REPORT TO CONGRESS: RISK ADJUSTMENT IN MEDICARE ADVANTAGE

DECEMBER 2021

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TABLE OF CONTENTS

Preface....1

Section 1. Introduction....3
1.1 Background on Payment in the Medicare Advantage Program....3
1.2 Risk Adjustment Provisions in the 21st Century Cures Act....5

Section 2. Primer on Risk Adjustment and the CMS-HCC Model....9
2.1 The Function of Risk Adjustment....9
2.2 History of Risk Adjustment Models for Medicare Managed Care....10
2.3 Principles for Risk Adjustment Model Development....14
2.4 Elements and Organization of the CMS-HCC Model....16
2.4.1 Diagnostic Classification System....16
2.4.2 Hierarchies....18
2.4.3 CMS-HCC Model Structure....19
2.4.4 Clinical Vignette....20
2.5 CMS-HCC Model Changes Specific to the 21st Century Cures Act....22
2.5.1 HCC Changes....23
2.5.2 Model with Count Variables....24
2.6 CMS-HCC Model Segments....25
2.6.1 Aged and Disabled Models — Community Dual versus Non-dual, and Institutional....25
2.6.2 Aged Disabled Model for New Enrollees....27
2.6.3 Chronic Condition Special Needs Plans with New Enrollees....28
2.7 End-Stage Renal Disease (ESRD) Models....29
2.7.1 ESRD Dialysis Models....30
2.7.2 Kidney Transplant....31
2.7.3 ESRD Functioning Graft Models with Post-Graft Factors....31
2.7.4 ESRD Model Statistics....32
2.8 Adjustments to the CMS-HCC models....33
2.8.1 Frailty Adjustment....33

Section 3. Model Evaluation....37
3.1 Methodology....37
3.1.1 Calculating Predictive Ratios....37
3.1.2 Defining Chronic Conditions....38
3.1.3 Beneficiary Cost....40
3.2 Aged-Disabled CMS-HCC Model Predictive Ratios....41
3.2.1 Predictive Ratios by Deciles of Predicted Risk....42

3.2.2 Predictive Ratios for All HCCs....45
3.2.3 Predictive Ratios by Body Systems or Disease Groups....45
3.2.4 Predictive Ratios by Count of Chronic Conditions....45
3.2.5 Predictive Ratios by Count of Payment Conditions....47
3.3 ESRD Dialysis Model Predictive Ratios....48
3.3.1 Predictive Ratios by Deciles of Predicted Risk....48
3.3.2 Predictive Ratios for all HCCs....49
3.3.3 Predictive Ratios by Body Systems or Disease Groups....50
3.3.4 Predictive Ratios by Count of Chronic Conditions....50
3.3.5 Predictive Ratios by Count of Payment Conditions....50
3.4 ESRD Functioning Graft Model and Kidney Transplant Predictive Ratios....50
3.4.1 Predictive Ratios by Deciles of Predicted Risk....51
3.4.2 Predictive Ratios for all HCCs....52
3.4.3 Predictive Ratios by Body Systems or Disease Groups....53
3.4.4 Predictive Ratios by Count of Chronic Conditions....53
3.4.5 Predictive Ratios by Count of Payment Conditions....53
3.4.6 Predictive Ratios by Post-Graft Factor....53
3.4.7 Predictive Ratio by Kidney Transplant Factor....54

Section 4. Ongoing Research....57
4.1 ICD-10....57

Section 5. Tables of Predictive Ratios....61

LIST OF TABLES

2-1 Medicare Managed Care historic risk adjustment model R^2 statistics 11
2-2 Hypothetical example of CMS-HCC (Version 24) expenditure predictions 22
2-3 2014–2015 model sample counts 26
2-4 Chronic conditions covered by special needs plans 29
2-5 ESRD risk adjustment model R^2 statistics 33
4-1 Model calibration data years and diagnosis code classification 58
5-1 Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees 61
5-2 Predictive ratios by deciles of predicted risk (sorted low to high): Aged enrollees 62
5-3 Predictive ratios by deciles of predicted risk (sorted low to high): Disabled enrollees 63
5-4 Predictive ratios by deciles of predicted risk (sorted low to high): Aged-disabled community continuing enrollees 64
5-5 Predictive ratios by deciles of predicted risk (sorted low to high): Aged-disabled institutional continuing enrollees 65
5-6 Predictive ratios by deciles of predicted risk (sorted low to high): Aged-disabled new enrollees 66
5-7 Predictive ratios by deciles of predicted risk (sorted low to high): Aged community continuing enrollees 67
5-8 Predictive ratios by deciles of predicted risk (sorted low to high): Disabled community continuing enrollees 68
5-9 Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual aged enrollees 69
5-10 Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual disabled enrollees 70
5-11 Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual aged enrollees 71
5-12 Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual disabled enrollees 72
5-13 Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual aged enrollees 73
5-14 Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual disabled enrollees 74
5-15 Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 0 chronic conditions 75
5-16 Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 1–3 chronic conditions 76
5-17 Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 4–6 chronic conditions 77
5-18 Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 7–9 chronic conditions 78
5-19 Predictive ratios by deciles of predicted risk (sorted low to high): All aged-disabled enrollees with 10+ chronic conditions 79
5-20a Predictive ratios for all eligible HCCs: All aged-disabled enrollees 2019 CMS-HCC Model 80

5-20b Predictive ratios for all eligible HCCs: All aged-disabled enrollees 2020 CMS-HCC Model 90
5-21 Predictive ratios by body systems/disease groups: All aged-disabled enrollees 100
5-22 Predictive ratios by count of chronic conditions: Aged enrollees 102
5-23 Predictive ratios by count of chronic conditions: Disabled enrollees 103
5-24 Predictive ratios by count of chronic conditions: Full benefit dual enrollees 104
5-25 Predictive ratios by count of chronic conditions: Partial benefit dual enrollees 105
5-26 Predictive ratios by count of chronic conditions: Non-dual enrollees 106
5-27 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with diabetes 107
5-28 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with HIV/AIDS 108
5-29 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with substance use disorder 109
5-30 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with mental health conditions 110
5-31 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with chronic obstructive pulmonary disease (COPD) 111
5-32 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with congestive heart failure (CHF) 112
5-33 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with vascular disorders 113
5-34 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with cancer 114
5-35 Predictive ratios by count of chronic conditions: All aged-disabled enrollees with chronic kidney disease (CKD) 115
5-36 Predictive ratios by count of payment conditions: Aged enrollees 116
5-37 Predictive ratios by count of payment conditions: Disabled enrollees 117
5-38 Predictive ratios by count of payment conditions: Full benefit dual enrollees 118
5-39 Predictive ratios by count of payment conditions: Partial benefit dual enrollees 119
5-40 Predictive ratios by count of payment conditions: Non-dual enrollees 120
5-41 Predictive ratios by deciles of predicted risk (sorted low to high): All dialysis enrollees 121
5-42 Predictive ratios by deciles of predicted risk (sorted low to high): Aged dialysis enrollees 122
5-43 Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged dialysis enrollees 123
5-44 Predictive ratios by deciles of predicted risk (sorted low to high): Dialysis continuing enrollees 124
5-45 Predictive ratios by deciles of predicted risk (sorted low to high): Dialysis new enrollees 125
5-46 Predictive ratios by deciles of predicted risk (sorted low to high): Aged dialysis continuing enrollees 126
5-47 Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged dialysis continuing enrollees 127

5-48 Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual dialysis continuing enrollees 128
5-49 Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual dialysis continuing enrollees 129
5-50 Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual dialysis continuing enrollees 130
5-51 Predictive ratios for all HCCs: All dialysis continuing enrollees 2019 and 2020 ESRD Models 131
5-52 Predictive ratios for all body systems/disease groups: All dialysis continuing enrollees 140
5-53 Predictive ratios by count of chronic conditions: All dialysis continuing enrollees 142
5-54 Predictive ratios by count of chronic conditions: Aged dialysis continuing enrollees 143
5-55 Predictive ratios by count of chronic conditions: Non-aged dialysis continuing enrollees 144
5-56 Predictive ratios by count of chronic conditions: Any Medicaid dialysis continuing enrollees 145
5-57 Predictive ratios by count of chronic conditions: Non-Medicaid dialysis continuing enrollees 146
5-58 Predictive ratios by count of chronic conditions: Full benefit dual dialysis continuing enrollees 147
5-59 Predictive ratios by count of chronic conditions: Partial benefit dual dialysis continuing enrollees 148
5-60 Predictive ratios by count of chronic conditions: Non-dual dialysis continuing enrollees 149
5-61 Predictive ratios by count of payment conditions: Aged dialysis continuing enrollees 150
5-62 Predictive ratios by count of payment conditions: Non-aged dialysis continuing enrollees 151
5-63 Predictive ratios by count of payment conditions: Full benefit dual dialysis continuing enrollees 152
5-64 Predictive ratios by count of payment conditions: Partial benefit dual dialysis continuing enrollees 153
5-65 Predictive ratios by count of payment conditions: Non-dual dialysis continuing enrollees 154
5-66 Predictive ratios by deciles of predicted risk (sorted low to high): All functioning graft enrollees 155
5-67 Predictive ratios by deciles of predicted risk (sorted low to high): Aged functioning graft enrollees 156
5-68 Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged functioning graft enrollees 157
5-69 Predictive ratios by deciles of predicted risk (sorted low to high): Functioning graft community continuing enrollees 158
5-70 Predictive ratios by deciles of predicted risk (sorted low to high): Functioning graft institutional continuing enrollees 159

5-71 Predictive ratios by deciles of predicted risk (sorted low to high): Functioning graft new enrollees 160
5-72 Predictive ratios by deciles of predicted risk (sorted low to high): Aged functioning graft community continuing enrollees 161
5-73 Predictive ratios by deciles of predicted risk (sorted low to high): Non-aged functioning graft community continuing enrollees 162
5-74 Predictive ratios by deciles of predicted risk (sorted low to high): Full benefit dual functioning graft continuing enrollees 163
5-75 Predictive ratios by deciles of predicted risk (sorted low to high): Partial benefit dual functioning graft continuing enrollees 164
5-76 Predictive ratios by deciles of predicted risk (sorted low to high): Non-dual functioning graft continuing enrollees 165
5-77a Predictive ratios for all HCCs: All functioning graft continuing enrollees 2019 ESRD Model 166
5-77b Predictive ratios for all HCCs: All functioning graft continuing enrollees 2020 ESRD Model 175
5-78 Predictive ratios for all body systems/disease groups: All functioning graft continuing enrollees 184
5-79 Predictive ratios by count of chronic conditions: All functioning graft continuing enrollees 186
5-80 Predictive ratios by count of chronic conditions: Aged functioning graft continuing enrollees 187
5-81 Predictive ratios by count of chronic conditions: Non-aged functioning graft continuing enrollees 188
5-82 Predictive ratios by count of chronic conditions: Any Medicaid functioning graft continuing enrollees 189
5-83 Predictive ratios by count of chronic conditions: Non-Medicaid functioning graft continuing enrollees 190
5-84 Predictive ratios by count of chronic conditions: Full benefit dual functioning graft continuing enrollees 191
5-85 Predictive ratios by count of chronic conditions: Partial benefit dual functioning graft continuing enrollees 192
5-86 Predictive ratios by count of chronic conditions: Non-dual functioning graft continuing enrollees 193
5-87 Predictive ratios by count of payment conditions: Aged functioning graft continuing enrollees 194
5-88 Predictive ratios by count of payment conditions: Non-aged functioning graft continuing enrollees 195
5-89 Predictive ratios by count of payment conditions: Full benefit dual functioning graft continuing enrollees 196
5-90 Predictive ratios by count of payment conditions: Partial benefit dual functioning graft continuing enrollees 197
5-91 Predictive ratios by count of payment conditions: Non-dual functioning graft continuing enrollees 198
5-92 Predictive ratios by post-graft factor: Functioning graft community continuing enrollees 199

5-93 Predictive ratios by post-graft factor: Functioning graft institutional continuing enrollees 200
5-94 Predictive ratios by post-graft factor: Functioning graft new enrollees 201
5-95 Predictive ratios by kidney transplant factor: Kidney transplant enrollees 202

LIST OF FIGURES

2-1 Aggregating ICD-9/10 Codes into Version 24 Hierarchical Condition Categories 17
2-2 Hierarchical Condition Categories for Coronary Artery Disease 18
2-3 Clinical vignette for CMS-HCC (Version 24) classification 21

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 (MA) program every three years, with the first report 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 MA plans, including very high and very low cost enrollees, and groups defined by the number of chronic conditions of enrollees.

In accordance with the timeline required in the 21st Century Cures Act, CMS released our first report in December 2018, and we are now releasing the second report on risk adjustment in MA required by the 21st Century Cures Act. This report 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 expenditures to actual expenditures, for subgroups of beneficiaries within the model sample. We include predictive ratios for the Payment Year 2019 CMS-HCC model and the current CMS-HCC model phased in from Payment Year 2020 to Payment Year 2022, which has additional factors that take into account the number of conditions a beneficiary has. Similarly, we include predictive ratios for the Payment Year 2019 ESRD models and the current ESRD models first implemented in Payment Year 2020 and continuing into Payment Year 2022, which have adjustments to improve prediction for three model segments.[1] 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's 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 MA 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 does not have uniform availability among 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 MA. Hence, the evaluation is conducted with beneficiaries in the traditional Medicare FFS program. We provide the predicted and actual cost for each population subgroup considered so that interested stakeholders may consider and compare the cost expected in FFS Medicare for each defined subgroup.

[1] The models have segments, which represent subpopulations with distinct cost patterns. Model segments are referred to by the population that is being predicted in that segment.

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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 MA organizations, that contract with the Centers for Medicare & Medicaid Services (CMS) to provide benefits as an alternative to the traditional Fee-for-Service (FFS) Medicare program. Anyone who is eligible for and enrolled in Medicare Parts A and B may elect to enroll in an MA plan offered in the service area in which he or she resides.[2] The MA 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 MA enrollment as a proportion of total Medicare enrollment from 2003, when approximately 13 percent of the Medicare population was enrolled in an MA plan, to today in 2021, when MA enrollees account for roughly 40 percent of all Medicare beneficiaries.

CMS pays each MA organization a monthly amount for each beneficiary enrolled in its plan. The payment rates for beneficiaries without End-Stage Renal Disease (ESRD) 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 (with cost sharing that is actuarially equivalent to FFS Medicare and excluding hospice and kidney acquisition costs for transplants) for a beneficiary of average health status in the area where service is offered. Plan bids are compared to a benchmark for the county or region 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 MA organization to provide Part A and Part B benefits in that service area over the next year. If the plan bid exceeds the benchmark, the plan is required to charge each enrollee 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 for Part B, Part D or mandatory supplemental benefits.

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

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[2] A number of beneficiaries enrolled in Part B but not Part A are enrolled in MA plans as a result of a transfer of their enrollment from plans offered pursuant to section 1876 of the Act that were available before the MA program was created in 1997. Effective 2021, per Section 17006 (a) of the 21st Century Cures Act, beneficiaries with end-stage renal disease (ESRD) can enroll in a Medicare Advantage plan.

