.000
10+ chronic eligible HCCs	787,445	28,853.25	27,619.37	0.957
2019 Payment Condition Count (PCC) Model				
Entire Sample	3,266,430	16,569.40	16,569.40	1.000
1–3 chronic eligible HCCs	389,658	8,720.01	9,461.43	1.085
4–6 chronic eligible HCCs	1,086,166	11,179.02	11,689.28	1.046
7–9 chronic eligible HCCs	1,003,161	16,424.05	16,323.37	0.994
10+ chronic eligible HCCs	787,445	28,853.25	27,844.29	0.965

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of chronic conditions: All aged-disabled enrollees with chronic kidney disease

Number of Chronic Eligible HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	282,199	18,241.79	18,241.79	1.000
1–3 chronic eligible HCCs	10,416	8,629.51	8,938.46	1.036
4–6 chronic eligible HCCs	68,237	11,125.69	11,971.45	1.076
7–9 chronic eligible HCCs	101,025	15,961.36	16,491.24	1.033
10+ chronic eligible HCCs	102,521	26,480.03	25,326.78	0.956
2019 CMS-HCC Model				
Entire Sample	1,398,777	15,350.17	15,359.82	1.001
1–3 chronic eligible HCCs	57,722	6,560.65	7,162.79	1.092
4–6 chronic eligible HCCs	383,089	9,029.41	9,768.77	1.082
7–9 chronic eligible HCCs	505,889	13,822.60	14,134.61	1.023
10+ chronic eligible HCCs	452,077	23,844.90	22,784.97	0.956
2019 Payment Condition Count (PCC) Model				
Entire Sample	1,398,777	15,350.17	15,360.25	1.001
1–3 chronic eligible HCCs	57,722	6,560.65	7,232.80	1.102
4–6 chronic eligible HCCs	383,089	9,029.41	9,760.17	1.081
7–9 chronic eligible HCCs	505,889	13,822.60	14,039.79	1.016
10+ chronic eligible HCCs	452,077	23,844.90	22,893.71	0.960

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of chronic condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of payment conditions: Aged enrollees

Number of Payment HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	23,650,907	9,753.46	9,753.46	1.000
0 payment HCCs	8,337,493	4,196.94	4,104.30	0.978
1–3 payment HCCs	12,081,520	9,577.26	9,625.18	1.005
4–6 payment HCCs	2,481,746	21,812.51	22,064.00	1.012
7–9 payment HCCs	574,043	36,507.73	36,325.80	0.995
10+ payment HCCs	176,105	57,268.64	55,196.62	0.964
2019 CMS-HCC Model				
Entire Sample	23,668,355	9,959.32	9,959.32	1.000
0 payment HCCs	8,325,552	4,265.99	4,188.06	0.982
1–3 payment HCCs	12,006,375	9,742.99	9,776.67	1.003
4–6 payment HCCs	2,552,800	21,992.94	22,249.20	1.012
7–9 payment HCCs	601,816	36,899.77	36,764.58	0.996
10+ payment HCCs	181,812	57,937.80	55,923.93	0.965
2019 Payment Condition Count (PCC) Model				
Entire Sample	23,668,355	9,959.32	9,959.32	1.000
0 payment HCCs	8,325,552	4,265.99	4,261.15	0.999
1–3 payment HCCs	12,006,375	9,742.99	9,743.38	1.000
4–6 payment HCCs	2,552,800	21,992.94	21,993.60	1.000
7–9 payment HCCs	601,816	36,899.77	36,951.42	1.001
10+ payment HCCs	181,812	57,937.80	57,985.87	1.001

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of payment conditions: Disabled enrollees

Number of Payment HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	4,668,678	9,731.10	9,731.10	1.000
0 payment HCCs	1,405,005	3,027.20	2,758.12	0.911
1–3 payment HCCs	2,565,410	8,431.98	8,565.95	1.016
4–6 payment HCCs	518,361	21,845.81	22,412.03	1.026
7–9 payment HCCs	127,791	41,479.26	40,482.46	0.976
10+ payment HCCs	52,111	68,608.22	65,772.29	0.959
2019 CMS-HCC Model				
Entire Sample	4,563,992	9,896.02	9,896.02	1.000
0 payment HCCs	1,338,558	3,077.67	2,861.07	0.930
1–3 payment HCCs	2,516,884	8,478.66	8,564.82	1.010
4–6 payment HCCs	525,226	21,617.25	22,221.63	1.028
7–9 payment HCCs	129,306	40,974.80	40,358.04	0.985
10+ payment HCCs	54,018	69,102.22	65,726.24	0.951
2019 Payment Condition Count (PCC) Model				
Entire Sample	4,563,992	9,896.02	9,896.02	1.000
0 payment HCCs	1,338,558	3,077.67	3,066.60	0.996
1–3 payment HCCs	2,516,884	8,478.66	8,502.19	1.003
4–6 payment HCCs	525,226	21,617.25	21,587.67	0.999
7–9 payment HCCs	129,306	40,974.80	40,794.98	0.996
10+ payment HCCs	54,018	69,102.22	68,954.09	0.998

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of payment conditions: Full dual eligible enrollees

Number of Payment HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	4,250,771	12,876.12	12,876.12	1.000
0 payment HCCs	1,067,089	4,650.52	4,315.43	0.928
1–3 payment HCCs	2,348,908	10,455.54	10,558.28	1.010
4–6 payment HCCs	605,362	25,059.35	25,590.12	1.021
7–9 payment HCCs	165,786	44,868.96	44,477.31	0.991
10+ payment HCCs	63,626	73,514.22	70,852.80	0.964
2019 CMS-HCC Model				
Entire Sample	4,015,611	13,154.40	13,154.40	1.000
0 payment HCCs	974,663	4,750.06	4,455.89	0.938
1–3 payment HCCs	2,223,791	10,537.53	10,619.82	1.008
4–6 payment HCCs	589,055	25,065.46	25,510.84	1.018
7–9 payment HCCs	164,152	44,570.78	44,553.75	1.000
10+ payment HCCs	63,950	73,804.81	70,911.46	0.961
2019 Payment Condition Count (PCC) Model				
Entire Sample	4,015,611	13,154.40	13,154.40	1.000
0 payment HCCs	974,663	4,750.06	4,656.45	0.980
1–3 payment HCCs	2,223,791	10,537.53	10,583.38	1.004
4–6 payment HCCs	589,055	25,065.46	25,043.98	0.999
7–9 payment HCCs	164,152	44,570.78	44,577.15	1.000
10+ payment HCCs	63,950	73,804.81	73,804.81	1.000

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of payment conditions: Partial dual eligible enrollees