The per person amount—either the bid amount or the applicable state or county rate—is adjusted to account for differences in health status between enrolled beneficiaries in order to determine the monthly payment. This adjustment 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" by the Medicare Prescription Drug, Improvement and Modernization Act of 2003 (MMA) (Pub. L. 108-173), enacted on December 8, 2003. The BBA broadly mandated that plan payments be risk adjusted for variations in per capita cost based on enrollee health status and demographic factors. Plans that disproportionately enrolled healthy beneficiaries would be paid less than they would have been if they had enrolled beneficiaries with the average risk profile, while plans that disproportionately enrolled the sickest patients would be paid more than if they had enrolled beneficiaries with the average risk profile. The specific approach to risk adjust payment rates was detailed in a 1999 Report to Congress, "Proposed Method of Incorporating Health Status Risk Adjusters into Medicare+Choice Payments", that was also required by the BBA.[3]

Risk adjustment that included an adjustment for health status (the same approach that is employed in MA today) was first authorized by the BBA in response to how individual enrollees' risk was taken into account in Medicare private health plans, the so-called "Risk Health Maintenance Organizations (HMOs)". Prior to the establishment of the M+C program by the BBA, Medicare beneficiaries could choose private HMOs or prepaid health plans under contract with Medicare for Medicare benefits. These Risk HMOs were paid a capitated (per person) rate for each beneficiary set at 95 percent of the "adjusted average per capita cost" (AAPCC) for a given beneficiary's county of residence. Payments were discounted 5 percent based on the assumption at the time that HMOs could operate more efficiently than FFS Medicare. Final payment amounts were adjusted for the relative risk associated with individual enrollees' 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.[4] Because of this broadening of 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, CMS was able to further 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

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[3] 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.

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

Medicare due to disability, and working aged status, as well as health status derived from only inpatient claims.[5] 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 related to inpatient hospital stays, but also from ambulatory settings. The MMA amended the statute to generally require adjustment of payments for risk factors such as age, disability status, gender, institutional status, as well as health status, with an explicit authority for the Secretary to add, modify or substitute risk factors.

CMS selected a new risk adjustment model to begin using for payment in 2004: the Centers for Medicare & Medicaid Services Hierarchical Condition Categories (CMS-HCC) model, which included diagnoses recorded on professional, inpatient, and outpatient claims.[6] Similar to the PIP-DCG model, the CMS-HCC model adjusts Medicare capitation payments to MA organizations for the variation in health expenditure risk of enrollees in their plans. This model more accurately captured the risk of enrolling beneficiaries with varying health status, thus addressing the BBA mandate that MA organizations be paid based on the variation in expected health care costs of the population they enroll, 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

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

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

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

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[5] 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.

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

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

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

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

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

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

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

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

Thus, Section 17006(f) of the 21st Century Cures Act required CMS to fully implement a risk adjustment model in 2022 that takes into account the number of conditions a beneficiary has, making an adjustment as the number of conditions increases, and separately adjusts for full benefit dual eligible individuals (as defined in section 1935(c)(6)) and individuals who are not full benefit dual eligible.[7] Section 17006(f) further required CMS to evaluate the impact of including additional factors for mental health, substance use disorder, and chronic kidney disease in the risk adjustment model.

In response to the amendments made by the 21st Century Cures Act, CMS conducted research in 2017 and considered several changes in how health status is taken into account when adjusting payments to MA plans for the risk of providing benefits to the Medicare beneficiaries they enroll. Independent of the 21st Century Cures Act, CMS implemented a model beginning with Payment Year (PY) 2017 that made an adjustment for differences in health status between beneficiaries who are dually eligible for Medicare and Medicaid and those who are not. Beneficiaries in the community receive a separate adjustment depending on whether they are full benefit dual (aged or disabled), partial benefit dual (aged or disabled), or non-dual (aged or disabled). We believe that splitting the community segment of the CMS-HCC model into six

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

segments based on dual and aged/disabled status 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 beginning with PY 2017 by also taking into account the number of conditions a beneficiary has, making an adjustment as the number of diseases or conditions increased, and including additional diagnosis codes related to mental health, substance use disorders, and chronic kidney disease.

We proposed a model that met all of the requirements in the 21st Century Cures Act in Part I of the PY 2019 Advance Notice, and discussed two other models, one that also met all of the requirements in the 21st Century Cures Act, and another that met part of the requirements (i.e., included additional HCCs) in order to gather stakeholder comments on approaches to implementing the 21st Century Cures Act requirements. We received extensive feedback and inquiries from stakeholders. Ultimately, for PY 2019 CMS implemented the model that includes additional HCCs for chronic kidney disease, mental health, and substance use disorder. CMS implemented the model that also takes into account the number of conditions a beneficiary may have beginning with PY 2020. As required by the 21st Century Cures Act, the model is being phased in over three years from 2020 to 2022 with the model fully implemented for PY 2022.

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 Version 12 (V12) model to the 2014 Version 22 (V22) model between PY 2014 and PY 2016. This method of phasing in revisions to a risk adjustment model was maintained for PY 2019 when 25 percent of the risk score was calculated with the model finalized for PY 2019 and 75 percent of the risk score was calculated with the model finalized for PY 2017.[8] CMS continued this approach to phasing in new models with the implementation of the model that meets all of the requirements in the 21st Century Cures Act, beginning with PY 2020, including condition counts, with a blend of 50 percent of the model finalized for PY 2020 and 50 percent of the model implemented for PY 2017. CMS increased the blend of the model first implemented for PY 2020 to 75 percent for PY 2021, with full implementation for PY 2022.

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's evaluation of CMS-HCC risk adjustment models.

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[8] 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 of 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, copayment 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 MA program function as a more comprehensive method of underwriting in which diagnoses and demographic information are used to adjust each enrollee's monthly capitation rate to account for the 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 2020, the Medicare program (Fee-for-Service and MA), administered by CMS, provides insurance to approximately 63 million beneficiaries (CMS, 2021). Medicare beneficiaries vary greatly in terms of their health status, which in turn affects their utilization of health care services and the total cost of services they receive. Those with serious illnesses, multiple chronic conditions, or who are frail have persistent costs and may require more care, which will lead to higher medical costs on average than their healthier counterparts. In the MA program, if capitation rates were unadjusted and only the highest cost beneficiaries (high risk) enrolled in a plan, that plan would have difficulty remaining viable. In contrast, if healthier than average (low risk) beneficiaries enrolled in a plan, the plan would make excess profits at the expense of the Medicare program. Thus, without an adjustment for health status, there is a strong incentive for MA plans to target the enrollment of beneficiaries who are healthier than average. Risk selection can occur by chance or by practices implemented by health plans.[9] For example, if a health plan were to set high copayment rates for office visits to specialists, beneficiaries needing care from specialists might not enroll in that plan. To address this issue of risk selection and to compensate MA health plans for accepting the risk of enrolling beneficiaries of varying health statuses, the MA program uses risk adjustment along with benefit related policies that serve to maintain a level playing field and encourage competition among plans.

The MA risk adjustment models use data from a large pool of beneficiaries in the Medicare FFS program. CMS uses beneficiaries from the entire FFS 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 of enrollment in the model prediction year. Most segments of

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

the CMS-HCC model have sample sizes over 1 million beneficiaries, with some having much more. This method of risk assessment is in accordance with the Actuarial Standard Board's Actuarial Standard of Practice for risk classification—the risk characteristics are related to expected outcomes and the risk classes are large enough to allow credible statistical inferences.[10] 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.[11] As the American Academy of Actuaries notes:

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

By risk adjusting the payments to MA plans, CMS reduces the incentives of these plans to risk select only the healthiest beneficiaries and avoids indirectly penalizing plans that provide care for the most seriously ill beneficiaries. For beneficiaries with lower than average predicted costs, CMS pays the MA organization an amount that is incrementally lower based on their risk profile and, for beneficiaries with higher than average predicted costs, CMS pays the MA organization an amount that is incrementally higher based on their risk profile.

The suitability of a risk adjuster depends on the nature of the groups to be paid using the adjuster. Sections 2.3 to 2.8 describe the characteristics and ability of the CMS-HCC risk adjustment model to account for the costs of conditions (HCCs) as well as the comorbidities and complications related to those conditions. Section 3 presents the evaluation of the models' ability to predict risk for enrollee groups that have concentrations 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. When changes are made to the model, they are proposed in the annual Advance Notice, then subsequently finalized in the Rate Announcement pursuant to section 1853(b) of the Act. The types of changes to the model adopted through this process 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 subpopulations. In MA, all risk adjustment models in use for payment are HCC-based models.

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

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

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.

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]	2017–2021	
Non-dual aged		0.1189
Non-dual disabled		0.1200
Partial benefit dual aged		0.1117
Partial benefit dual disabled		0.1234
Full benefit dual aged		0.1207
Full benefit dual disabled		0.1140
Version 23 CMS-HCC Six Community Segments[3,6,7]	2019	
Non-dual aged		0.1245
Non-dual disabled		0.1142
Partial benefit dual aged		0.1107
Partial benefit dual disabled		0.0981
Full benefit dual aged		0.1198
Full benefit dual disabled		0.1310
Version 24 CMS-HCC Six Community Segments[3,6,7]	2020–2022	
Non-dual aged		0.1257
Non-dual disabled		0.1148
Partial benefit dual aged		0.1122
Partial benefit dual disabled		0.0986
Full benefit dual aged		0.1214
Full benefit dual disabled		0.1317

Table 2-1 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 and V24 six community segments are based on the 2014–2015 calibration sample.
[7.] The V23 and V24 models apply 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.

The version of the model indicates clinical classification of the conditions (HCCs). HCCs may be redefined to make condition categories more clinically meaningful, improve the degree to which they predict medical expenditures, or increase the specificity of the diagnoses included in the category. When changes in diagnosis classifications are made, the model coefficients are re-estimated, and the version number changes to indicate a new clinical specification. When only non-clinical changes are made to a model, such as when data years underlying the model are updated, the model coefficients are re-estimated but the version number stays the same.

The AAPCC risk adjustment methodology that was in effect from 1985 through 1999 included only demographic information and explained about one percent of the individual variation in expenditures for Medicare beneficiaries and, among beneficiaries with similar demographic profiles, did not pay more for sicker people. Research showed that the managed care program increased total Medicare expenditures because its enrollees were generally healthier than FFS enrollees and the AAPCC did not account for this favorable risk selection (Brown et al., 1993; Riley et al., 1996; Mello et al., 2003).[12,13,14] At the same time, this payment methodology did not appropriately compensate plans that enrolled beneficiaries who are sicker on average, or plans specializing in treating populations with higher predicted costs, 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 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.

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[12] 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.

[13] 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.

[14] 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.

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 only on inpatient diagnoses was the PIP-DCG model's major shortcoming because only illnesses that resulted in hospital admissions were counted. Therefore, M+C organizations that reduced admissions (e.g., through effective ambulatory care) could end up with apparently healthier patients and be penalized through lower payments. The Benefits Improvement Protection Act of 2000 (BIPA) addressed the PIP-DCG limitations by requiring the use of ambulatory diagnoses in Medicare risk adjustment to be phased in from 2004 to 2007.

CMS evaluated several risk adjustment models that used both ambulatory and inpatient diagnoses and ultimately chose the DCG-HCC model for Medicare risk adjustment, partly because it "…would lend itself most easily to necessary modifications that would be clear to analysts and physicians".[15] 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's 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 in more detail 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. 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 completed for the models that were implemented for the Program of All-Inclusive Care for the Elderly (PACE) starting in PY 2012 and phased in for MA starting in PY 2014; most recently the CMS-HCC model used for MA payment underwent revisions that were implemented starting in PY 2019 and PY 2020, 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 PY 2017 CMS started using a CMS-HCC model for MA payment 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

[15] 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.

model's explanatory power, raising it to 11–13 percent for most versions and segments of the model. (See **Table 2-1**.)[16]

In addition to the changes made in response to the 21st Century Cures Act, the 2019 (V23) and 2020 (V24) CMS-HCC models included an update in the diagnosis filtering method for diagnoses from outpatient and professional settings. The purpose of diagnosis filtering is to select diagnoses that are relevant to predicting costs. In the calibration for models other than the 2019 and 2020 CMS-HCC models, 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. For these models, roughly 70 physician specialty codes were 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; MA organizations were to use these specialty codes to determine which diagnoses to submit to the Risk Adjustment Processing System (RAPS). Diagnoses from inpatient settings are filtered using Type of Bill (TOB) in the models finalized for payment both pre-2019 and 2019 and later.[17]

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 for 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.[18] As previously stated, risk adjustment eligible diagnoses from inpatient settings are identified by TOB. If the claim includes a risk adjustment allowable TOB the diagnoses are considered for risk adjustment.

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

[16] Throughout this report, we refer to V12, V21, V22, V23, and V24 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.

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

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

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.[19] These codes should all relate to a reasonably well-specified disease or medical condition that defines the category. Conditions must be sufficiently clinically specific to minimize opportunities for discretionary coding. Clinical meaningfulness improves the face validity (whether the diagnostic category is intuitive to clinicians) of the classification system to clinicians, its interpretability, and its utility for disease management and quality monitoring.
>
> ***Principle 2*—Diagnostic categories should predict medical expenditures**. Diagnoses in the same HCC should be reasonably homogeneous with respect to their effect on both current (this year's) and future (next year's) costs.
>
> ***Principle 3*—Diagnostic categories that will affect payments should have adequate sample sizes to permit accurate and stable estimates of expenditures**. Diagnostic categories used in establishing payments should have adequate sample sizes in available data sets. Given the extreme skewness of medical expenditure data, the data cannot reliably determine the expected cost of extremely rare diagnostic categories.
>
> ***Principle 4*—In creating an individual's clinical profile, hierarchies should be used to characterize the person's illness level within each disease process, while the effects of 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

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[19] 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.

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.