Number of Payment HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	1,769,093	10,195.40	10,195.40	1.000
0 payment HCCs	487,545	4,018.08	3,817.04	0.950
1–3 payment HCCs	985,139	8,957.56	9,032.31	1.008
4–6 payment HCCs	224,935	20,930.91	21,330.82	1.019
7–9 payment HCCs	54,266	36,894.52	36,460.92	0.988
10+ payment HCCs	17,208	59,566.13	56,602.50	0.950
2019 CMS-HCC Model				
Entire Sample	1,737,201	10,342.22	10,342.22	1.000
0 payment HCCs	473,834	4,095.05	3,933.70	0.961
1–3 payment HCCs	963,593	9,007.56	9,036.95	1.003
4–6 payment HCCs	227,201	20,779.64	21,270.20	1.024
7–9 payment HCCs	54,710	36,907.45	36,558.81	0.991
10+ payment HCCs	17,863	60,012.32	57,083.99	0.951
2019 Payment Condition Count (PCC) Model				
Entire Sample	1,737,201	10,342.22	10,342.22	1.000
0 payment HCCs	473,834	4,095.05	4,086.12	0.998
1–3 payment HCCs	963,593	9,007.56	9,006.06	1.000
4–6 payment HCCs	227,201	20,779.64	20,779.96	1.000
7–9 payment HCCs	54,710	36,907.45	37,023.51	1.003
10+ payment HCCs	17,863	60,012.32	60,012.32	1.000

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual cost 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 Ratio by count of payment conditions: Non-dual eligible enrollees

Number of Payment HCCs	Sample size	Mean Actual Expenditure ($)	Mean Predicted Expenditure ($)	Predictive Ratio
2017 CMS-HCC Model				
Entire Sample	22,576,333	8,898.35	8,898.35	1.000
0 payment HCCs	8,409,947	3,929.08	3,847.07	0.979
1–3 payment HCCs	11,472,730	9,101.81	9,156.32	1.006
4–6 payment HCCs	2,109,707	21,151.01	21,393.99	1.011
7–9 payment HCCs	453,233	35,957.74	35,566.07	0.989
10+ payment HCCs	130,716	56,578.93	54,076.22	0.956
2019 CMS-HCC Model				
Entire Sample	22,746,830	9,133.84	9,133.84	1.000
0 payment HCCs	8,426,399	4,008.70	3,941.80	0.983
1–3 payment HCCs	11,494,777	9,281.38	9,316.10	1.004
4–6 payment HCCs	2,204,367	21,319.68	21,600.51	1.013
7–9 payment HCCs	483,704	36,341.78	36,026.50	0.991
10+ payment HCCs	137,583	57,518.16	54,908.62	0.955
2019 Payment Condition Count (PCC) Model				
Entire Sample	22,746,830	9,133.84	9,133.84	1.000
0 payment HCCs	8,426,399	4,008.70	4,017.99	1.002
1–3 payment HCCs	11,494,777	9,281.38	9,274.72	0.999
4–6 payment HCCs	2,204,367	21,319.68	21,318.35	1.000
7–9 payment HCCs	483,704	36,341.78	36,341.78	1.000
10+ payment HCCs	137,583	57,518.16	57,518.16	1.000

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

Predicted and actual cost are annualized to account for partial year enrollment and changes in status throughout the year. Averaging the predicted or actual cost across all groupings by count of payment condition using weights based on sample size may not equal the average predicted or actual cost 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	373,176	$80,912.08	$82,059.49	1.014
First (lowest) decile	37,318	$46,553.50	$47,317.53	1.016
Second decile	37,318	$57,300.62	$56,721.69	0.990
Third decile	37,318	$63,467.85	$63,449.03	1.000
Fourth decile	37,318	$69,346.03	$69,991.71	1.009
Fifth decile	37,318	$73,324.05	$75,899.03	1.035
Sixth decile	37,318	$78,936.72	$82,006.20	1.039
Seventh decile	37,317	$85,330.53	$88,213.66	1.034
Eighth decile	37,317	$95,866.25	$97,423.41	1.016
Ninth decile	37,317	$109,172.20	$110,404.37	1.011
Tenth (highest)	37,317	$140,708.27	$140,136.10	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

SOURCE: RTI International analysis of Medicare 2013–2014 (v22) and 2014–2015 (v23) 100% sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	178,003	$86,650.90	$87,004.55	1.004
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	$75,574.09	$74,733.03	0.989
Fifth decile	17,800	$80,770.96	$81,061.35	1.004
Sixth decile	17,800	$86,377.53	$87,288.38	1.011
Seventh decile	17,800	$92,496.79	$94,547.72	1.022
Eighth decile	17,800	$101,523.23	$103,318.26	1.018
Ninth decile	17,800	$112,135.26	$115,296.21	1.028
Tenth (highest)	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

SOURCE: RTI International analysis of Medicare 2014–2015 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	195,173	$75,956.45	$77,789.31	1.024
First (lowest) decile	19,518	$44,422.26	$44,843.53	1.009
Second decile	19,518	$52,651.02	$52,809.23	1.003
Third decile	19,518	$57,871.09	$59,129.60	1.022
Fourth decile	19,517	$62,903.41	$65,213.93	1.037
Fifth decile	19,517	$68,017.04	$71,898.32	1.057
Sixth decile	19,517	$72,308.82	$77,216.24	1.068
Seventh decile	19,517	$77,974.48	$83,494.63	1.071
Eighth decile	19,517	$86,537.66	$90,195.25	1.042
Ninth decile	19,517	$104,205.96	$104,217.46	1.000
Tenth (highest)	19,517	$139,657.24	$136,170.84	0.975
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

SOURCE: RTI International analysis of Medicare 2014–2015 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-45
Predictive ratios by deciles of predicted risk (sorted low to high): Dialysis new enrollees
2019 ESRD Model

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
Entire Sample	47,941	$72,242.65	$83,021.79	1.149
First decile (lowest)	4,795	$53,189.74	$60,702.16	1.141
Second decile	4,794	$60,767.28	$71,435.32	1.176
Third decile	4,794	$63,637.16	$74,829.65	1.176
Fourth decile	4,794	$68,049.20	$77,368.17	1.137
Fifth decile	4,794	$67,600.34	$81,519.72	1.206
Sixth decile	4,794	$75,181.33	$84,231.22	1.120
Seventh decile	4,794	$71,489.54	$85,090.71	1.190
Eighth decile	4,794	$77,191.55	$88,528.39	1.147
Ninth decile	4,794	$87,005.38	$96,782.65	1.112
Tenth (highest)	4,794	$98,353.13	$109,405.75	1.112
Top 5%	2,397	$97,345.33	$112,866.34	1.159
Top 1%	479	$100,698.09	$115,598.57	1.148
Top 0.1%	47	$105,702.30	$121,521.74	1.150

SOURCE: RTI International analysis of Medicare 2014–2015 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 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	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-51
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	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

(continued)

Table 5-51 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			154,841	$99,007.08	$96,664.08	0.976
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

(continued)

Table 5-51 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC47	Disorders of Immunity	Y	Y	14,351	$112,129.70	$112,129.70	1.000
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
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

(continued)

Table 5-51 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
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
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

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Table 5-5251 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
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
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

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Table 5-51 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
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	18,549	$87,260.25	$84,204.33	0.965
HCC133	End Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status	Y	Y	.	.	.	.
HCC135	Acute Renal Failure	Y		.	.	.	.
HCC136	Chronic Kidney Disease, Stage 5	Y	Y	.	.	.	.
HCC137	Chronic Kidney Disease, Severe (Stage 4)	Y	Y	.	.	.	.
HCC138	Chronic Kidney Disease, Moderate (Stage 3)	Y	Y	.	.	.	.

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Table 5-51 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)	Y	Y	.	.	.	.
HCC140	Unspecified Renal Failure	Y	Y	.	.	.	.
HCC141	Nephritis	Y	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
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

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Table 5-51 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
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
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	*			
HCC181	Premature Newborns, Including Birthweight 1000-1499 Grams		Y	.	.	.	.

(continued)

Table 5-51 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All dialysis continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
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			.	.	.	.

NOTES:

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.

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-53
Predictive ratio for all body systems/disease groups: All dialysis continuing enrollees

Body System Label	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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

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 100% ESRD sample claims and enrollment data.

Table 5-53
Predictive ratio for ESRD interacted with count of chronic conditions: All dialysis continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-54
Predictive ratio for ESRD interacted with count of chronic conditions: Aged dialysis continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-55
Predictive ratio for ESRD interacted with count of chronic conditions: Non-aged dialysis continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-56
Predictive ratio for ESRD interacted with count of chronic conditions: Any Medicaid dialysis continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	160,672	$86,768.99	$86,768.99	1.000
0 chronic HCCs	5,592	$47,269.19	$50,945.33	1.078
1–3 chronic HCCs	17,841	$55,476.06	$57,980.95	1.045
4–6 chronic HCCs	30,665	$66,304.38	$68,399.39	1.032
7–9 chronic HCCs	36,371	$79,899.79	$80,936.20	1.013
10+ chronic HCCs	70,203	$112,123.14	$109,571.29	0.977

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-57
Predictive ratio for ESRD interacted with count of chronic conditions: Non-Medicaid dialysis continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-58
Predictive ratio for ESRD interacted with count of chronic conditions: Full Dual eligible dialysis continuing enrollees
2019 ESRD Model

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-60
Predictive ratio by count of chronic conditions: Non-Dual eligible dialysis continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-65
Predictive ratio by count of payment conditions: Non-dual eligible dialysis continuing enrollees
2019 ESRD Model

Number of payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-66
Predictive ratio by deciles of predicted risk (sorted low to high): All functioning graft enrollees
2019 ESRD Model

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
Entire Sample	105,059	$24,863.86	$24,652.96	0.992
First (lowest) decile	10,506	$9,837.91	$10,727.64	1.090
Second decile	10,506	$12,612.96	$13,729.81	1.089
Third decile	10,506	$15,686.97	$15,919.05	1.015
Fourth decile	10,506	$17,875.19	$18,029.13	1.009
Fifth decile	10,506	$19,988.12	$20,582.95	1.030
Sixth decile	10,506	$22,933.33	$23,565.89	1.028
Seventh decile	10,506	$26,550.81	$27,253.51	1.026
Eighth decile	10,506	$32,219.80	$31,793.06	0.987
Ninth decile	10,506	$39,231.07	$38,884.37	0.991
Tenth (highest)	10,505	$64,473.54	$57,311.74	0.889
Top 5%	5,252	$76,867.36	$66,460.97	0.865
Top 1%	1,050	$106,521.97	$87,345.52	0.820
Top 0.1%	105	$139,637.04	$115,143.70	0.825

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	38,609	$26,964.08	$26,785.25	0.993
First (lowest) decile	3,861	$10,525.86	$13,876.70	1.318
Second decile	3,861	$15,114.90	$15,816.78	1.046
Third decile	3,861	$17,313.02	$17,924.41	1.035
Fourth decile	3,861	$19,063.26	$20,244.55	1.062
Fifth decile	3,861	$20,668.03	$22,700.96	1.098
Sixth decile	3,861	$24,967.16	$25,750.42	1.031
Seventh decile	3,861	$28,519.07	$29,405.58	1.031
Eighth decile	3,861	$35,836.84	$34,153.15	0.953
Ninth decile	3,861	$43,280.56	$41,534.05	0.960
Tenth (highest)	3,860	$70,461.48	$59,182.71	0.840
Top 5%	1,930	$82,841.07	$67,973.36	0.821
Top 1%	386	$111,799.13	$86,489.96	0.774
Top 0.1%	38	$165,817.35	$110,346.44	0.665

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	66,450	$23,450.62	$23,218.15	0.990
First (lowest) decile	6,645	$8,941.06	$10,084.27	1.128
Second decile	6,645	$12,143.94	$12,296.08	1.013
Third decile	6,645	$14,889.51	$14,688.38	0.986
Fourth decile	6,645	$17,332.58	$16,869.72	0.973
Fifth decile	6,645	$19,463.05	$19,170.49	0.985
Sixth decile	6,645	$22,381.80	$22,130.80	0.989
Seventh decile	6,645	$25,595.15	$25,881.55	1.011
Eighth decile	6,645	$29,931.73	$30,379.32	1.015
Ninth decile	6,645	$36,006.94	$37,182.25	1.033
Tenth (highest)	6,645	$61,026.99	$56,110.86	0.919
Top 5%	3,322	$72,775.37	$65,402.42	0.899
Top 1%	664	$103,368.72	$87,959.35	0.851
Top 0.1%	66	$129,365.89	$117,162.40	0.906