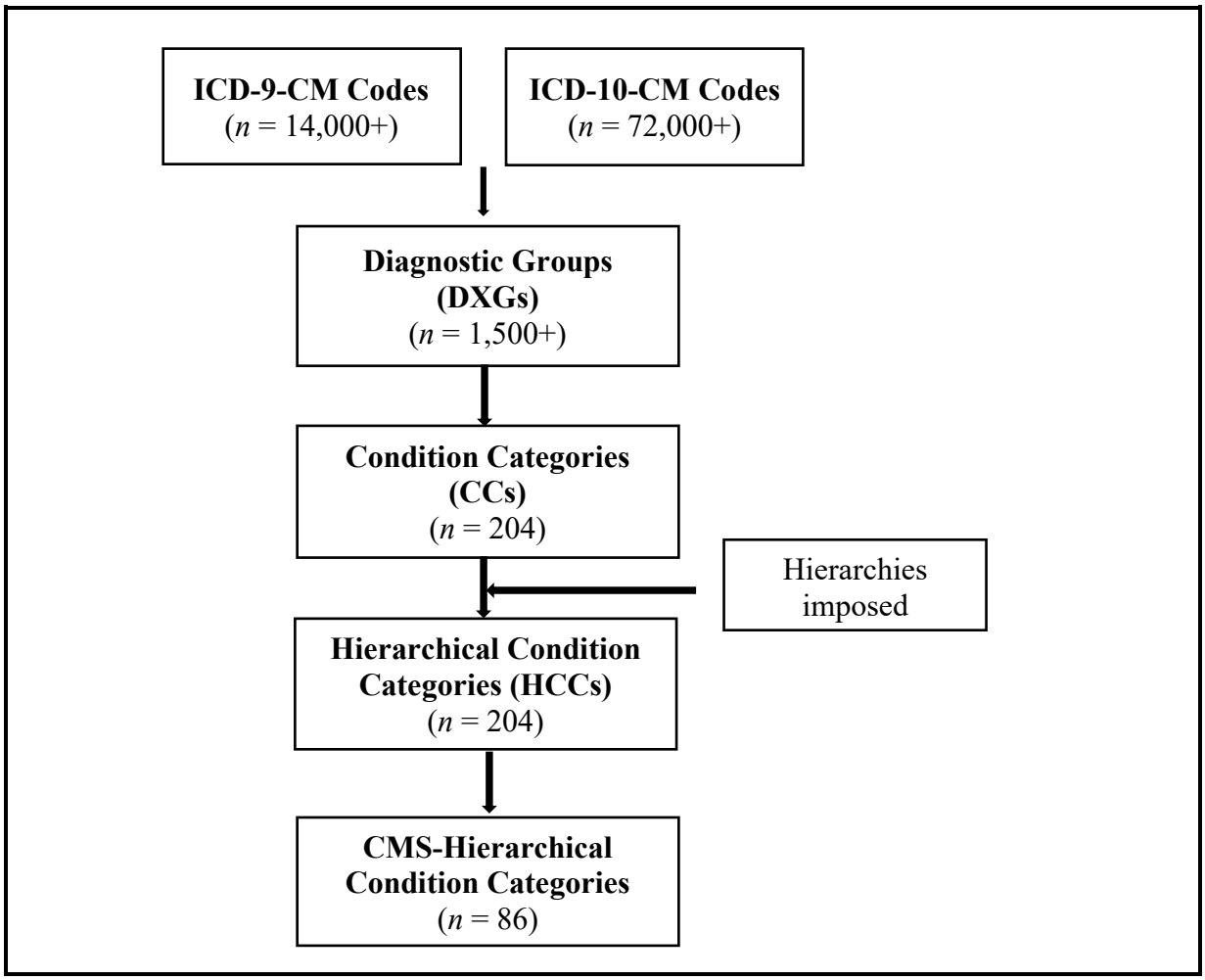
2.4 Elements and Organization of the CMS-HCC Model

2.4.1 Diagnostic Classification System

The HCC diagnostic classification system begins by classifying over 14,000 ICD-9-CM diagnosis codes (and over 72,000 ICD-10-CM diagnosis codes) into approximately 1,500 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.[20] 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 100 Ischemic or Unspecified Stroke*, which includes *DXG 95.02 iatrogenic cerebrovascular infarction or hemorrhage (e.g., postoperative stroke), DXG 96.01 precerebral or cerebral arterial occlusion with infarction*, *DXG 96.02 acute but ill-defined cerebrovascular disease (ICD-9),* and *DXG 170.59 neonatal cerebral infarction*.

Figure 2-1
Aggregating ICD-9/10 Codes into Version 24 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.

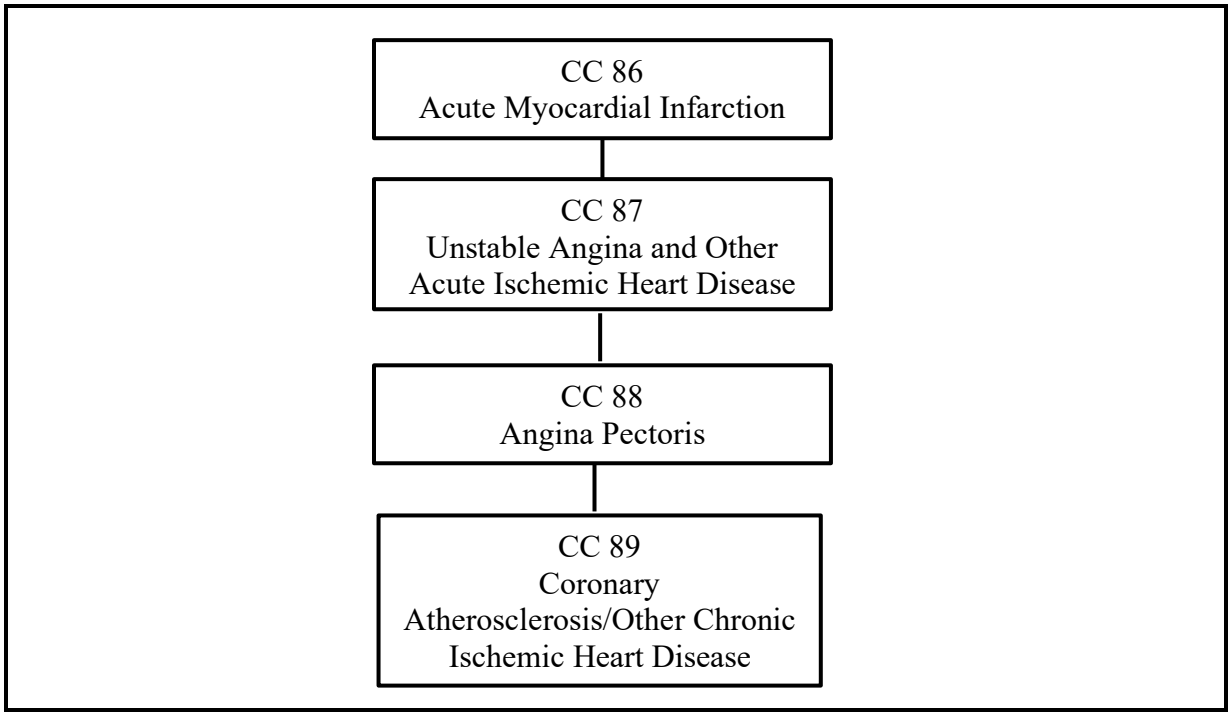
[20] For explanatory purposes, this report primarily describes the classification of ICD-9-CM diagnosis codes because those codes were used in the calibrations of the models being evaluated. Because the structure of ICD-10-CM diagnosis codes differs and they may contain multiple clinical concepts, many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

2.4.2 Hierarchies

Hierarchies are imposed among related CCs, so that a beneficiary's risk score includes only the most severe manifestation among related diseases. Hierarchies allow for payment based on the most serious conditions when less serious conditions also exist. 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*. 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* will have both CC 87 and CC 88.

After imposing hierarchies, CCs become Hierarchical Condition Categories, or HCCs. If a person has more than one CC in a hierarchy, only the highest (most severe) CC in the hierarchy will be assigned as the HCC for calculating the risk score. 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* is assigned HCC 87 for risk score calculation, 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.[21] 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 after the filtering process is applied to inpatient, outpatient, and physician diagnoses; in particular, it places no premium on diagnoses from inpatient care.

2.4.3 CMS-HCC Model Structure

The CMS-HCC V22 models include 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. The CMS-HCC V24 model includes 86 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, to base payments 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

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

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.

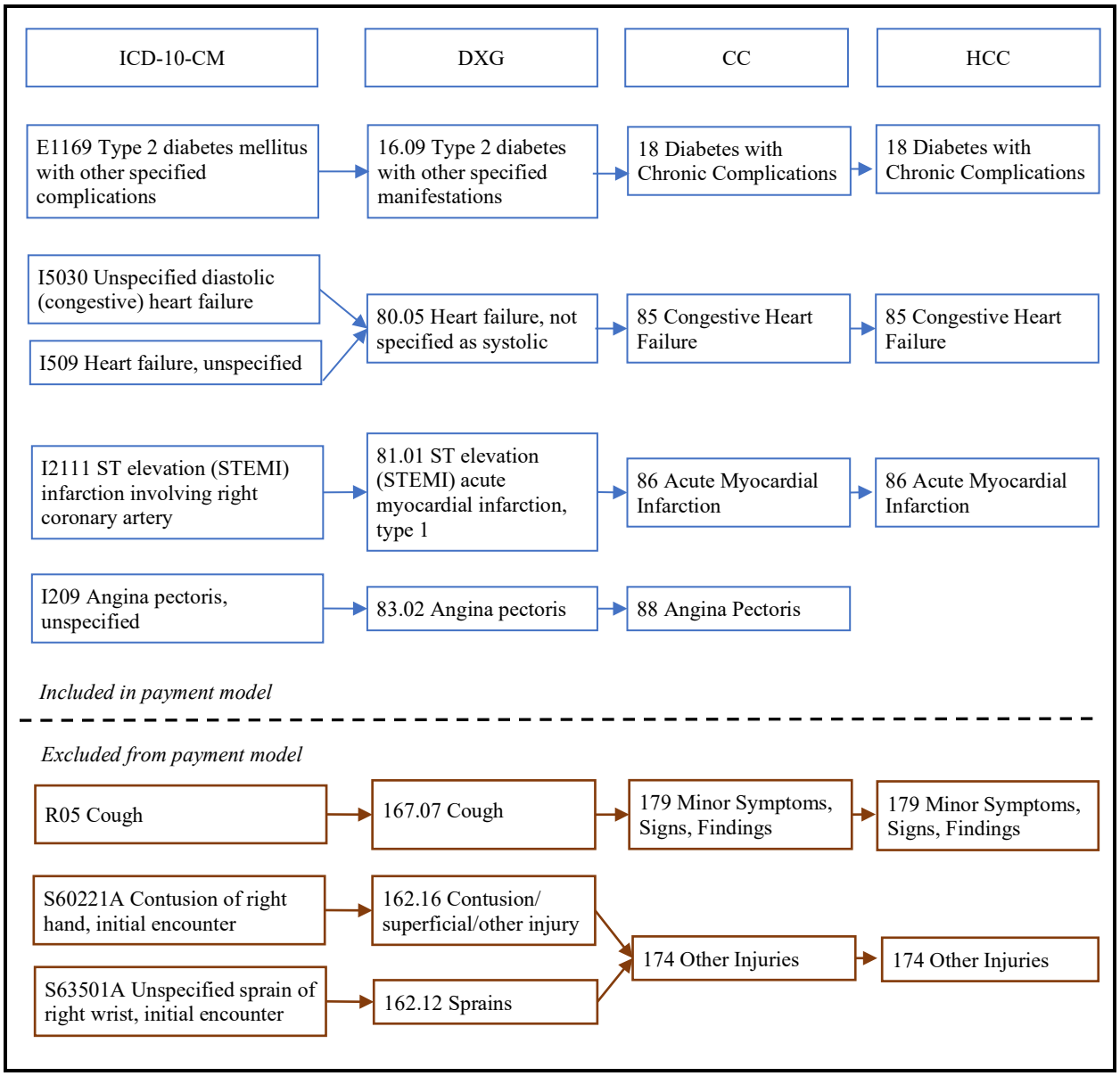
Along with HCCs, each segment of the CMS-HCC model also relies on demographics to predict costs. Demographic adjusters include mutually exclusive age-sex categories (e.g., female, age 65–69) and two sex specific indicators of disability as the original reason of Medicare eligibility in the three aged 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.[22] **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 MA 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 MA 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.

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

Figure 2-3
Clinical vignette for CMS-HCC (Version 24) 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

The predicted expenditures and risk score for the man in this hypothetical example are presented in **Table 2-2**. (Predicted FFS costs are from the V24 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 for someone who is age 74 and male ($5,615), each of the three payment HCCs identified in the

clinical vignette contributes additively to this person's risk profile (Diabetes with Chronic Complications $3,181; Congestive Heart Failure $3,479; AMI $3,534), and there is an additional disease interaction (Diabetes and Congestive Heart Failure $1,794). His total predicted expenditures are the sum of the individual increments, or $17,603. His total risk score is the total predicted FFS expenditure divided by the average predicted expenditure, or the sum of the individual relative factors, 1.880.

Table 2-2
Hypothetical example of CMS-HCC (Version 24) expenditure predictions

Risk marker	Incremental prediction of FFS cost	Relative risk factor
Male, Age 70–74	$5,615	0.600
Diabetes with Chronic Complications (HCC 18)	$3,181	0.340
Congestive Heart Failure (HCC 85)	$3,479	0.371
Acute Myocardial Infarction (HCC 86)	$3,534	0.377
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)	$1,794	0.192
Total raw risk score	**$17,603**	**1.880**

Table 2-2 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 MA, which must be completely phased in for payments for 2022 and subsequent years. The PY 2019 CMS-HCC risk adjustment model is based on V23 CMS-HCC classification, whereas the PY 2020 CMS-HCC risk adjustment model is based on V24. Changes in the PY 2020 CMS-HCC V24 model compared to the PY 2019 V23 model include:

(a) Classification of diagnoses into HCCs: The 2020 model was updated to include (1) mappings for new Fiscal Year (FY) 2019 ICD-10 codes; and (2) additional payment HCCs in the model. The new payment HCCs are detailed in section 2.5.1.

(b) Factors included in the model: In accordance with the 21st Century Cures Act, a model with count variables was proposed and finalized for the 2020 payment year– the 2020 CMS-HCC model (V24). This model takes into account the number of conditions a

beneficiary has; and as the number of conditions increases, an adjustment is made to the total predicted cost (or risk score).[23]

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

Aside from the aforementioned changes, there are no additional differences between the V23 and V24 CMS-HCC models. Both models are based on the same data years, 2014–2015, and both use the CPT/HCPCS filtering method.

2.5.1 HCC Changes

Among the 21st Century Cures Act amendments to Section 1853(a)(1) of the Act to improve risk adjustment for MA for 2019 and subsequent years are directions for the Secretary to evaluate the impact of including the severity of chronic kidney disease in the risk adjustment model and the impact of including additional diagnosis codes related to mental health and substance use disorders in the risk adjustment model. In response to this directive, CMS evaluated and added conditions for chronic kidney disease, mental health, and substance use disorder to the 2019 (V23) model.

The conditions added to the V23 model in response to the 21st Century Cures Act are also in the 2020 V24 model. However, CMS research found that some beneficiaries with multiple chronic conditions were under predicted by the V23 CMS-HCC model. After evaluating the under-predicted HCCs, additional conditions for dementia and pressure ulcers were added to the V24 model for payment to better predict medical expenditures. These are the specific HCCs added to the V24 model[24]:

1. Dementia– two HCCs were added to the payment model.

2019 CMS-HCC Payment Model (Dementia)	2020 CMS-HCC Payment Model (Dementia)
N/A	• **HCC 51 Dementia with Complications** • **HCC 52 Dementia without Complications**

NOTE: New payment HCCs are shown in bold text.

2. Pressure Ulcer– one HCC was added to the V24 payment model.

[23] A version of this model was originally proposed in the 2019 Advance Notice, but was not finalized.
[24] For more information see Part I of the 2020 Advance Notice: https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Advance2020Part1.pdf.

2019 CMS-HCC Payment Model (Pressure Ulcer)	2020 CMS-HCC Payment Model (Pressure Ulcer)
• HCC 157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone • HCC 158 Pressure Ulcer of Skin with Full Thickness Skin Loss	• HCC 157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone • HCC 158 Pressure Ulcer of Skin with Full Thickness Skin Loss • **HCC 159 Pressure Ulcer of Skin with Partial Thickness Skin Loss**

NOTE: New payment HCCs are shown in bold text.

After a new pressure ulcer payment HCC was added to the V24 CMS-HCC model, we also updated the interaction terms in the V24 institutional segment that included pressure ulcers to reflect the revised group of pressure ulcer HCCs.

2.5.2 Model with Count Variables

As discussed in Section 1.2 of this report, Section 1853(a)(1)(I) of the Act, "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 MA 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 model were proposed in the 2019 Advance Notice, Part I but were not finalized for PY 2019. For PY 2020, the CMS-HCC V24 model, which counts payment HCCs and utilizes individual HCC count indicators, was proposed and finalized, as it improved predictions over the range of predicted costs grouped by deciles (all beneficiaries in the model sample sorted into ten equal groups by predicted cost). The finalized count model adds to the base V24 specification a set of individual indicators (i.e., dummy variables) for counts of payment HCCs. The first included dummy corresponds to the lowest positive and statistically significant payment HCC count dummy in each community segment. 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 to determine the number that made the lowest dummy positive and statistically significant. The HCC count dummy was stopped at 10 or more payment HCCs because additional dummy variables resulted in reduced HCC coefficients for a few community segments and we were concerned that, if we included all count variables that met the statistical criteria, the clinical nature of the model would be compromised.