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	906	$51,704.15	$43,239.59	0.836
First (lowest) decile	91	$30,055.04	$22,973.89	0.764
Second decile	91	$30,351.03	$27,853.29	0.918
Third decile	91	$40,251.17	$31,213.47	0.775
Fourth decile	91	$44,729.44	$34,806.28	0.778
Fifth decile	91	$43,837.32	$38,528.43	0.879
Sixth decile	91	$46,310.91	$42,868.26	0.926
Seventh decile	90	$59,685.21	$47,863.11	0.802
Eighth decile	90	$54,641.70	$54,285.59	0.993
Ninth decile	90	$68,901.36	$63,349.05	0.919
Tenth (highest)	90	$115,090.90	$82,419.75	0.716
Top 5%	45	$114,875.71	$90,285.18	0.786
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 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	6,779	$22,921.40	$18,475.75	0.806
First (lowest) decile	678	$18,347.81	$14,461.82	0.788
Second decile	678	$16,401.55	$15,359.36	0.936
Third decile	678	$16,804.00	$15,694.78	0.934
Fourth decile	678	$23,183.02	$16,513.87	0.712
Fifth decile	678	$23,934.99	$16,873.04	0.705
Sixth decile	678	$24,564.42	$17,785.93	0.724
Seventh decile	678	$26,153.62	$19,146.30	0.732
Eighth decile	678	$26,798.69	$21,033.06	0.785
Ninth decile	678	$30,841.07	$27,424.92	0.889
Tenth (highest)	677	$34,140.56	$31,032.30	0.909
Top 5%	338	$32,692.82	$32,357.39	0.990
Top 1%	67	$34,903.47	$34,122.60	0.978
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 100% ESRD sample claims and enrollment data.

Table 5-72
Predictive ratio by deciles of predicted risk (sorted low to high): Aged functioning graft community continuing enrollees

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 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)	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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	27,855	$30,081.30	$26,746.45	0.889
First (lowest) decile	2,786	$11,522.14	$11,281.80	0.979
Second decile	2,786	$16,146.17	$14,107.65	0.874
Third decile	2,786	$17,639.86	$17,042.24	0.966
Fourth decile	2,786	$21,516.02	$19,820.03	0.921
Fifth decile	2,786	$24,559.52	$22,839.75	0.930
Sixth decile	2,785	$28,084.00	$26,113.70	0.930
Seventh decile	2,785	$32,346.77	$30,034.99	0.929
Eighth decile	2,785	$38,393.79	$35,107.43	0.914
Ninth decile	2,785	$49,254.94	$42,623.60	0.865
Tenth (highest)	2,785	$78,537.09	$62,368.36	0.794
Top 5%	1,392	$89,023.33	$72,032.67	0.809
Top 1%	278	$116,586.50	$93,622.85	0.803
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 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	11,339	$25,364.84	$25,281.54	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	$17,286.64	$18,990.41	1.099
Fifth decile	1,134	$20,448.23	$21,713.44	1.062
Sixth decile	1,134	$23,586.18	$24,740.08	1.049
Seventh decile	1,134	$26,831.20	$28,310.19	1.055
Eighth decile	1,134	$33,378.25	$33,258.81	0.996
Ninth decile	1,134	$42,013.21	$40,372.07	0.961
Tenth (highest)	1,133	$66,187.21	$58,970.06	0.891
Top 5%	566	$75,968.40	$68,140.52	0.897
Top 1%	113	$100,705.12	$88,726.42	0.881
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 100% ESRD sample claims and enrollment data.

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

Deciles	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	66,344	$23,843.30	$24,308.86	1.020
First (lowest) decile	6,635	$9,051.25	$10,295.96	1.138
Second decile	6,635	$11,373.46	$13,348.41	1.174
Third decile	6,635	$14,353.40	$15,563.39	1.084
Fourth decile	6,635	$16,918.28	$17,900.75	1.058
Fifth decile	6,634	$18,882.41	$20,485.55	1.085
Sixth decile	6,634	$22,223.73	$23,349.26	1.051
Seventh decile	6,634	$25,677.57	$26,960.14	1.050
Eighth decile	6,634	$32,040.23	$31,597.11	0.986
Ninth decile	6,634	$38,173.10	$38,687.35	1.013
Tenth (highest)	6,634	$63,109.46	$56,512.27	0.895
Top 5%	3,317	$76,505.41	$65,394.50	0.855
Top 1%	663	$106,993.76	$85,406.95	0.798
Top 0.1%	66	$176,007.72	$111,576.44	0.634

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-77
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	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	$30,717.29	1.016
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		8,994	$49,549.16	$43,367.41	0.875
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			856	$49,687.94	$41,186.56	0.829
HCC4	Viral and Late Effects Central Nervous System Infections			242	$35,609.63	$38,510.02	1.081
HCC5	Tuberculosis			284	$36,505.22	$35,596.24	0.975
HCC6	Opportunistic Infections	Y		4,629	$35,462.40	$40,529.13	1.143
HCC7	Other Infectious Diseases			36,364	$33,031.45	$30,562.63	0.925
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	773	$61,516.55	$59,099.12	0.961
HCC9	Lung and Other Severe Cancers	Y	Y	997	$42,906.93	$43,436.49	1.012
HCC10	Lymphoma and Other Cancers	Y	Y	1,167	$37,757.47	$37,750.08	1.000
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	2,307	$31,534.37	$32,400.61	1.027
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	3,952	$28,534.87	$28,992.37	1.016
HCC13	Other Respiratory and Heart Neoplasms			248	$44,490.31	$34,253.89	0.770
HCC14	Other Digestive and Urinary Neoplasms			6,334	$29,799.28	$27,727.73	0.930
HCC15	Other Neoplasms			11,405	$24,851.12	$24,506.07	0.986
HCC16	Benign Neoplasms of Skin, Breast, Eye			7,375	$23,251.65	$23,822.48	1.025
HCC17	Diabetes with Acute Complications	Y	Y	1,960	$47,214.92	$37,417.76	0.792
HCC18	Diabetes with Chronic Complications	Y	Y	34,704	$32,037.65	$30,385.39	0.948
HCC19	Diabetes without Complication	Y	Y	14,235	$23,228.94	$23,590.89	1.016
HCC20	Type I Diabetes Mellitus		Y	17,993	$34,367.33	$31,500.83	0.917
HCC21	Protein-Calorie Malnutrition	Y		3,228	$57,987.08	$51,530.06	0.889
HCC22	Morbid Obesity	Y	Y	5,494	$36,063.61	$33,399.29	0.926

(continued)

Table 5-77 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	28,327	$29,685.89	$29,754.28	1.002
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			36,566	$36,405.97	$32,759.58	0.900
HCC25	Disorders of Lipoid Metabolism		Y	61,572	$27,556.54	$27,040.95	0.981
HCC26	Other Endocrine/Metabolic/Nutritional Disorders		Y	49,706	$29,092.72	$28,468.96	0.979
HCC27	End-Stage Liver Disease	Y	Y	908	$49,445.32	$45,877.04	0.928
HCC28	Cirrhosis of Liver	Y	Y	1,134	$38,076.06	$34,798.25	0.914
HCC29	Chronic Hepatitis	Y	Y	2,317	$30,166.03	$30,565.97	1.013
HCC30	Acute Liver Failure/Disease			243	$49,123.07	$38,970.50	0.793
HCC31	Other Hepatitis and Liver Disease		Y	2,984	$32,732.76	$29,856.52	0.912
HCC32	Gallbladder and Biliary Tract Disorders			1,961	$42,706.78	$35,465.11	0.830
HCC33	Intestinal Obstruction/Perforation	Y		4,110	$42,990.91	$40,645.45	0.945
HCC34	Chronic Pancreatitis	Y	Y	573	$48,213.01	$42,571.02	0.883
HCC35	Inflammatory Bowel Disease	Y	Y	1,334	$38,919.84	$34,599.90	0.889
HCC36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders			12,282	$41,731.39	$35,031.02	0.839
HCC37	Appendicitis			263	$31,933.11	$34,584.92	1.083
HCC38	Other Gastrointestinal Disorders			52,151	$31,303.61	$29,302.71	0.936
HCC39	Bone/Joint/Muscle Infections/Necrosis	Y		3,771	$48,761.78	$44,404.25	0.911
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	Y	Y	7,301	$29,958.98	$31,037.86	1.036
HCC41	Disorders of the Vertebrae and Spinal Discs		Y	12,205	$33,809.45	$29,292.67	0.866
HCC42	Osteoarthritis of Hip or Knee		Y	6,401	$32,675.83	$28,495.83	0.872
HCC43	Osteoporosis and Other Bone/Cartilage Disorders		Y	22,583	$29,606.61	$28,826.45	0.974
HCC44	Congenital/Developmental Skeletal and Connective Tissue Disorders		Y	172	$38,076.39	$30,300.29	0.796

(continued)

Table 5-77 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC45	Other Musculoskeletal and Connective Tissue Disorders			58,716	$29,534.97	$27,917.49	0.945
HCC46	Severe Hematological Disorders	Y	Y	1,118	$70,689.86	$62,494.68	0.884
HCC47	Disorders of Immunity	Y	Y	25,344	$30,898.68	$34,101.52	1.104
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	10,902	$37,390.22	$35,756.91	0.956
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			27,592	$28,725.87	$24,609.24	0.857
HCC50	Delirium and Encephalopathy			4,176	$56,500.92	$44,720.01	0.791
HCC51	Dementia With Complications	Y	Y	553	$49,482.87	$43,549.22	0.880
HCC52	Dementia Without Complication	Y	Y	1,913	$47,695.72	$39,602.47	0.830
HCC53	Nonpsychotic Organic Brain Syndromes/Conditions		Y	910	$39,174.35	$32,253.14	0.823
HCC54	Drug/Alcohol Psychosis	Y	Y	613	$46,554.69	$44,488.16	0.956
HCC55	Drug/Alcohol Dependence	Y	Y	1,437	$41,888.65	$37,307.53	0.891
HCC56	Drug/Alcohol Abuse, Without Dependence		Y	7,189	$32,419.68	$28,880.18	0.891
HCC57	Schizophrenia	Y	Y	601	$35,658.65	$32,886.63	0.922
HCC58	Major Depressive, Bipolar, and Paranoid Disorders	Y	Y	6,059	$35,257.57	$31,759.01	0.901
HCC59	Reactive and Unspecified Psychosis			947	$48,182.86	$40,285.48	0.836
HCC60	Personality Disorders		Y	89	$35,246.24	$29,014.17	0.823
HCC61	Depression		Y	9,743	$34,872.39	$30,874.54	0.885
HCC62	Anxiety Disorders		Y	1,061	$27,404.46	$26,558.38	0.969
HCC63	Other Psychiatric Disorders		Y	5,433	$30,879.27	$28,571.22	0.925
HCC64	Profound Intellectual Disability/Developmental Disorder		Y	60	$26,004.95	$30,904.94	1.188
HCC65	Severe Intellectual Disability/Developmental Disorder		Y	*			

(continued)

Table 5-77 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	66	$29,375.25	$25,009.46	0.851
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	473	$27,108.87	$25,961.21	0.958
HCC68	Other Developmental Disorders		Y	1,071	$27,018.49	$26,084.49	0.965
HCC69	Attention Deficit Disorder		Y	451	$24,334.00	$26,002.31	1.069
HCC70	Quadriplegia	Y	Y	136	$74,666.78	$59,716.51	0.800
HCC71	Paraplegia	Y	Y	183	$72,010.48	$51,857.16	0.720
HCC72	Spinal Cord Disorders/Injuries	Y	Y	666	$40,890.40	$38,520.59	0.942
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	Y	Y	*			
HCC74	Cerebral Palsy	Y	Y	186	$32,356.19	$29,055.86	0.898
HCC75	Polyneuropathy	Y	Y	17,814	$39,208.99	$36,027.09	0.919
HCC76	Muscular Dystrophy	Y	Y	44	$42,235.15	$38,541.17	0.913
HCC77	Multiple Sclerosis	Y	Y	244	$37,105.68	$37,116.68	1.000
HCC78	Parkinson's and Huntington's Diseases	Y	Y	526	$42,729.16	$38,587.69	0.903
HCC79	Seizure Disorders and Convulsions	Y	Y	4,423	$39,401.86	$35,608.73	0.904
HCC80	Coma, Brain Compression/Anoxic Damage	Y	Y	329	$61,862.33	$51,011.33	0.825
HCC81	Mononeuropathy, Other Neurological Conditions/Injuries		Y	14,744	$35,102.48	$31,336.31	0.893
HCC82	Respirator Dependence/Tracheostomy Status	Y	Y	599	$80,821.28	$62,230.12	0.770
HCC83	Respiratory Arrest	Y		61	$44,723.12	$49,886.46	1.115
HCC84	Cardio-Respiratory Failure and Shock	Y		5,873	$52,467.07	$46,484.20	0.886
HCC85	Congestive Heart Failure	Y	Y	20,858	$42,590.48	$36,884.98	0.866
HCC86	Acute Myocardial Infarction	Y	Y	1,813	$54,080.06	$43,853.91	0.811
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	Y	Y	2,904	$43,665.90	$37,919.60	0.868
HCC88	Angina Pectoris	Y	Y	2,128	$35,217.51	$31,272.17	0.888

(continued)