With the adoption of a count model and beginning to blend risk scores using it for PY 2020, we will meet the requirement that changes under the 21st Century Cures Act be phased in over three years, with such changes being fully implemented for 2022.

The phase-in of the 21st Century Cures Act requirements began in PY 2019, when HCCs for chronic kidney disease, mental health, and substance use disorder were added to the model

for payment. For PY 2019, CMS calculated risk scores using diagnoses from encounter data as well as from RAPS data. CMS used a weighted average of 25% of the risk score calculated using diagnoses from encounter data, FFS claims, and RAPS inpatient records (2019 CMS-HCC V23 model), summed with 75% of the risk score calculated using diagnoses from all RAPS records and FFS claims (2017 CMS-HCC V22 model).

For PY 2020, CMS continued to phase in changes to the risk adjustment model by calculating risk scores with the weighted average of 50% of the risk score calculated with using diagnoses from encounter data, FFS claims, and RAPS inpatient records (2020 CMS-HCC V24 model), summed with 50% of the risk score calculated using diagnoses from all RAPS records and FFS claims (2017 CMS-HCC V22 model). For PY 2021, CMS calculated risk scores by using the sum of 75% of the risk score calculated with encounter data, FFS claims, and RAPS inpatient records (2020 CMS-HCC V24 model) and 25% of the risk score calculated with the 2017 CMS-HCC V22 model. For PY 2022, 100% of the risk score will be calculated with the 2020 CMS-HCC V24 model using diagnoses from encounter data and FFS claims only, thus fully implementing the required changes under the 21st Century Cures Act.

2.6 CMS-HCC Model Segments

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

2.6.1 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 in the 2014–2015 model sample are long term residents in institutions, primarily nursing facilities (**Table 2-3**). Institutionalized beneficiaries are allowed to enroll, or remain enrolled, in MA plans. Another characteristic is Medicare-Medicaid dual eligibility. About 20 percent of Medicare FFS beneficiaries in the 2014–2015 model sample 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 benefit dual aged	896,980	3.05%
Partial benefit dual disabled	840,221	2.86%
Full benefit dual aged	1,984,583	6.75%
Full benefit dual disabled	2,031,028	6.91%
Institutional	906,802	3.08%
Total Medicare FFS beneficiaries	**29,406,444**	

Table 2-3 Notes: Aged/disabled continuing enrollees are defined by (i) payment year criteria: at least one month of Part A, Part B, non-HMO, non-ESRD, non-MSP, non-Hospice, original reason for entitlement either age or disability, US residence, no Kidney Transplant Status (assigned using base year diagnosis codes); (ii) base year criteria: Part A and Part B enrollment for all 12 months, no months of HMO or ESRD, original reason for entitlement either age or disability, US residence, no Kidney Transplant Status (assigned using base year diagnosis codes). At least 1 month of institutional status in payment year is also required for institutional beneficiaries.

SOURCE: RTI International.

Separate CMS-HCC model segments for aged or disabled community and institutional residents have existed since the implementation of the first CMS-HCC risk adjustment model. Community and institutional enrollees have different cost patterns. Among the aged or disabled population, institutional residents are about twice as expensive as community residents, $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 patterns of service utilization between people in the community and in institutions for beneficiaries with the same health status. To recognize the medical characteristics of the institutional population, the institutional segment includes different sets of two-disease interactions and disease-disabled status interactions than the community segments. For example, starting with V21, the institutional segment contains a sepsis-pressure ulcer interaction term, indicating that 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 segment. In the V24 model finalized for PY 2020, both community and institutional segments include 86 payment HCCs.

Separate CMS-HCC community segments based on aged/disabled status and dual status have existed since the implementation of V22 segmented CMS-HCC risk adjustment models for PY 2017. The six community segments are:

- Non-Dual Aged,

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

Separate model segments for these populations were created to improve accuracy of payments to MA plans, which were increasingly specializing in dual eligible beneficiaries. The V22 single-segment community model under predicted spending among full benefit dual eligible groups. Dual eligibility status is measured in the payment year, which is consistent with MA plans experiencing enrollment of dual eligible beneficiaries throughout the payment year.

2.6.2 Aged 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 [prediction year] expenditures) and requires a complete 12 month base year diagnostic profile for continuing enrollees. 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 prediction year enrollment, are defined for risk adjustment purposes as "new enrollees". This new enrollee definition includes new entrants to Medicare, as well as beneficiaries without a full year of prior diagnosis information for Part B.

- New entrants to Medicare: Many new enrollees are newly eligible for Medicare by age, having reached the qualifying age of 65. New enrollees may be under age 65 if they become eligible for Medicare by disability or ESRD status. They may be over age 65 if they delay Medicare enrollment.
- Other beneficiaries without 12 months of Part B: Not all new enrollees are new entrants to Medicare, but are those who had only recently enrolled in Part B, so they do not have a full year of prior diagnosis information. For example, a beneficiary might be entitled by age to Part A (hospital insurance) at age 65, but might not enroll in Part B, or might enroll and pay the Part B (physician insurance) premium at an older age.[25]

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

[25] 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.

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

2.6.3 Chronic Condition Special Needs Plans with New Enrollees

Under the Medicare Modernization Act of 2003 (MMA), Congress created a new type of MA plan focused on coordinating care for beneficiaries with special needs, called a Special Needs Plan (SNP). These plans 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**.[26]

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

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

Table 2-4
Chronic conditions covered by special needs plans

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

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

2.7 End-Stage Renal Disease (ESRD) Models

People with ESRD (permanent kidney failure requiring dialysis or kidney transplant) 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 do not have ESRD. For example, using model calibration data, continuing enrollees on dialysis have mean annual medical expenditures of $81,945 (2015 FFS expenditure data). It has also been shown that the incremental costs of other medical conditions for this population are quite different from those in the non-dialysis population. For this reason, separate risk adjustment models are applied to the ESRD population.

ESRD beneficiaries are categorized into three groups based on treatment status: dialysis, transplant (initial 3 months), and functioning graft (from 4 months post-graft). Brief descriptions

of each group and the models associated with them are described below. Previously, persons in dialysis status could not join an MA plan, except under certain circumstances, such as when it is a C-SNP specific to ESRD. Beneficiaries who were already enrolled in an MA plan when they developed ESRD could remain in their plan. But with the implementation of the 21st Century Cures Act, starting in 2021, ESRD patients have the option to enroll in MA plans of their choosing. Risk adjusting payment by ESRD treatment status avoids problematic incentives in specialty MA plans for ESRD beneficiaries. Without adequate risk adjustment, plans might enroll lower cost functioning graft patients and avoid higher cost dialysis patients or those likely to have a transplant.

There are separate ESRD models for the dialysis, transplant, and functioning graft populations—the dialysis and functioning graft models are regression based; the kidney transplant factors are based on average costs of the transplant stay and post-graft months 2 and 3. Beneficiaries are assigned to a model based on the ESRD designation for each month in the payment year.

For PY 2020, CMS implemented a revised ESRD risk adjustment model,[27] which was phased in for calculating ESRD risk scores for PY 2020 and PY2021 and fully phased in for PY2022. As discussed in Sections 2.7.1, 2.7.2, and 2.7.3, the revised model includes adjustments to the dialysis new enrollee, post-graft new enrollee, and post-graft LTI segments of the model to correct for over-prediction and under-prediction of expenditures for these segments that was identified in the December 2018 Report to Congress.[28]

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-disabled interactions).[29]

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

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[27] 2020 Medicare Advance Notice: https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Advance2020Part2.pdf.

[28] Report to Congress: Risk Adjustment in Medicare Advantage, December 20, 2018, https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Risk-Adjustors-Items/ReportToCongress.html.

[29] 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.

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.

In the December 2018 Report to Congress,[30] the overall sample predictive ratio (i.e., the ratio of the average predicted cost to the average actual cost) under the 2019 ESRD risk adjustment model for dialysis new enrollees was 1.149, representing approximately 15 percent over prediction. To address the over prediction for the dialysis new enrollee segment in the 2020 ESRD model, CMS adjusted the coefficients by the dialysis new enrollee predictive ratio to set the entire segment predictive ratio to 1.0. Specifically, all demographic coefficients of this model were divided by 1.149. As a result, there is less over prediction for all deciles of risk in this subpopulation.

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 by estimating the coefficients for a few variables 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 segments) to capture the differing predicted costs of post-graft ESRD beneficiaries based on age and time since transplant.

[30] Report to Congress: Risk Adjustment in Medicare Advantage, December 20, 2018, https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Risk-Adjustors-Items/ReportToCongress.html.

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, and
- 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 the 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.[31]

In the December 2018 Report to Congress,[32] the overall sample predictive ratio under the 2019 ESRD risk adjustment model for functioning graft new enrollees was 0.806 and for functioning graft institutional enrollees was 0.836, representing approximately 19 percent and 16 percent under prediction, respectively. To address this under prediction for these segments, CMS adjusted the coefficients in the 2020 ESRD model by the applicable predictive ratio to set the entire segment predictive ratio to 1.0. Specifically, all coefficients in the functioning graft new enrollee segment of the model were divided by 0.806 and all coefficients in the functioning graft institutional segment were divided by 0.836. As a result, the prediction is improved in most of the deciles of risk for these subpopulations using the 2020 ESRD model.

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 and 2020, 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

[31] 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.

[32] Report to Congress: Risk Adjustment in Medicare Advantage, December 20, 2018, https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Risk-Adjustors-Items/ReportToCongress.html.

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).

Table 2-5.
ESRD risk adjustment model R^2 statistics

Risk adjustment model	Payment years	R^2
ESRD CMS-HCC Models (2003 calibration)[1,2]	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]	2019–2020	
Dialysis Continuing Enrollee		0.1376
Dialysis New Enrollee		0.0264
Functioning Graft Community Continuing Enrollee		0.1029

Table 2-5 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 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 enrollees in 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. The frailty adjustment is applied to risk scores in payment, after risk score calculation. CMS has applied a frailty adjustment to payments for enrollees in PACE organizations since 2004.[33] CMS

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

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 2014–2015 CAHPS sample ($9,263.50).[34]

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 MA 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 1853(a)(1)(B)(iv) of the Act, only FIDE SNPs with "similar average levels of frailty… as the PACE program" can receive frailty adjusted payments.

CMS conducted research to determine whether to apply the frailty adjustment to all MA 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 MA 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, MA 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 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

[34] 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.

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 given the current approach 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 expenditures between individuals. The predictive ratio is the ratio of predicted expenditures to actual expenditures for a group or subgroup and measures the ability of the model to predict average expenditures 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 expenditures between individuals may still accurately predict the expenditures for groups or subgroups of beneficiaries. For example, a simple risk adjustment model may accurately predict (i.e., predictive ratio close to 1.0) the average expenditure for a large group of beneficiaries because the prediction errors will average out. However, the model may fail to differentiate between high and low individual expenditures within the group. This is the case with the demographic risk adjustment model implemented in the original capitated payment methodology, the AAPCC, where the predictive ratios can be 1.0 or close to 1.0 for subgroups of beneficiaries defined by age and sex, which are the main building blocks of the system. However, the AAPCC model R^2 is very low, indicating there is significant unexplained variation among the beneficiaries within the groups. Each segment of the CMS-HCC model, which has a considerably greater R^2 than the demographic model used for new enrollees (described in Section 2.6.2), may have predictive ratios that are not equal to 1.0; however, this model is superior in its ability to distinguish high and low expenditure individuals.

The subgroups for which predictive ratios are computed should be meaningful for evaluating payments (e.g., related to types of adverse or favorable selection of enrollees into health plans). This report presents predictive ratios for subgroups within the model's sample defined by predicted medical expenditures, individual HCCs and disease groups, counts of chronic conditions, and counts of payment HCCs. Sections 3.2, 3.3, and 3.4 discuss predictive ratios and analyses for the CMS-HCC aged-disabled, ESRD dialysis, and ESRD functioning graft models, respectively. Tables of specific predictive ratios are presented in Section 5, with accompanying discussions of relevant methodological and analytical explanations of the results in this section.

3.1 Methodology

3.1.1 Calculating Predictive Ratios

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

calculate a full year predictive ratio for a beneficiary in more than one segment in a year, the total actual and predicted expenditures in each segment must be summed.

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

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

3.1.2 Defining Chronic Conditions

The 21st Century Cures Act directs that this report should include predictive ratios for groups of beneficiaries defined by the number of chronic conditions they may have. To assess the performance of the risk adjustment models for beneficiaries with chronic conditions, we must identify beneficiaries' chronic conditions. Definitions of chronic conditions vary widely. Some recurrent themes include prolonged course of illness (duration at least three months or longer, and usually twelve months or longer), functional limitations and ongoing medical care, and the absence of a cure.[35] The U.S. Department of Health and Human Services (HHS) defines chronic conditions as "conditions that last a year or more and require ongoing medical attention and/or limit activities of daily living"; chronic conditions include both physical conditions, such as arthritis, cancer, and HIV infection, as well as mental health and cognitive disorders, such as ongoing depression, substance addiction, and dementia.[36] Goodman et al (2013) summarize the World Health Organization's definition, which characterizes chronic conditions as having "uncertain etiology, multiple risk factors, a long latency period, a prolonged course of illness,

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

[36] 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).

noncontagious origin, functional impairment or disability, and incurability".[37] The National Center for Health Statistics defines as chronic "[…] conditions that are not cured once acquired (such as heart disease, diabetes, and birth defects in the original response categories, and amputee and old age in the ad hoc categories)" or conditions "[…] present for 3 months or longer".[38]

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 hierarchical condition categories (HCCs) to count as chronic. With the methods outlined below, each unique condition and condition category–a grouping of clinically similar diagnosis codes–was classified as chronic or non-chronic.

1. First, we weighted each diagnosis code in each unique hierarchical condition category by the number of beneficiaries in our model sample with that diagnosis code.[39] We then identified which diagnoses were chronic with the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP) Chronic Condition Indicator (CCI).[40] CCI categorizes each 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 are considered chronic by AHRQ's CCI. For each included HCC, the count of unique beneficiary-chronic diagnosis code combinations was divided by the total count of unique beneficiary diagnosis code combinations within an HCC based on the Medicare 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 coefficients was larger than 0.8, a condition category was considered chronic.

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[37] McKenna M, Collins J. Current issues and challenges in chronic disease control. In: Remington PL, Brownson RC, Wegner MV, editors. Chronic disease epidemiology and control. 2nd edition. Washington (DC): American Public Health Association; 2010. p. 1–24.

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

[39] At the time, ICD-9 diagnosis codes were analyzed because of the data years, 2013 and 2014. ICD-10 diagnosis codes have been in effect since October 2015.

[40] AHRQ. Chronic Condition Indicator (CCI) for ICD-9-CM. 4/16/2021, available at https://hcup-us.ahrq.gov/toolssoftware/chronic/chronic.jsp.