Table 5-77 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	22,797	$33,372.55	$30,341.16	0.909
HCC90	Heart Infection/Inflammation, Except Rheumatic			2,526	$47,238.55	$38,455.91	0.814
HCC91	Valvular and Rheumatic Heart Disease		Y	16,319	$38,158.01	$32,626.74	0.855
HCC92	Major Congenital Cardiac/Circulatory Defect		Y	115	$34,037.91	$30,566.85	0.898
HCC93	Other Congenital Heart/Circulatory Disease		Y	545	$31,327.31	$32,272.42	1.030
HCC94	Hypertensive Heart Disease		Y	3,993	$26,150.41	$25,816.45	0.987
HCC95	Hypertension		Y	61,846	$21,355.50	$22,659.49	1.061
HCC96	Specified Heart Arrhythmias	Y	Y	14,184	$39,953.89	$35,104.27	0.879
HCC97	Other Heart Rhythm and Conduction Disorders		Y	10,325	$34,935.23	$32,090.90	0.919
HCC98	Other and Unspecified Heart Disease		Y	13,488	$39,788.98	$34,603.51	0.870
HCC99	Cerebral Hemorrhage	Y	Y	605	$45,590.09	$41,641.11	0.913
HCC100	Ischemic or Unspecified Stroke	Y	Y	3,478	$41,795.75	$37,159.91	0.889
HCC101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia		Y	5,335	$36,255.48	$31,077.11	0.857
HCC102	Cerebrovascular Atherosclerosis, Aneurysm, and Other Disease		Y	905	$36,269.48	$33,118.52	0.913
HCC103	Hemiplegia/Hemiparesis	Y	Y	1,223	$46,847.31	$41,737.06	0.891
HCC104	Monoplegia, Other Paralytic Syndromes	Y	Y	137	$50,013.86	$39,529.73	0.790
HCC105	Late Effects of Cerebrovascular Disease, Except Paralysis		Y	1,692	$42,016.38	$35,867.23	0.854
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	Y	Y	2,384	$58,085.35	$50,403.46	0.868
HCC107	Vascular Disease with Complications	Y		3,379	$42,422.91	$38,084.69	0.898
HCC108	Vascular Disease	Y	Y	20,425	$35,158.84	$32,733.56	0.931
HCC109	Other Circulatory Disease			11,789	$31,034.78	$28,578.59	0.921
HCC110	Cystic Fibrosis	Y	Y	73	$48,231.38	$60,232.55	1.249

(continued)

Table 5-77 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	7,924	$41,704.13	$37,908.83	0.909
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	1,547	$37,398.67	$35,031.04	0.937
HCC113	Asthma		Y	4,761	$31,292.83	$27,416.64	0.876
HCC114	Aspiration and Specified Bacterial Pneumonias	Y		1,542	$67,939.67	$55,063.21	0.810
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	Y		680	$46,073.12	$40,855.75	0.887
HCC116	Viral and Unspecified Pneumonia, Pleurisy			8,345	$43,709.39	$36,449.37	0.834
HCC117	Pleural Effusion/Pneumothorax			3,377	$57,446.92	$44,814.84	0.780
HCC118	Other Respiratory Disorders			24,928	$33,632.36	$30,537.73	0.908
HCC119	Legally Blind		Y	2,097	$37,247.50	$34,120.69	0.916
HCC120	Major Eye Infections/Inflammations			340	$36,936.51	$30,752.01	0.833
HCC121	Retinal Detachment			1,541	$30,098.77	$29,759.42	0.989
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	Y	Y	10,773	$32,752.46	$31,854.61	0.973
HCC123	Diabetic and Other Vascular Retinopathies		Y	10,804	$33,857.28	$30,759.74	0.909
HCC124	Exudative Macular Degeneration	Y	Y	736	$30,862.12	$32,895.44	1.066
HCC125	Other Retinal Disorders		Y	4,451	$24,805.62	$25,212.91	1.016
HCC126	Glaucoma		Y	12,261	$29,276.32	$27,853.61	0.951
HCC127	Cataract		Y	20,345	$27,137.13	$26,995.89	0.995
HCC128	Other Eye Disorders			29,959	$28,700.51	$27,569.35	0.961
HCC129	Significant Ear, Nose, and Throat Disorders			1,210	$37,045.85	$32,200.94	0.869
HCC130	Hearing Loss		Y	5,807	$31,608.09	$29,109.48	0.921
HCC131	Other Ear, Nose, Throat, and Mouth Disorders			31,999	$28,367.51	$27,007.18	0.952
HCC132	Kidney Transplant Status		Y	.	.	.	.
HCC133	End Stage Renal Disease		Y	.	.	.	.
HCC134	Dialysis Status	Y	Y	.	.	.	.
HCC135	Acute Renal Failure	Y		.	.	.	.

(continued)

Table 5-77 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC136	Chronic Kidney Disease, Stage 5	Y	Y	.	.	.	.
HCC137	Chronic Kidney Disease, Severe (Stage 4)	Y	Y	.	.	.	.
HCC138	Chronic Kidney Disease, Moderate (Stage 3)	Y	Y	.	.	.	.
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)	Y	Y	.	.	.	.
HCC140	Unspecified Renal Failure	Y	Y	.	.	.	.
HCC141	Nephritis	Y	Y	.	.	.	.
HCC142	Urinary Obstruction and Retention			12,588	$36,786.39	$32,713.43	0.889
HCC143	Urinary Incontinence		Y	4,435	$38,003.97	$32,452.80	0.854
HCC144	Urinary Tract Infection			23,098	$34,655.52	$31,119.94	0.898
HCC145	Other Urinary Tract Disorders			30,977	$31,822.59	$29,383.34	0.923
HCC146	Female Infertility		Y	46	$26,386.39	$23,405.86	0.887
HCC147	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders		Y	2,342	$29,546.00	$27,212.55	0.921
HCC148	Other Female Genital Disorders		Y	6,586	$27,344.69	$26,000.13	0.951
HCC149	Male Genital Disorders		Y	14,385	$30,466.77	$29,152.80	0.957
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	$26,840.03	0.671
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	$77,095.47	0.755

(continued)

Table 5-77(continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	482	$67,780.46	$61,344.35	0.905
HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss	Y	Y	446	$69,105.84	$55,368.95	0.801
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage	Y	Y	1,045	$55,772.89	$48,763.96	0.874
HCC161	Chronic Ulcer of Skin, Except Pressure	Y	Y	5,322	$40,218.29	$35,662.83	0.887
HCC162	Severe Skin Burn or Condition	Y		*			
HCC163	Moderate Skin Burn or Condition			60	$51,738.92	$37,742.95	0.729
HCC164	Cellulitis, Local Skin Infection			13,899	$39,594.85	$34,095.08	0.861
HCC165	Other Dermatological Disorders			40,109	$28,189.13	$27,442.67	0.974
HCC166	Severe Head Injury	Y		*			
HCC167	Major Head Injury	Y		472	$45,838.52	$38,759.66	0.846
HCC168	Concussion or Unspecified Head Injury			1,327	$42,210.69	$32,609.26	0.773
HCC169	Vertebral Fractures without Spinal Cord Injury	Y		737	$43,438.65	$38,607.91	0.889
HCC170	Hip Fracture/Dislocation	Y		953	$45,282.05	$39,891.97	0.881
HCC171	Major Fracture, Except of Skull, Vertebrae, or Hip			1,721	$35,402.89	$31,165.78	0.880
HCC172	Internal Injuries			1,247	$44,496.50	$39,711.42	0.892
HCC173	Traumatic Amputations and Complications	Y		1,350	$51,767.88	$47,782.79	0.923
HCC174	Other Injuries			27,642	$33,918.77	$30,264.65	0.892
HCC175	Poisonings and Allergic and Inflammatory Reactions			13,339	$36,651.69	$33,746.35	0.921
HCC176	Complications of Specified Implanted Device or Graft	Y		8,518	$40,294.73	$40,248.80	0.999
HCC177	Other Complications of Medical Care			25,450	$38,802.06	$35,096.71	0.905
HCC178	Major Symptoms, Abnormalities			62,292	$30,746.26	$28,694.44	0.933
HCC179	Minor Symptoms, Signs, Findings			20,183	$17,776.52	$20,634.75	1.161