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 of the 204 HCCs in each of the V23 and V24 full classifications were chronic. Seventy-six percent of beneficiaries in the model sample were determined to have three or more chronic conditions and fifty-four percent of beneficiaries in the model sample were determined to have five or more chronic conditions. In the 2020 CMS-HCC model (V24), 67 of the 86 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 expenditures.[41] In both the 2019 and 2020 CMS-HCC aged-disabled model samples, the ten percent of beneficiaries with the highest expenditures account for nearly sixty percent of the total expenditures, and many of these beneficiaries have one or more chronic conditions. When beneficiaries in FFS Medicare without ESRD (i.e., the aged-disabled sample) are grouped by actual expenditures, beneficiaries in the lowest decile have average annual expenditures of $20 and beneficiaries in the highest decile have average annual expenditures of $64,547. In the 2019 and 2020 CMS-HCC models, the expenditures for beneficiaries in the first through eighth deciles (80 percent of the population) are over predicted, with the lowest deciles over predicted by a substantial amount. The ninth and tenth deciles are under predicted, with the tenth decile under predicted by a substantial amount. There is very little change between the 2019 and 2020 CMS-HCC models in terms of this over or under prediction for each decile. This prediction pattern is almost inevitable when sorting by actual expenditures. It occurs because the model cannot account for all the random events that result in either high or low expenditures in a given year.

However, given the objective of the risk adjustment model, interpreting predictive ratios arranged by actual expenditures at the individual level is not a meaningful approach to determining the model's effectiveness. We instead interpret predictive ratios arranged by deciles of predicted expenditures. Modeling of future medical spending can never exactly predict expenditures at an individual level, and sorting by actual expenditures essentially tests to see if all beneficiaries with high actual expenditures were predicted to have high expenditures and all those with low actual expenditures were predicted to have low expenditures. 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 expenditures for a group equals the average predicted expenditures; for a given group, average predicted expenditures should be close to average actual expenditures. MA organizations are licensed risk bearing entities that pool many individuals' random adverse and favorable expenditures, and are expected to manage some degree of unpredictable risk.

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

3.2 Aged-Disabled CMS-HCC Model Predictive Ratios

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

- The CMS-HCC model finalized for PY 2019 (V23), and
- The CMS-HCC model finalized for PY 2020 (V24 Payment Condition Count model).

The CMS-HCC models finalized for PY 2019 and PY 2020 were calibrated using 2014 diagnoses and 2015 demographic information to predict 2015 expenditures. HCCs were created with diagnoses filtered using the HCPCS filtering method, the same method CMS applies when calculating MA risk scores from diagnoses submitted to the encounter data system (EDS). The 2020 CMS-HCC model includes a count of conditions as required by the 21st Century Cures Act, whereas the 2019 CMS-HCC model does not. The 2020 CMS-HCC model also includes three additional HCCs not in the 2019 CMS-HCC model: HCC 51 Dementia With Complications; HCC 52 Dementia Without Complications; and HCC 159 Pressure Ulcer of Skin with Partial Thickness Skin Loss.

Predictive ratios are provided for the following subpopulation:

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

Five main types of predictive ratios are presented, one in each subsection. Subsection 3.2.1 includes predictive ratios by deciles of predicted medical expenditures. Subsection 3.2.2 discusses predictive ratios for all individual HCCs (including payment and eligible[42] 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 aged-disabled models and for most of their predictive ratio tables, the entire sample predictive ratio is equal to 1.0, indicating that the expenditures predicted by the models are, on average, accurate for the calibration sample; predictive ratio tables that feature a subpopulation of model segments, such as enrollees with 0 chronic conditions (**Table 5-15**), may have an overall sample predictive ratio above or below 1.0. In each subsection, we highlight under prediction and over prediction trends and selected population groups with particularly accurate or inaccurate prediction, and we compare the predictive accuracy between the 2019 and 2020 CMS-HCC models.

Improvement in the CMS-HCC models is determined by whether predicted expenditures are closer to actual expenditures for beneficiaries in each decile of predicted risk. Perfect prediction is a predictive ratio of 1.0. Typically, a predictive ratio between 0.90 and 1.10 is considered accurate. By this measure, in most cases, the 2020 CMS-HCC model with additional HCCs and factors that account for a beneficiary's number of conditions better predicts expenditures on average relative to the 2019 CMS-HCC model.

3.2.1 Predictive Ratios by Deciles of Predicted Risk

Tables 5-1 through 5-14 present predictive ratios by decile of predicted expenditure. Predictive ratios are provided for groups of beneficiaries broken into ten equal groups by their predicted expenditure. 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 the full aged-disabled enrollee population, composed of the community and institutional continuing enrollee and new enrollee subpopulations. In the 2019 and 2020 CMS-HHC models, the lowest deciles have some under prediction and the top deciles have slight over prediction. Decile breakouts show deviations from 1.0 between –0.046 (indicating 4.6 percent under prediction) and 0.020 (indicating 2.0 percent over prediction) for the 2019 CMS-HCC model. The 2020 CMS-HCC model shows slight improvement, with deviations from 1.0 between -0.027 (2.7 percent under prediction) and 0.005 (0.5 percent over prediction). Under prediction for the lowest predicted groups is related to the structure of the model. The lowest predicted groups are healthier; most beneficiaries in these groups have no HCCs included in the model. Predicted expenditures for beneficiaries without conditions that map to HCCs in the model are determined by the CMS-HCC model's

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

demographic factors only, and the values for these demographic factors are the same for beneficiaries with and without HCCs included in the model. We note that these predictive ratios fall within the range that we consider well predicted (0.90 to 1.10). The difference in dollars of the under prediction in the low deciles is relatively small, as it is a percentage of a relatively small expenditure level. We observe that the 2020 CMS-HCC model slightly improves predictive accuracy compared to the 2019 CMS-HCC model in all deciles except the tenth, where the predictive ratio is the same between the models. Changes in predictive accuracy between the 2019 CMS-HCC model and the 2020 CMS-HCC model may be due in part to differences in included payment HCCs or the structure of the models (e.g., the addition of condition count variables).

Table 5-2 displays predictive ratios for aged enrollees, including community and institutional continuing enrollees and new enrollees. Both models have predictive accuracy across the deciles. The 2019 CMS-HCC model has a larger range in prediction (5.1 percent under prediction to 1.6 over prediction) than the 2020 CMS-HCC model (3.6 percent under prediction to 0.5 percent over prediction).

Table 5-3 presents predictive ratios for disabled enrollees, including community and institutional continuing enrollees and new enrollees. The 2019 CMS-HCC model shows some under prediction in the four lowest deciles, ranging from 4.6 to 8.3 percent. The 2020 CMS-HCC model improves or maintains predictive accuracy across all deciles and the highest percentiles. The lowest under prediction improves to 4.8 percent; the highest over prediction reduces to 2.4 percent.

Tables 5-4, 5-5, and 5-6 provide predictive ratios for aged-disabled community continuing enrollees, aged-disabled institutional continuing enrollees, and aged-disabled new enrollees, respectively. In the 2019 CMS-HCC model, expenditures for aged-disabled community and institutional enrollees are generally under predicted in lower deciles and in the top 5%, 1%, and 0.1% (under prediction ranges from 0.3 percent to 14.1 percent across both segments), and over predicted in higher deciles (0.2 percent to 2.8 percent across both segments). Compared to the 2019 CMS-HCC model, in the 2020 CMS-HCC model for aged-disabled community continuing enrollees (**Table 5-4**), a similar pattern is observed, but there are improvements in predictive accuracy in eight out of ten deciles and in the top 5%, 1%, and 0.1%. For aged-disabled institutional continuing enrollees (**Table 5-5**), predictive ratios only changed slightly from the 2019 to the 2020 CMS-HCC model. This limited change occurred because the new payment HCCs for dementia and the condition count variables in the 2020 model were negative or non-significant in the institutional segment and were thus constrained to $0. For new enrollees (**Table 5-6**), there is no consistent pattern in under or over prediction across deciles and model years. Overall, deviations from 1.0 are small: the largest under prediction is 2.3 percent and the largest over prediction is 2.8 percent. Note that the predictive ratios for the 2019 and 2020 CMS-HCC models are the same. The specification for the new enrollee segment is identical because only demographic factors are included as regressors in the new enrollee model.

Tables 5-7 and 5-8 present predictive ratios for aged community continuing enrollees and disabled community continuing enrollees. For aged enrollees (**Table 5-7**), as compared to the 2019 CMS-HCC model, the 2020 CMS-HCC model improves or maintains predictive accuracy in nine out of ten deciles and in the top 5%, 1% and 0.1%. For disabled enrollees

(**Table 5-8**), the 2020 CMS-HCC model improves or maintains predictive accuracy across all deciles, as compared to the 2019 CMS-HCC model.

Tables 5-9 and 5-10 examine full benefit dual aged and full benefit dual disabled enrollees. For full benefit dual aged enrollees (**Table 5-9**), the 2019 CMS-HCC and the 2020 CMS-HCC models generally show some under prediction (0.2 percent to 8.1 percent in 2019; 0.6 percent to 8.5 percent in 2020) for beneficiaries in lower deciles and in the top 1% and 0.1%. Most upper deciles are over predicted in both the 2019 and 2020 models (0.1 percent to 1.5 percent in 2019; 0.1 percent to 0.6 percent in 2020). For full benefit dual disabled enrollees (**Table 5-10**), most lower and mid-range deciles are under predicted in both the 2019 and 2020 CMS-HCC models (0.1 percent to 13.7 percent in 2019; 0.1 percent to 12.7 percent in 2020). Compared to the 2019 CMS-HCC model, predictive accuracy improves in the 2020 CMS-HCC model for most deciles and percentiles.

Tables 5-11 and 5-12 show predictive ratios for partial benefit dual aged and partial benefit dual disabled enrollees. In both tables, most lower and mid-range deciles are under predicted for the 2019 and 2020 CMS-HCC models. The 2020 CMS-HCC model shows improvements in predictive accuracy in nine out of ten deciles for partial benefit dual aged enrollees (**Table 5-11**) and nine out of ten deciles for partial benefit dual disabled enrollees (**Table 5-12**).

Tables 5-13 and 5-14 provide predictive ratios for non-dual aged and non-dual disabled enrollees. For non-dual aged enrollees (**Table 5-13**), moderate under prediction is shown for enrollees in lower deciles and in the top 1% and 0.1% (under prediction ranges from 0.1 percent to 5.7 percent in 2019, and from 0.4 percent to 4.1 percent in 2020). The 2020 CMS-HCC model improves or maintains predictive accuracy for eight out of ten deciles and in the top 5%, 1%, and 0.1%. In both the 2019 and 2020 CMS-HCC models, for non-dual disabled enrollees (**Table 5-14**), under prediction is observed in lower and mid-range deciles and in the top percentiles (1.1 percent to 9.4 percent in 2019; 0.1 percent to 4.8 percent in 2020). Compared to the 2019 CMS-HCC model, predictive accuracy is improved in the 2020 CMS-HCC model in eight out of ten deciles.

Tables 5-15 through 5-19 report predictive ratios by deciles of predicted expenditures for all aged and disabled enrollees grouped by 0, 1–3, 4–6, 7–9, and 10+ counts of chronic conditions. Predictive ratios for the entire sample are more accurate for enrollees with more chronic conditions, compared to enrollees with 0 or few chronic conditions. In general, the 2020 CMS-HCC model improves predictive accuracy, compared to the 2019 CMS-HCC model. Beneficiaries with 0 or few chronic conditions may have chronic non-payment HCCs, which are not included in the CMS-HCC models, thus resulting in under prediction of their expenditures. Over prediction occurs across all deciles for beneficiaries with 0 chronic conditions (**Table 5-15**; 22.3 percent to 62.1 percent over prediction in 2019; 16.9 percent to 54.5 percent over prediction in 2020). Over prediction is attenuated among beneficiaries with 1–3 chronic conditions (2.1 percent to 15.1 percent over prediction in 2019; 3.5 percent to 15.5 percent over prediction in 2020). In contrast, for beneficiaries with 4–6 and 7–9 chronic conditions (**Tables 5-17 and 5-18**), in both the 2019 and 2020 CMS-HCC models, under prediction is observed in lower deciles. For beneficiaries with 10+ chronic conditions, under prediction is observed in all deciles and in

the top percentiles, with slight improvement in the range of under prediction for the 2020 CMS-HCC model.

3.2.2 Predictive Ratios for All HCCs

Tables 5-20a and **5-20b** present predictive ratios by individual eligible HCCs for all aged and disabled community and institutional enrollees with columns indicating whether a particular HCC is in the payment model, is categorized as a chronic condition, or both.[43] They provide an evaluation of the 2019 and 2020 CMS-HCC models' predictive accuracy for groups of aged-disabled beneficiaries with each of the 204 HCCs in the 2019 or 2020 CMS-HCC full classification. Most payment HCCs show predictive ratios close to 1.0 in both the 2019 and 2020 CMS-HCC models. Only beneficiaries with HCC 134 Dialysis Status have noticeably under predicted expenditures (predictive ratios=0.842 and 0.843 in the 2019 and 2020 CMS-HCC models, respectively, indicating almost 16 percent under prediction in both models). In this case, under prediction is caused by a constraint setting HCC 134 equal to HCC 135 Acute Renal Failure. Most non-payment HCCs also show some under prediction. Substantial under prediction of HCCs usually results from small sample size issues. For example, HCC 150 Ectopic and Molar Pregnancy has severe under prediction in the 2019 and 2020 CMS-HCC models; this condition is fairly rare in the Medicare population (only 951 enrollees). With such a small sample, predictive ratios can be affected by outliers and random variations in expenditures. However, most non-payment HCCs have predictive ratios above 0.85. Only a few HCCs are over predicted (for example, non-payment HCC 64 Profound Intellectual Disability/Developmental Disorder 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 26 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. Body systems included in Table 5-21 are based on payment HCCs, except for the Cognitive group in the 2019 CMS-HCC model. Both the 2019 and 2020 CMS-HCC models show near perfect predictive accuracy of expenditures by body systems/disease groupings. Most of the 26 body systems/disease groups have predictive ratios at or very near 1.0, except the Cognitive disease group in the 2019 CMS-HCC model, which has a predictive ratio of 0.895 (indicating 10.5 percent under prediction). As expected, with the addition of two dementia HCCs to the 2020 CMS-HCC model, predictive accuracy for the Cognitive disease group improves (2020 predictive ratio=1.006).

3.2.4 Predictive Ratios by Count of Chronic Conditions

The additive structure of the CMS-HCC models implies a greater disease burden as the count of HCCs increases. Most (approximately 80 percent) of payment HCCs in the CMS-HCC

[43] Eligible HCCs are those populated by disease- or condition-specific diagnoses. They exclude HCCs related to symptoms, utilization, history, procedures, durable medical equipment, or external causes. Additionally, some conditions are rare or not applicable to the Medicare population (such as Extremely Immature Newborns) and their HCC predictive ratio information is also not shown.

models are considered chronic. **Tables 5-22 through 5-26** display predictive ratios for aged, disabled, full benefit dual, partial benefit dual, and non-dual beneficiaries by count of chronic conditions grouped by 0, 1–3, 4–6, 7–9, and 10+ chronic conditions. The counts of chronic conditions in these tables are based on the full classification of HCCs (see **Tables 5-20a and 5-20b**; the full set of HCCs that are "chronic eligible" are those with a 'Y' in the Chronic column in these tables). They include chronic non-payment HCCs (54 HCCs in the 2019 CMS-HCC model; 51 HCCs in the 2020 CMS-HCC model) and chronic payment HCCs (64 in the 2019 CMS-HCC model; 67 in the 2020 CMS-HCC model). Except for the full benefit dual group, which is fairly well predicted, the 2019 and 2020 CMS-HCC models show noticeable over-prediction among beneficiaries with 0 chronic HCCs for most subgroups (e.g., predictive ratios=1.450 and 1.460 for the non-dual sample in the 2019 and 2020 CMS-HCC models, respectively, indicating 45.0 percent and 46.0 percent over-prediction). For individuals without chronic HCCs, predicted expenditures may be solely based on demographic factors (unless beneficiaries have non-chronic payment HCCs). Demographic factors estimated from payment CMS-HCC models tend to over-predict expenditures, as beneficiaries without any payment or non-payment chronic HCCs may incur very low or even $0 in actual expenditures. Predictive accuracy improves among beneficiaries with more than 1 chronic HCC compared to those with 0 chronic HCCs. Predictive ratios for beneficiaries with 1–3 and 4–6 HCCs show slight over-prediction, whereas predictive ratios for beneficiaries with 7–9 and 10+ HCCs show slight under-prediction. Improvements in predictive accuracy in the 2020 CMS-HCC model, as compared to the 2019 CMS-HCC model, are likely due to the addition of payment HCC count variables in the 2020 model.