(continued)

Table 5-77 (continued)
Predictive ratio for all HCCs with an indicator for which HCCs are payment and/or chronic: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC Label	In Payment Model	Chronic	Counts	Mean Actual	Mean Predicted	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	$34,767.78	0.814
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	$29,740.48	1.000
HCC187	Other Organ Transplant Status/Replacement		Y	1,254	$34,718.43	$29,748.14	0.857
HCC188	Artificial Openings for Feeding or Elimination	Y	Y	2,192	$49,313.36	$44,741.58	0.907
HCC189	Amputation Status, Lower Limb/Amputation Complications	Y	Y	2,768	$46,314.81	$41,343.54	0.893
HCC190	Amputation Status, Upper Limb			205	$51,541.79	$38,833.18	0.753
HCC191	Post-Surgical States/Aftercare/Elective			74,931	$27,667.54	$26,957.46	0.974
HCC192	Radiation Therapy			478	$39,641.10	$34,839.86	0.879
HCC193	Chemotherapy			909	$65,214.47	$42,270.07	0.648
HCC194	Rehabilitation			5,744	$40,640.60	$35,581.48	0.876
HCC195	Screening/Observation/Special Exams			70,102	$27,181.58	$26,726.30	0.983
HCC196	History of Disease			52,215	$31,486.25	$29,706.69	0.943
HCC197	Supplemental Oxygen			966	$58,091.18	$44,908.66	0.773
HCC198	CPAP/IPPB/Nebulizers			.	.	.	.
HCC199	Patient Lifts, Power Operated Vehicles, Beds			69	$82,822.01	$60,908.24	0.735
HCC200	Wheelchairs, Commodes			333	$63,474.00	$47,185.65	0.743
HCC201	Walkers			.	.	.	.

NOTES:
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.
SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Body System label	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	98,280	$24,956.69	$24,948.20	1.000
Infection	13,228	$42,847.40	$40,681.16	0.949
Neoplasm	9,196	$34,450.87	$34,741.25	1.008
Diabetes	50,899	$30,053.64	$28,685.60	0.954
Metabolic	33,334	$31,455.87	$30,829.09	0.980
Liver	4,359	$36,214.38	$34,819.82	0.961
Gastrointestinal	5,751	$41,834.53	$38,749.27	0.926
Musculoskeletal	10,628	$36,173.46	$35,357.49	0.977
Blood	32,265	$31,933.83	$33,795.63	1.058
Cognitive	2,466	$48,091.33	$40,476.13	0.842
Substance Use	2,050	$43,240.17	$39,387.42	0.911
Psychiatric	6,660	$35,294.32	$31,862.31	0.903
Spinal	985	$51,255.59	$43,875.52	0.856
Neurological	21,727	$38,511.07	$35,353.89	0.918
Arrest	6,533	$54,946.12	$47,929.15	0.872
Heart	30,317	$38,199.56	$34,234.86	0.896
Cerebrovascular Disease	4,589	$42,571.77	$37,816.02	0.888
Vascular	26,188	$38,281.56	$35,109.03	0.917
Lung	10,936	$42,622.86	$38,595.91	0.906
Eye	11,372	$32,631.14	$31,866.84	0.977
Kidney	.	.	.	.
Skin	7,496	$47,136.49	$41,146.82	0.873
Injury	3,304	$46,637.74	$41,772.70	0.896
Complications	8,518	$40,294.73	$40,248.80	0.999
Transplant	10,538	$29,746.86	$29,740.48	1.000
Openings	2,192	$49,313.36	$44,741.58	0.907
Amputation	2,768	$46,314.81	$41,343.54	0.893

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 100% ESRD sample claims and enrollment data.

Table 5-79
Predictive ratio for ESRD interacted with count of chronic conditions: All functioning graft continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	98,280	$24,956.69	$24,948.20	1.000
0 chronic eligible HCCs	2,382	$5,332.54	$11,708.74	2.196
1–3 chronic eligible HCCs	14,834	$12,443.79	$14,393.02	1.157
4–6 chronic eligible HCCs	27,393	$17,307.09	$19,027.25	1.099
7–9 chronic eligible HCCs	25,520	$24,197.31	$25,066.85	1.036
10+ chronic eligible HCCs	28,151	$42,404.85	$38,079.16	0.898

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	36,883	$27,231.59	$27,201.39	0.999
0 chronic eligible HCCs	768	$4,642.77	$14,084.40	3.034
1–3 chronic eligible HCCs	3,396	$12,773.77	$16,383.72	1.283
4–6 chronic eligible HCCs	9,099	$17,150.54	$20,086.66	1.171
7–9 chronic eligible HCCs	10,541	$24,726.75	$25,519.17	1.032
10+ chronic eligible HCCs	13,079	$43,076.11	$38,301.90	0.889

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	61,397	$23,411.83	$23,418.07	1.000
0 chronic eligible HCCs	1,614	$5,706.43	$10,421.00	1.826
1–3 chronic eligible HCCs	11,438	$12,326.72	$13,686.73	1.110
4–6 chronic eligible HCCs	18,294	$17,397.31	$18,416.70	1.059
7–9 chronic eligible HCCs	14,979	$23,770.18	$24,701.93	1.039
10+ chronic eligible HCCs	15,072	$41,763.53	$37,866.36	0.907

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	37,245	$28,301.84	$26,288.34	0.929
0 chronic eligible HCCs	551	$8,002.64	$12,053.44	1.506
1–3 chronic eligible HCCs	5,809	$14,135.34	$15,009.20	1.062
4–6 chronic eligible HCCs	10,517	$19,625.59	$19,951.26	1.017
7–9 chronic eligible HCCs	9,501	$26,863.12	$26,254.93	0.977
10+ chronic eligible HCCs	10,867	$47,741.39	$40,057.16	0.839