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 disorder
- Mental health conditions
- Chronic obstructive pulmonary disease (COPD)
- Congestive heart failure (CHF)
- Vascular disorders
- Cancer
- Chronic kidney disease (CKD)

We observe some over-prediction for most disease groups in subgroups with fewer chronic HCCs. Over prediction is attenuated as the number of chronic HCCs increases: for example, prediction is fairly accurate for beneficiaries with 7–9 chronic HCCs. For beneficiaries with 10+ chronic HCCs, under-prediction is seen (e.g., expenditures for beneficiaries with HIV/AIDS with 10+ chronic HCCs are 16.0 percent and 14.1 percent under predicted in the 2019 and 2020 CMS-HCC models, respectively). Overall, the 2020 CMS-HCC model shows improved predictive ratios for all disease groups for beneficiaries with 10+ chronic HCCs because of the additional condition count variables not included in the 2019 CMS-HCC model. The disease groups for substance use disorders and mental health conditions showed the greatest

improvement in predictive accuracy for beneficiaries with 10+ chronic HCCs; for substance use disorders, predictive ratios improved from 0.941 to 0.960 and, for mental health conditions, predictive ratios improved from 0.931 to 0.947.

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 are presented for aged, disabled, full benefit dual, partial benefit dual, and non-dual enrollees. Predictive ratios of all five subpopulations are relatively close to 1.0 across the 2019 and 2020 CMS-HCC models. The 2020 CMS-HCC model clearly shows better predictive accuracy than the 2019 CMS-HCC model, which was expected as the 2020 CMS-HCC model includes three additional HCCs and counts of payment HCCs. Specific examples are provided below for each subgroup of enrollees. In addition, as noted above, we also observe some under prediction among individuals with 0 payment HCCs. Beneficiaries in this group may have non-payment HCCs, which are not taken into account in the CMS-HCC payment models.

Among aged enrollees (**Table 5-36**), prediction is fairly close to 1.0 across the 2019 and 2020 CMS-HCC models. Predictive accuracy improves in each payment HCC count category in the 2020 CMS-HCC model (ranging from 0.2 percent under predicted to 0.2 percent over predicted), compared to the 2019 model (ranging from 3.5 percent under predicted to 1.2 percent over predicted). In the 2020 CMS-HCC model, only one subgroup (0 payment HCCs) is under predicted (predictive ratio=0.998).

For disabled enrollees (**Table 5-37**), prediction is close to 1.0 in both the 2019 and 2020 CMS-HCC models, with prediction improving in the 2020 model. In the 2019 model, under prediction ranges from 1.5 percent to 7.0 percent, and over prediction ranges from 1.0 percent to 2.8 percent. In the 2020 CMS-HCC model, there are noticeable improvements in predictive accuracy: under prediction is reduced (ranges from 0.1 percent to 0.5 percent) and only one subgroup (1–3 payment HCCs) is over predicted (predictive ratio=1.003).

Among full benefit dual enrollees (**Table 5-38**), predictive ratios are close to 1.0 across payment HCC count groups and models, and predictive accuracy improves or is maintained for each payment HCC count group in the 2020 CMS-HCC model, compared to the 2019 CMS-HCC model. In the 2019 CMS-HCC model, under prediction ranges from 3.9 percent to 6.2 percent, and over prediction ranges from 0.8 percent to 1.8 percent. In the 2020 CMS-HCC model, under prediction is reduced (ranges from 0.1 percent to 2.2 percent) and, similar to the disabled enrollees subgroup, only one payment HCC count group (1–3 payment HCCs) is over predicted (predictive ratio=1.005).

Among partial benefit dual enrollees (**Table 5-39**), predictive ratios are close to 1.0 in both the 2019 and 2020 CMS-HCC models, with slightly more variation seen in partial benefit dual enrollees in the 2019 CMS-HCC model, compared to other subgroups. In the 2019 CMS-HCC model, under prediction ranges from 0.9 percent to 4.9 percent, and over prediction ranges from 0.3 to 2.4 percent. Substantial improvements in predictive accuracy are seen for this subgroup in the 2020 CMS-HCC model with near perfect prediction.

Among non-dual enrollees (**Table 5-40**), predictive ratios are fairly close to 1.0 across payment HCC count groups and models. Compared to the 2019 CMS-HCC model, predictive

accuracy improves for each payment HCC count group in the 2020 CMS-HCC model. In the 2019 CMS-HCC model, under prediction ranges from 0.9 percent to 4.5 percent, and over prediction ranges from 0.4 percent to 1.3 percent. In comparison, near perfect prediction is observed in predictive ratios in the 2020 CMS-HCC model.

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 in Sections 3.3 and 3.4 are calculated from a 2014–2015 sample for both the 2019 and 2020 ESRD models, which include two dialysis model segments (dialysis continuing enrollee and dialysis new enrollee), transplant factors, and three functioning graft model segments (community continuing enrollee, institutional continuing enrollee, and new enrollee). As documented in the 2018 Report to Congress, the 2019 ESRD models predicted well for the segments that had greater sample sizes—dialysis continuing enrollee and functioning graft community continuing enrollee—on which the model or a subset of model variables were estimated. For segments with populations too small to reliably estimate predicted costs—dialysis new enrollee, functioning graft institutional continuing enrollee, and functioning graft new enrollee—alternative modeling sample configurations are used as described in Sections 2.7.1 and 2.7.3. This resulted in less accurate prediction for these 2019 ESRD model segments: over prediction for dialysis new enrollee; under prediction for functioning graft institutional continuing enrollee; and under prediction for functioning graft new enrollee. To improve prediction for those three model segments, we applied adjustments to their estimates for the 2020 ESRD models. This ensured their entire sample on average was predicted perfectly (1.0).

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 subpopulations:

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

- partial benefit dual dialysis continuing enrollees, and
- non-dual dialysis continuing enrollees.

Tables 5-41, 5-42, and 5-43 present predictive ratios for the combined continuing enrollee and new enrollee dialysis population, featuring the full sample and breakouts by aged or non-aged. In the 2020 ESRD model, this combined full sample is no longer over predicted because of the adjustment applied to the new enrollee subpopulation. Similarly, the aged and non-aged breakouts show slight changes in prediction.

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. In the 2019 ESRD model, 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. In the 2020 ESRD model, the overall sample predictive ratio for the true subset of dialysis new enrollees is now 1.0. The decile breakouts also indicate improved prediction, showing under prediction or over prediction ranging from 3 to 5 percent.

Tables 5-48, 5-49, and 5-50 present predictive ratios for the dialysis continuing enrollee sample by dual status (full benefit dual, partial benefit dual, non-dual). These predictive ratios indicate slight under prediction overall for the full benefit and non-dual subpopulations 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 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, partial benefit dual, and non-dual. For all subpopulations, the largest populated breakout is "10 or more chronic conditions", indicating the dialysis population has multiple comorbidities in addition to the underlying renal disease. The counts include chronic conditions beyond those in the model, and the corresponding HCCs 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 subpopulations: aged, non-aged, full benefit dual, partial benefit dual, and non-dual. The accuracy of these predictive ratios is quite good. In general, the range of over prediction or under prediction by count of payment conditions is smaller than for the set by count of chronic conditions, indicating better prediction.

3.4 ESRD Functioning Graft Model and Kidney Transplant Predictive Ratios

These predictive ratios are calculated using predicted expenditures from the 2019 and 2020 ESRD functioning 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

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 continuing enrollees, and 6 percent are new enrollees. None of these subpopulations

are large enough to reliably estimate a full regression model. Instead, as was described in Section 2.7.3, the model's community and institutional segments use most factors from a CMS-HCC model calibrated with the non-ESRD aged/disabled population, and then supplements them with a few variables specific to the functioning 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 subpopulation dominates the functioning graft continuing enrollee modeling sample (and thus the post-graft factors represent its population), the community continuing enrollee predictive ratios are better overall than those of the other subpopulations. To address the under prediction of the 2019 ESRD models for the functioning graft institutional continuing enrollees (16 percent under prediction) and functioning graft new enrollees (19 percent under prediction), adjustments were applied in the 2020 ESRD models.

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 subpopulations:

- all functioning graft enrollees (community and institutional continuing enrollees and new enrollees),
- aged (65 and older) functioning graft enrollees (community and institutional continuing enrollees and new enrollees),
- non-aged (<65) functioning graft enrollees (community and institutional continuing enrollees and new enrollees),
- functioning graft community continuing enrollees,
- functioning graft institutional continuing enrollees,
- functioning graft new enrollees,
- aged 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. In the 2019 ESRD

model, this combined sample as a whole is slightly under predicted because of under prediction of the institutional and new enrollee subpopulations. In the 2020 ESRD model, adjustments were applied leading to near perfect overall prediction for the combined sample. **Tables 5-69, 5-70, and 5-71** present predictive ratios for each of the three functioning graft model samples: community continuing enrollee, institutional continuing enrollee, and new enrollee. **Tables 5-70 and 5-71** show how the adjusted 2020 ESRD models have improved prediction for the functioning graft institutional and functioning graft new enrollee segments, which now have perfect prediction of 1.0 for the overall samples. At the decile level, the community continuing enrollee functioning graft model over predicts at the lower deciles, predicts fairly accurately for the fifth through ninth deciles, and under predicts at the highest decile. The small sample sizes in **Tables 5-70 and 5-71** lead to more variable predictive ratios throughout the deciles.

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 two 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 benefit, partial benefit, 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. The adjustment in the 2020 models had a minimal impact on predictive ratios for these breakouts because the institutional subpopulation is small.

3.4.2 Predictive Ratios for all HCCs

Tables 5-77a and 5-77b illustrate the predictive ratios for all continuing enrollee functioning graft enrollees for all HCCs in the full classification, with columns indicating whether a particular HCC is in the payment model, is categorized as a chronic condition, or both. Although the overall samples have near or perfect predictive ratios (2019 ESRD model is 1.0; 2020 ESRD model is 1.002), we do not expect the functioning graft models to predict as accurately at the individual HCC level as the dialysis and Part C aged-disabled models do because most HCC estimates used in the functioning graft models were carried forward from the underlying Part C aged-disabled models. **Tables 5-77a and 5-77b** confirm this—with most HCCs over-predicted or under-predicted, including payment HCCs. Although sample sizes are too small to estimate HCC 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 all functioning graft continuing enrollees. In the 2020 ESRD model, there are very slight increases in the predicted expenditures and the predictive ratios because of the adjustment applied to the functioning graft institutional model. 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+) in addition to the underlying renal disease[44] for the following functioning graft continuing enrollee samples: all continuing enrollees, aged, non-aged, any Medicaid, non-Medicaid, full benefit dual, partial benefit dual, and non-dual. For all subpopulations, most functioning graft enrollees have 4 or more chronic conditions, and 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 subpopulation suggests that functioning graft patients with no recorded chronic comorbidities may have unique characteristics (see **Tables 5-77a and 5-77b** for specific HCCs). They are a very small proportion of the population. The overall sample predictive ratios 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. The same general predictive ratio patterns hold between the 2019 and 2020 ESRD models; the adjustment for 2020 applied to the institutional subpopulation has a slight impact on a few predictive ratios.

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 the following functioning graft continuing enrollee subpopulation: aged, non-aged, full benefit dual, partial benefit dual, and non-dual. **Tables 5-87, 5-88, and 5-91** 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. The latter group is relatively small. **Table 5-89**, which corresponds to the full benefit dual subpopulation, presents lower predictive ratios than the other breakouts in this group; this is consistent with the under prediction in **Table 5-82** for the Medicaid population. For all tables in this set, the predictive ratios indicate that in general the models predict best for enrollees with 4–6 payment conditions. The 2020 adjustment had a small effect, mostly improving prediction slightly for the 7–9 and 10+ payment HCC groups.

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

[44] In the 2018 Report to Congress, the renal disease HCCs were included when categorizing by count of chronic conditions. In this current report for both 2019 and 2020 ESRD model results, we exclude those HCCs to focus on non-renal disease comorbidities.

enrollees, respectively. **Table 5-92** indicates that the model for the functioning graft community continuing enrollees, who, as noted earlier, are 93 percent of the functioning graft population, provides a highly accurate estimate of 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 (n = 906) limits their impact within the modeling sample, the 2019 ESRD model 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, 4–9 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. The 2020 adjustment substantially improves prediction. The 2020 ESRD model post-graft factors for the institutional population have under or over prediction less than 5 percent compared to 12–19 percent under prediction for the 2019 ESRD model.

Table 5-94 illustrates that the post-graft factors in the 2019 model (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). The 2020 adjustment for functioning graft new enrollees substantially improves prediction. The entire sample has a perfect predictive ratio of 1.0. Two of the four post-graft factors are now over predicted, one has near perfect prediction, and one is slightly under predicted.

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. The predictive ratio for Kidney transplant month 1 shows perfect prediction (1.0) because month 1 is intended to capture costs of the entire transplant stay. The amount is paid in one month as a lump sum. Although the costs for months 2 and 3 following transplant are estimated individually for each month, for payment simplicity, the average over the two months is paid for each. The monthly amounts averaged are weighted by enrollee population.[45] 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 (n = 8,481) is a subset of the populations used for the individual month calculations (n = 9,405 and 9,246, respectively). The combined population is slightly smaller than those of month 2 or month 3 because it contains individuals who had *both* month 2 and month 3 in the expenditure year (2015 for this evaluation). With this slightly different

[45] 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

population, the predictive ratio for Kidney transplant months 2 and 3 shows accurate (1.013), but not perfect, prediction.

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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, we are conducting analyses 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 how coding is stabilizing, how this may play a role in model calibration, and what additional clinical reclassification changes may be appropriate for the HCCs in the CMS-HCC model when implementing an ICD-10 based calibration for payment purposes.

CMS is currently conducting ICD-10 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 ~72,000 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 PY 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, which enabled 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 2016–2017 CMS-HCC analyses began by calculating the frequency, mean annualized expenditures, and predictive ratios (PRs) for each ICD-10 code, DXG, CC, and HCC. Regression analyses are being conducted on

the V24 CMS-HCC model (segmented and combined) with the dependent variable being per beneficiary expenditures. Multiple variations of the V24 CMS-HCC model are being 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 and RxHCC models to determine an approach to reclassification. 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 informs potential changes and review of 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 utilizing concurrent models (current year diagnoses to predict current year spending) using 2016 through 2019 data to assess stability of coding. In this manner we can compare the stability diagnosis code reporting and HCC rates for multiple years of data. 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 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 (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	30,863,674	$9,701.43	$9,701.43	1.000
First (lowest) decile	3,086,368	$2,885.57	$2,854.35	0.989
Second decile	3,086,368	$3,705.42	$3,645.08	0.984
Third decile	3,086,368	$4,513.32	$4,458.62	0.988
Fourth decile	3,086,368	$5,142.02	$5,117.51	0.995
Fifth decile	3,086,367	$6,252.50	$6,265.44	1.002
Sixth decile	3,086,367	$7,701.50	$7,661.08	0.995
Seventh decile	3,086,367	$9,456.85	$9,450.16	0.999
Eighth decile	3,086,367	$11,865.67	$11,893.95	1.002
Ninth decile	3,086,367	$16,133.73	$16,209.78	1.005
Tenth (highest)	3,086,367	$31,557.05	$31,670.94	1.004
Top 5%	1,543,183	$40,504.28	$40,512.61	1.000
Top 1%	308,636	$62,509.01	$62,342.51	0.997
Top 0.1%	30,863	$95,827.22	$93,229.56	0.973

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	25,739,689	$9,658.46	$9,659.08	1.000
First (lowest) decile	2,573,969	$3,091.50	$3,008.61	0.973
Second decile	2,573,969	$3,803.88	$3,751.19	0.986
Third decile	2,573,969	$4,504.69	$4,528.33	1.005
Fourth decile	2,573,969	$5,142.02	$5,116.65	0.995
Fifth decile	2,573,969	$6,215.56	$6,237.54	1.004
Sixth decile	2,573,969	$7,651.68	$7,616.06	0.995
Seventh decile	2,573,969	$9,460.50	$9,447.48	0.999
Eighth decile	2,573,969	$11,950.94	$11,941.67	0.999
Ninth decile	2,573,969	$16,301.15	$16,347.03	1.003
Tenth (highest)	2,573,968	$30,812.43	$30,963.40	1.005
Top 5%	1,286,984	$39,074.75	$39,162.27	1.002
Top 1%	257,396	$59,240.76	$58,967.58	0.995
Top 0.1%	25,739	$89,528.10	$86,272.36	0.964

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	5,123,985	$9,919.12	$9,915.98	1.000
First (lowest) decile	512,399	$2,235.31	$2,289.66	1.024
Second decile	512,399	$3,172.12	$3,171.64	1.000
Third decile	512,399	$4,084.42	$3,890.03	0.952
Fourth decile	512,399	$5,243.59	$5,044.88	0.962
Fifth decile	512,399	$6,458.65	$6,405.49	0.992
Sixth decile	512,398	$7,913.87	$7,883.00	0.996
Seventh decile	512,398	$9,381.96	$9,447.03	1.007
Eighth decile	512,398	$11,590.84	$11,730.97	1.012
Ninth decile	512,398	$15,244.14	$15,491.34	1.016
Tenth (highest)	512,398	$35,097.16	$35,046.38	0.999
Top 5%	256,199	$47,188.84	$46,836.85	0.993
Top 1%	51,239	$74,874.25	$74,792.90	0.999
Top 0.1%	5,123	$112,267.50	$109,973.40	0.980

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	27,574,242	$9,719.21	$9,719.21	1.000
First (lowest) decile	2,757,425	$2,890.31	$2,831.91	0.980
Second decile	2,757,425	$3,572.40	$3,521.56	0.986
Third decile	2,757,424	$4,290.42	$4,208.85	0.981
Fourth decile	2,757,424	$5,244.04	$5,155.97	0.983
Fifth decile	2,757,424	$6,309.31	$6,335.15	1.004
Sixth decile	2,757,424	$7,688.24	$7,673.62	0.998
Seventh decile	2,757,424	$9,439.83	$9,492.44	1.006
Eighth decile	2,757,424	$11,992.14	$12,058.15	1.006
Ninth decile	2,757,424	$16,465.57	$16,562.04	1.006
Tenth (highest)	2,757,424	$32,135.27	$32,201.32	1.002
Top 5%	1,378,712	$41,252.12	$41,174.22	0.998
Top 1%	275,742	$63,835.88	$63,402.58	0.993
Top 0.1%	27,574	$99,171.67	$95,221.04	0.960

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	906,802	$19,465.55	$19,465.55	1.000
First (lowest) decile	90,681	$8,687.63	$7,451.69	0.858
Second decile	90,681	$10,406.93	$9,983.01	0.959
Third decile	90,680	$11,858.63	$11,803.34	0.995
Fourth decile	90,680	$13,478.54	$13,475.66	1.000
Fifth decile	90,680	$14,961.00	$15,294.68	1.022
Sixth decile	90,680	$17,026.46	$17,424.23	1.023
Seventh decile	90,680	$19,631.99	$20,140.21	1.026
Eighth decile	90,680	$23,513.21	$23,986.39	1.020
Ninth decile	90,680	$29,912.89	$30,348.31	1.015
Tenth (highest)	90,680	$48,771.44	$48,253.67	0.989
Top 5%	45,340	$58,504.74	$57,544.87	0.984
Top 1%	9,068	$81,506.42	$78,847.70	0.967
Top 0.1%	906	$109,195.68	$104,208.42	0.954

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	2,631,327	$6,746.77	$6,746.77	1.000
First (lowest) decile	263,133	$4,925.13	$4,811.89	0.977
Second decile	263,133	$4,840.70	$4,847.25	1.001
Third decile	263,133	$4,864.90	$4,861.23	0.999
Fourth decile	263,133	$4,917.58	$4,870.54	0.990
Fifth decile	263,133	$4,755.21	$4,887.61	1.028
Sixth decile	263,133	$5,317.76	$5,340.17	1.004
Seventh decile	263,133	$6,835.96	$6,840.93	1.001
Eighth decile	263,132	$8,785.06	$8,778.08	0.999
Ninth decile	263,132	$10,101.01	$10,113.77	1.001
Tenth (highest)	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 2014–2015 100% sample claims and enrollment data.

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 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
2020 CMS-HCC Model				
Entire sample	23,075,236	$9,735.05	$9,735.05	1.000
First (lowest) decile	2,307,524	$3,022.24	$2,959.46	0.979
Second decile	2,307,524	$3,708.23	$3,634.02	0.980
Third decile	2,307,524	$4,369.20	$4,326.99	0.990
Fourth decile	2,307,524	$5,346.53	$5,288.03	0.989
Fifth decile	2,307,524	$6,426.87	$6,451.35	1.004
Sixth decile	2,307,524	$7,816.62	$7,808.99	0.999
Seventh decile	2,307,523	$9,581.56	$9,636.73	1.006
Eighth decile	2,307,523	$12,157.84	$12,196.30	1.003
Ninth decile	2,307,523	$16,591.82	$16,660.37	1.004
Tenth (highest)	2,307,523	$31,367.34	$31,440.29	1.002
Top 5%	1,153,761	$39,793.36	$39,760.96	0.999
Top 1%	230,752	$60,579.29	$59,937.20	0.989
Top 0.1%	23,075	$92,559.57	$87,970.49	0.950

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	4,499,006	$9,637.30	$9,637.30	1.000
First (lowest) decile	449,901	$2,130.59	$2,222.64	1.043
Second decile	449,901	$3,060.08	$3,053.25	0.998
Third decile	449,901	$3,803.60	$3,636.00	0.956
Fourth decile	449,901	$4,790.85	$4,512.60	0.942
Fifth decile	449,901	$5,822.89	$5,687.81	0.977
Sixth decile	449,901	$7,016.61	$6,970.09	0.993
Seventh decile	449,900	$8,650.59	$8,701.18	1.006
Eighth decile	449,900	$11,095.29	$11,287.15	1.017
Ninth decile	449,900	$15,714.55	$15,989.67	1.018
Tenth (highest)	449,900	$35,878.76	$35,910.99	1.001
Top 5%	224,950	$48,114.07	$47,855.05	0.995
Top 1%	44,990	$76,738.44	$76,306.55	0.994
Top 0.1%	4,499	$118,104.71	$112,649.56	0.954

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	1,984,583	$15,707.58	$15,707.58	1.000
First (lowest) decile	198,459	$4,887.58	$4,735.74	0.969
Second decile	198,459	$6,072.80	$6,109.97	1.006
Third decile	198,459	$7,709.10	$7,617.04	0.988
Fourth decile	198,458	$9,350.44	$9,295.78	0.994
Fifth decile	198,458	$11,102.71	$11,173.08	1.006
Sixth decile	198,458	$13,442.94	$13,447.48	1.000
Seventh decile	198,458	$16,364.12	$16,428.13	1.004
Eighth decile	198,458	$20,630.64	$20,686.30	1.003
Ninth decile	198,458	$27,902.71	$27,953.45	1.002
Tenth (highest)	198,458	$48,262.29	$48,298.65	1.001
Top 5%	99,229	$59,086.36	$59,305.87	1.004
Top 1%	19,845	$85,907.39	$84,021.41	0.978
Top 0.1%	1,984	$127,271.11	$116,431.41	0.915

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	2,031,028	$10,834.33	$10,834.33	1.000
First (lowest) decile	203,103	$2,236.53	$2,407.61	1.076
Second decile	203,103	$3,250.51	$3,304.07	1.016
Third decile	203,103	$4,517.23	$4,033.96	0.893
Fourth decile	203,103	$5,401.83	$5,079.18	0.940
Fifth decile	203,103	$6,448.19	$6,395.50	0.992
Sixth decile	203,103	$7,814.40	$7,805.80	0.999
Seventh decile	203,103	$9,678.04	$9,871.93	1.020
Eighth decile	203,103	$12,511.70	$12,755.36	1.019
Ninth decile	203,102	$18,140.14	$18,292.92	1.008
Tenth (highest)	203,102	$41,440.70	$41,506.14	1.002
Top 5%	101,551	$55,469.82	$55,240.10	0.996
Top 1%	20,310	$87,808.62	$86,437.05	0.984
Top 0.1%	2,031	$141,917.09	$123,864.40	0.873

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	896,980	$10,791.10	$10,791.10	1.000
First (lowest) decile	89,698	$3,529.56	$3,523.41	0.998
Second decile	89,698	$4,253.12	$4,245.61	0.998
Third decile	89,698	$5,080.94	$4,963.81	0.977
Fourth decile	89,698	$6,243.18	$6,162.97	0.987
Fifth decile	89,698	$7,494.66	$7,486.61	0.999
Sixth decile	89,698	$8,862.98	$8,896.72	1.004
Seventh decile	89,698	$10,854.80	$10,891.39	1.003
Eighth decile	89,698	$13,634.07	$13,716.64	1.006
Ninth decile	89,698	$18,501.93	$18,620.21	1.006
Tenth (highest)	89,698	$33,314.23	$33,266.72	0.999
Top 5%	44,849	$41,496.82	$41,247.30	0.994
Top 1%	8,969	$59,717.85	$59,686.69	0.999
Top 0.1%	896	$83,275.44	$81,730.89	0.981

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	840,221	$9,851.89	$9,851.89	1.000
First (lowest) decile	84,023	$3,139.48	$2,934.23	0.935
Second decile	84,022	$3,610.94	$3,681.92	1.020
Third decile	84,022	$4,136.95	$4,088.91	0.988
Fourth decile	84,022	$5,255.47	$5,142.56	0.979
Fifth decile	84,022	$6,309.06	$6,196.63	0.982
Sixth decile	84,022	$7,321.30	$7,311.75	0.999
Seventh decile	84,022	$8,949.78	$9,049.35	1.011
Eighth decile	84,022	$11,253.53	$11,538.71	1.025
Ninth decile	84,022	$15,948.86	$16,106.83	1.010
Tenth (highest)	84,022	$34,459.04	$34,334.97	0.996
Top 5%	42,011	$45,586.95	$45,068.69	0.989
Top 1%	8,402	$69,059.99	$69,220.58	1.002
Top 0.1%	840	$92,482.38	$99,549.56	1.076

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	20,657,519	$9,203.56	$9,203.56	1.000
First (lowest) decile	2,065,752	$3,048.40	$2,951.38	0.968
Second decile	2,065,752	$3,603.98	$3,540.94	0.983
Third decile	2,065,752	$4,161.37	$4,143.25	0.996
Fourth decile	2,065,752	$5,050.88	$4,996.02	0.989
Fifth decile	2,065,752	$6,132.93	$6,152.26	1.003
Sixth decile	2,065,752	$7,395.43	$7,412.00	1.002
Seventh decile	2,065,752	$9,071.45	$9,112.69	1.005
Eighth decile	2,065,752	$11,461.93	$11,499.53	1.003
Ninth decile	2,065,752	$15,549.91	$15,604.16	1.003
Tenth (highest)	2,065,751	$29,233.05	$29,310.45	1.003
Top 5%	1,032,875	$37,113.68	$37,096.47	1.000
Top 1%	206,575	$56,497.89	$55,599.71	0.984
Top 0.1%	20,657	$83,646.00	$80,184.50	0.959

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	2,089,311	$8,373.23	$8,373.23	1.000
First (lowest) decile	208,932	$1,814.85	$1,977.84	1.090
Second decile	208,931	$2,798.17	$2,682.81	0.959
Third decile	208,931	$3,230.81	$3,173.78	0.982
Fourth decile	208,931	$3,933.42	$3,862.61	0.982
Fifth decile	208,931	$5,170.59	$4,921.22	0.952
Sixth decile	208,931	$6,158.05	$6,139.26	0.997
Seventh decile	208,931	$7,826.48	$7,689.57	0.983
Eighth decile	208,931	$9,870.88	$9,946.54	1.008
Ninth decile	208,931	$13,721.82	$14,106.84	1.028
Tenth (highest)	208,931	$31,184.86	$31,229.45	1.001
Top 5%	104,465	$42,036.86	$41,657.58	0.991
Top 1%	20,893	$66,661.48	$66,572.15	0.999
Top 0.1%	2,089	$100,047.98	$97,942.92	0.979

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	2,697,830	$2,840.11	$3,886.17	1.368
First (lowest) decile	269,783	$1,600.56	$2,229.44	1.393
Second decile	269,783	$2,060.23	$2,884.57	1.400
Third decile	269,783	$1,902.56	$2,939.80	1.545
Fourth decile	269,783	$2,015.54	$3,043.55	1.510
Fifth decile	269,783	$2,402.32	$3,495.66	1.455
Sixth decile	269,783	$2,418.34	$3,666.44	1.516
Seventh decile	269,783	$2,926.25	$4,022.46	1.375
Eighth decile	269,783	$3,173.76	$4,411.63	1.390
Ninth decile	269,783	$3,976.90	$5,182.17	1.303
Tenth (highest)	269,783	$6,057.77	$7,115.68	1.175
Top 5%	134,891	$6,836.09	$7,991.66	1.169
Top 1%	26,978	$8,303.12	$9,927.61	1.196
Top 0.1%	2,697	$9,205.75	$12,806.59	1.391

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	7,074,549	$5,074.96	$5,573.11	1.098
First (lowest) decile	707,455	$2,924.67	$2,734.39	0.935
Second decile	707,455	$2,906.97	$3,029.50	1.042
Third decile	707,455	$3,235.37	$3,550.71	1.097
Fourth decile	707,455	$3,521.79	$3,770.55	1.071
Fifth decile	707,455	$3,913.68	$4,301.73	1.099
Sixth decile	707,455	$4,288.18	$4,890.52	1.140
Seventh decile	707,455	$4,923.91	$5,688.11	1.155
Eighth decile	707,455	$5,865.69	$6,700.23	1.142
Ninth decile	707,455	$7,435.73	$8,240.17	1.108
Tenth (highest)	707,454	$12,179.94	$13,320.14	1.094
Top 5%	353,727	$14,896.85	$16,296.59	1.094
Top 1%	70,745	$25,940.42	$26,857.10	1.035
Top 0.1%	7,074	$51,331.19	$43,048.11	0.839