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	61,035	$23,021.95	$24,173.09	1.050
0 chronic eligible HCCs	1,831	$4,543.24	$11,606.84	2.555
1–3 chronic eligible HCCs	9,025	$11,390.77	$14,009.44	1.230
4–6 chronic eligible HCCs	16,876	$15,940.87	$18,482.76	1.159
7–9 chronic eligible HCCs	16,019	$22,719.14	$24,408.07	1.074
10+ chronic eligible HCCs	17,284	$39,209.06	$36,894.64	0.941

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-84
Predictive ratio by count of chronic conditions: Full Dual eligible functioning graft continuing enrollees

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	27,855	$30,081.30	$26,746.45	0.889
0 chronic eligible HCCs	394	$8,056.05	$11,901.63	1.477
1–3 chronic eligible HCCs	4,304	$14,920.89	$15,047.07	1.008
4–6 chronic eligible HCCs	7,695	$20,595.46	$20,107.14	0.976
7–9 chronic eligible HCCs	7,027	$28,335.85	$26,378.49	0.931
10+ chronic eligible HCCs	8,435	$49,930.62	$40,457.64	0.810

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	11,339	$25,364.84	$25,281.54	0.997
0 chronic eligible HCCs	172	$8,828.51	$12,307.39	1.394
1–3 chronic eligible HCCs	1,777	$13,092.59	$14,934.75	1.141
4–6 chronic eligible HCCs	3,366	$17,738.39	$19,544.38	1.102
7–9 chronic eligible HCCs	2,991	$24,921.91	$25,956.95	1.042
10+ chronic eligible HCCs	3,033	$44,000.07	$39,006.72	0.887

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Chronic Eligible HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
2019 ESRD Model				
Entire Sample	66,344	$23,843.30	$24,308.86	1.020
0 chronic eligible HCCs	1,953	$4,865.54	$11,637.44	2.392
1–3 chronic eligible HCCs	9,925	$11,802.39	$14,080.58	1.193
4–6 chronic eligible HCCs	18,341	$16,487.22	$18,559.99	1.126
7–9 chronic eligible HCCs	17,359	$23,524.72	$24,590.40	1.045
10+ chronic eligible HCCs	18,766	$40,694.68	$37,168.38	0.913

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	36,883	$27,231.59	$27,201.39	0.999
0 payment HCCs	3,296	$10,509.14	$14,114.96	1.343
1–3 payment HCCs	16,976	$18,819.02	$20,567.73	1.093
4–6 payment HCCs	10,532	$30,737.05	$31,315.42	1.019
7–9 payment	4,125	$51,913.93	$44,419.18	0.856
10+ payment HCCs	1,954	$77,456.27	$63,276.01	0.817

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	61,397	$23,411.83	$23,418.07	1.000
0 payment HCCs	6,865	$8,963.19	$10,548.36	1.177
1–3 payment HCCs	29,840	$17,028.52	$17,532.28	1.030
4–6 payment HCCs	16,116	$28,358.59	$28,836.55	1.017
7–9 payment HCCs	5,981	$43,653.53	$41,881.38	0.959
10+ payment HCCs	2,595	$71,681.84	$61,244.38	0.854

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	27,855	$30,081.30	$26,746.45	0.889
0 payment HCCs	2,302	$11,410.75	$11,843.12	1.038
1–3 payment HCCs	12,736	$20,652.62	$19,251.58	0.932
4–6 payment HCCs	7,849	$32,733.21	$30,448.42	0.930
7–9 payment HCCs	3,352	$52,383.35	$43,538.92	0.831
10+ payment HCCs	1,616	$84,231.50	$63,677.66	0.756

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	11,339	$25,364.84	$25,281.54	0.997
0 payment HCCs	1,032	$11,829.61	$12,062.96	1.020
1–3 payment HCCs	5,459	$17,449.58	$19,024.46	1.090
4–6 payment HCCs	3,129	$29,997.34	$29,998.89	1.000
7–9 payment HCCs	1,188	$47,853.45	$42,895.60	0.896
10+ payment HCCs	531	$72,648.91	$62,552.64	0.861

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Number of Payment HCCs	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	66,344	$23,843.30	$24,308.86	1.020
0 payment HCCs	7,495	$9,002.37	$11,759.98	1.306
1–3 payment HCCs	31,935	$17,183.72	$18,522.33	1.078
4–6 payment HCCs	17,700	$28,972.24	$29,658.93	1.024
7–9 payment HCCs	6,378	$46,080.21	$42,779.78	0.928
10+ payment HCCs	2,836	$72,710.50	$61,401.73	0.844

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Post-graft Factor	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	97,806	$24,786.13	$24,831.56	1.002
Aged < 65, 4-9 months since transplant	9,335	$36,998.29	$37,007.18	1.000
Aged < 65, 10+ months since transplant	51,871	$22,285.44	$22,319.85	1.002
Aged 65+, 4-9 months since transplant	2,626	$43,266.28	$43,222.86	0.999
Aged 65+, 10+ months since transplant	33,974	$26,534.18	$26,601.60	1.003

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Post-graft Factor	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	906	$51,704.15	$43,239.59	0.836
Aged < 65, 4-9 months since transplant	*			
Aged < 65, 10+ months since transplant	325	$52,923.88	$46,329.88	0.875
Aged 65+, 4-9 months since transplant	*			
Aged 65+, 10+ months since transplant	563	$51,146.61	$41,170.47	0.805

NOTE:

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

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

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

Post-graft Factor	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
		2019 ESRD Model		
Entire Sample	6,779	$22,921.40	$18,475.75	0.806
Aged < 65, 4-9 months since transplant	1,181	$32,198.55	$29,382.45	0.913
Aged < 65, 10+ months since transplant	3,872	$22,683.24	$17,444.48	0.769
Aged 65+, 4-9 months since transplant	146	$32,535.57	$29,953.26	0.921
Aged 65+, 10+ months since transplant	1,580	$20,181.24	$16,430.46	0.814

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.

Table 5-95
Predictive ratio by kidney transplant factor: Kidney transplant enrollees
2019 ESRD Model

Kidney Transplant Factor	Counts	Mean Actual	Mean Predicted	Ratio Predicted to Actual
Month 1	9,606	$41,260.76	$41,260.76	1.000
Month 2	9,405	$7,274.64	$6,126.29	0.842
Month 3	9,246	$4,958.20	$6,126.29	1.236
Months 2 and 3	8,481	$12,096.78	$12,252.58	1.013

SOURCE: RTI International analysis of Medicare 2014–2015 100% ESRD sample claims and enrollment data.