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	9,581,219	$8,229.13	$8,363.95	1.016
First (lowest) decile	958,122	$4,430.11	$3,185.01	0.719
Second decile	958,122	$4,806.54	$3,984.49	0.829
Third decile	958,122	$5,287.93	$4,817.25	0.911
Fourth decile	958,122	$5,842.94	$5,732.83	0.981
Fifth decile	958,122	$6,426.77	$6,628.66	1.031
Sixth decile	958,122	$7,314.16	$7,607.44	1.040
Seventh decile	958,122	$8,284.75	$8,831.17	1.066
Eighth decile	958,122	$9,729.23	$10,423.21	1.071
Ninth decile	958,122	$11,970.53	$12,871.48	1.075
Tenth (highest)	958,121	$19,198.62	$20,719.07	1.079
Top 5%	479,060	$23,602.69	$25,381.58	1.075
Top 1%	95,812	$36,875.28	$38,017.71	1.031
Top 0.1%	9,581	$56,426.81	$55,908.63	0.991

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	5,670,564	$13,780.49	$13,296.57	0.965
First (lowest) decile	567,057	$7,129.79	$4,418.50	0.620
Second decile	567,057	$8,160.69	$6,493.37	0.796
Third decile	567,057	$9,170.26	$7,932.41	0.865
Fourth decile	567,057	$10,102.03	$9,327.95	0.923
Fifth decile	567,056	$11,191.03	$10,751.89	0.961
Sixth decile	567,056	$12,605.27	$12,360.91	0.981
Seventh decile	567,056	$14,264.09	$14,281.52	1.001
Eighth decile	567,056	$16,524.16	$16,797.83	1.017
Ninth decile	567,056	$19,961.19	$20,755.16	1.040
Tenth (highest)	567,056	$31,131.14	$32,648.48	1.049
Top 5%	283,528	$37,372.93	$39,079.34	1.046
Top 1%	56,705	$52,456.74	$54,447.36	1.038
Top 0.1%	5,670	$74,506.49	$76,199.78	1.023

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	3,208,185	$25,989.17	$24,366.25	0.938
First (lowest) decile	320,819	$11,587.37	$7,875.20	0.680
Second decile	320,819	$14,230.76	$11,609.11	0.816
Third decile	320,819	$16,411.04	$14,311.18	0.872
Fourth decile	320,819	$18,661.38	$16,947.92	0.908
Fifth decile	320,819	$21,274.55	$19,760.74	0.929
Sixth decile	320,818	$24,059.68	$22,956.87	0.954
Seventh decile	320,818	$27,755.55	$26,852.96	0.967
Eighth decile	320,818	$32,999.31	$32,075.12	0.972
Ninth decile	320,818	$40,767.95	$40,129.95	0.984
Tenth (highest)	320,818	$60,699.74	$60,168.95	0.991
Top 5%	160,409	$70,884.42	$70,146.96	0.990
Top 1%	32,081	$94,931.12	$92,251.70	0.972
Top 0.1%	3,208	$131,103.55	$121,692.26	0.928

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

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

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

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				28,232,347	$9,949.14	$9,949.14	1.000
HCC1	HIV/AIDS	Y	Y	100,346	$15,248.52	$15,248.52	1.000
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		595,422	$35,841.56	$35,841.56	1.000
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			40,179	$29,613.78	$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	712,185	$21,096.89	$19,107.79	0.906
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 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
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 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	1,080,878	$22,029.97	$22,029.97	1.000
HCC49	Iron Deficiency and Other/Unspecified Anemias and Blood Disease			3,908,675	$18,139.37	$16,405.51	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 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
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

(continued)

Table 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
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 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	3,592,677	$19,407.79	$19,407.79	1.000
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	Y	Y	228,989	$16,618.95	$16,618.95	1.000
HCC113	Asthma		Y	1,220,110	$11,342.69	$10,108.59	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 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
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

(continued)

Table 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
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 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	.	.	.	.
HCC181	Premature Newborns, Including Birthweight 1000–1499 Grams		Y	.	.	.	.
HCC182	Serious Perinatal Problem Affecting Newborn		Y	4,870	$21,954.06	$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 5-20a (continued)
Predictive ratios 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 (Ratio predicted to actual)
HCC203	Alcohol/Cannabis Use or Use Disorder, Mild or Uncomplicated; Non-Psychoactive Substance Abuse; Nicotine Dependence		Y	1,981,142	$14,231.31	$13,339.18	0.937
HCC204	External Causes of Morbidity, Except Self-Inflicted Injury			.	.	.	.

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

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year.

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

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

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

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

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

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

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

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

(continued)

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

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

(continued)

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

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

(continued)

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

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

(continued)

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

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

(continued)

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

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

(continued)

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

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

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

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year.

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

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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 ratios by body systems/disease groups: All aged-disabled enrollees

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

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

Predicted and actual expenditures are annualized to account for partial year enrollment and changes in status throughout the year.

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	23,668,355	$9,959.32	$9,959.32	1.000
0 chronic eligible HCCs	2,095,466	$3,019.17	$4,161.12	1.378
1–3 chronic eligible HCCs	5,663,293	$5,086.83	$5,577.89	1.097
4–6 chronic eligible HCCs	8,194,931	$8,109.06	$8,253.88	1.018
7–9 chronic eligible HCCs	4,932,479	$13,525.75	$13,066.86	0.966
10+ chronic eligible HCCs	2,782,186	$25,208.07	$23,632.96	0.938

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	4,563,992	$9,896.02	$9,896.02	1.000
0 chronic eligible HCCs	602,364	$2,208.90	$2,916.94	1.321
1–3 chronic eligible HCCs	1,411,256	$5,026.61	$5,553.61	1.105
4–6 chronic eligible HCCs	1,386,288	$8,946.61	$9,021.68	1.008
7–9 chronic eligible HCCs	738,085	$15,489.54	$14,837.70	0.958
10+ chronic eligible HCCs	425,999	$31,021.85	$29,090.89	0.938

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	4,015,611	$13,154.40	$13,154.40	1.000
0 chronic eligible HCCs	349,647	$4,077.39	$4,245.41	1.041
1–3 chronic eligible HCCs	1,017,264	$6,145.86	$6,673.24	1.086
4–6 chronic eligible HCCs	1,249,419	$10,451.47	$10,731.70	1.027
7–9 chronic eligible HCCs	810,911	$17,242.43	$17,003.08	0.986
10+ chronic eligible HCCs	588,370	$32,421.91	$31,018.27	0.957

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	1,737,201	$10,342.22	$10,342.22	1.000
0 chronic eligible HCCs	180,407	$3,221.22	$3,920.97	1.217
1–3 chronic eligible HCCs	449,316	$5,379.46	$5,928.36	1.102
4–6 chronic eligible HCCs	565,260	$8,752.10	$8,887.53	1.015
7–9 chronic eligible HCCs	340,566	$14,334.50	$13,895.54	0.969
10+ chronic eligible HCCs	201,652	$26,420.82	$24,841.39	0.940

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	22,746,830	$9,133.84	$9,133.84	1.000
0 chronic eligible HCCs	2,269,856	$2,613.21	$3,815.62	1.460
1–3 chronic eligible HCCs	5,780,615	$4,823.10	$5,310.47	1.101
4–6 chronic eligible HCCs	7,843,224	$7,761.89	$7,854.40	1.012
7–9 chronic eligible HCCs	4,492,369	$12,995.21	$12,430.78	0.957
10+ chronic eligible HCCs	2,360,766	$24,078.39	$22,395.12	0.930

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	7,104,165	$14,168.47	$14,168.47	1.000
1–3 chronic eligible HCCs	653,752	$5,572.23	$6,381.50	1.145
4–6 chronic eligible HCCs	2,496,601	$8,090.85	$8,794.61	1.087
7–9 chronic eligible HCCs	2,217,271	$13,708.87	$13,760.11	1.004
10+ chronic eligible HCCs	1,736,541	$27,410.56	$25,953.82	0.947

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	100,346	$15,248.52	$15,248.52	1.000
1–3 chronic eligible HCCs	25,726	$6,151.23	$7,853.45	1.277
4–6 chronic eligible HCCs	37,021	$10,612.40	$11,542.49	1.088
7–9 chronic eligible HCCs	22,147	$17,639.18	$17,799.24	1.009
10+ chronic eligible HCCs	15,452	$39,249.51	$33,699.62	0.859

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	728,437	$21,280.50	$21,280.50	1.000
1–3 chronic eligible HCCs	90,877	$8,033.67	$9,756.78	1.214
4–6 chronic eligible HCCs	203,327	$12,611.90	$13,453.27	1.067
7–9 chronic eligible HCCs	200,785	$19,526.67	$19,511.37	0.999
10+ chronic eligible HCCs	233,448	$36,168.07	$34,709.39	0.960

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	2,581,874	$16,250.98	$16,251.25	1.000
0 chronic eligible HCCs	4,187	$4,455.58	$6,296.67	1.413
1–3 chronic eligible HCCs	478,647	$5,925.07	$7,267.65	1.227
4–6 chronic eligible HCCs	795,609	$10,316.51	$11,009.85	1.067
7–9 chronic eligible HCCs	673,157	$16,923.34	$16,629.55	0.983
10+ chronic eligible HCCs	630,274	$31,905.77	$30,203.42	0.947

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	3,826,031	$19,259.78	$19,259.78	1.000
1–3 chronic eligible HCCs	305,771	$8,085.86	$9,011.79	1.115
4–6 chronic eligible HCCs	1,052,464	$11,403.58	$12,157.71	1.066
7–9 chronic eligible HCCs	1,209,125	$17,204.93	$17,483.01	1.016
10+ chronic eligible HCCs	1,258,671	$31,167.56	$29,981.46	0.962

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	3,111,271	$23,079.39	$23,079.39	1.000
1–3 chronic eligible HCCs	130,102	$10,109.59	$10,808.25	1.069
4–6 chronic eligible HCCs	688,269	$13,482.04	$14,526.72	1.077
7–9 chronic eligible HCCs	1,031,750	$19,334.28	$19,903.27	1.029
10+ chronic eligible HCCs	1,261,150	$33,260.46	$32,092.69	0.965

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	4,091,132	$19,228.00	$19,228.00	1.000
0 chronic eligible HCCs	2,155	$7,004.92	$8,180.00	1.168
1–3 chronic eligible HCCs	216,448	$8,755.63	$9,923.05	1.133
4–6 chronic eligible HCCs	992,870	$11,307.45	$12,323.82	1.090
7–9 chronic eligible HCCs	1,379,679	$16,146.16	$16,555.75	1.025
10+ chronic eligible HCCs	1,499,980	$29,255.48	$27,982.46	0.956

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	3,266,430	$16,569.40	$16,569.40	1.000
1–3 chronic eligible HCCs	389,658	$8,720.01	$9,433.07	1.082
4–6 chronic eligible HCCs	1,086,166	$11,179.02	$11,664.99	1.043
7–9 chronic eligible HCCs	1,003,161	$16,424.05	$16,310.27	0.993
10+ chronic eligible HCCs	787,445	$28,853.25	$27,912.57	0.967

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	1,398,777	$15,350.17	$15,359.59	1.001
1–3 chronic eligible HCCs	57,722	$6,560.65	$7,120.78	1.085
4–6 chronic eligible HCCs	383,089	$9,029.41	$9,696.00	1.074
7–9 chronic eligible HCCs	505,889	$13,822.60	$14,016.42	1.014
10+ chronic eligible HCCs	452,077	$23,844.90	$22,989.95	0.964

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	23,668,355	$9,959.32	$9,959.32	1.000
0 payment HCCs	8,107,039	$4,147.78	$4,138.45	0.998
1–3 payment HCCs	11,946,456	$9,553.34	$9,550.52	1.000
4–6 payment HCCs	2,715,094	$21,298.57	$21,326.56	1.001
7–9 payment HCCs	677,057	$35,409.76	$35,465.32	1.002
10+ payment HCCs	222,709	$55,373.41	$55,401.21	1.001

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	4,563,992	$9,896.02	$9,896.02	1.000
0 payment HCCs	1,329,617	$3,060.45	$3,047.48	0.996
1–3 payment HCCs	2,505,906	$8,413.21	$8,439.25	1.003
4–6 payment HCCs	536,119	$21,231.09	$21,210.15	0.999
7–9 payment HCCs	134,109	$40,091.93	$39,890.74	0.995
10+ payment HCCs	58,241	$67,583.04	$67,364.10	0.997

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	4,015,611	$13,154.40	$13,154.40	1.000
0 payment HCCs	942,110	$4,554.92	$4,454.30	0.978
1–3 payment HCCs	2,203,307	$10,328.61	$10,375.46	1.005
4–6 payment HCCs	617,131	$24,344.65	$24,330.07	0.999
7–9 payment HCCs	178,860	$43,161.22	$43,161.22	1.000
10+ payment HCCs	74,203	$71,357.58	$71,357.58	1.000

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

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

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

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	1,737,201	$10,342.22	$10,342.22	1.000
0 payment HCCs	466,467	$4,034.77	$4,019.60	0.996
1–3 payment HCCs	960,857	$8,916.88	$8,920.09	1.000
4–6 payment HCCs	232,559	$20,498.73	$20,516.83	1.001
7–9 payment HCCs	57,531	$36,254.59	$36,254.59	1.000
10+ payment HCCs	19,787	$58,858.11	$58,858.11	1.000

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

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

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

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 CMS-HCC Model				
Entire sample	22,746,830	$9,133.84	$9,133.84	1.000
0 payment HCCs	8,252,920	$3,920.72	$3,927.12	1.002
1–3 payment HCCs	11,497,244	$9,147.86	$9,143.06	0.999
4–6 payment HCCs	2,305,850	$20,867.79	$20,868.50	1.000
7–9 payment HCCs	529,608	$35,333.25	$35,333.25	1.000
10+ payment HCCs	161,208	$55,706.97	$55,706.97	1.000

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

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	373,176	$80,912.08	$80,913.46	1.000
First (lowest) decile	37,318	$46,300.23	$47,123.31	1.018
Second decile	37,318	$56,604.34	$56,048.47	0.990
Third decile	37,318	$63,194.82	$62,636.57	0.991
Fourth decile	37,318	$68,115.88	$67,843.47	0.996
Fifth decile	37,318	$73,022.80	$73,223.00	1.003
Sixth decile	37,318	$78,674.58	$78,781.55	1.001
Seventh decile	37,317	$86,657.21	$86,617.38	1.000
Eighth decile	37,317	$95,117.70	$95,885.89	1.008
Ninth decile	37,317	$109,408.68	$109,463.69	1.001
Tenth (highest)	37,317	$140,691.98	$140,121.07	0.996
Top 5%	18,658	$155,408.01	$154,933.37	0.997
Top 1%	3,731	$184,534.83	$185,415.90	1.005
Top 0.1%	373	$207,709.56	$222,306.23	1.070

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	178,003	$86,650.90	$86,574.22	0.999
First (lowest) decile	17,801	$53,118.71	$52,691.20	0.992
Second decile	17,801	$65,163.18	$62,088.80	0.953
Third decile	17,801	$70,418.38	$68,566.49	0.974
Fourth decile	17,800	$75,077.92	$74,231.85	0.989
Fifth decile	17,800	$80,614.41	$79,982.41	0.992
Sixth decile	17,800	$86,207.90	$86,321.77	1.001
Seventh decile	17,800	$92,569.52	$93,254.36	1.007
Eighth decile	17,800	$100,781.62	$102,111.81	1.013
Ninth decile	17,800	$112,707.44	$114,992.97	1.020
Tenth (highest)	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	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	195,173	$75,956.45	$76,025.26	1.001
First (lowest) decile	19,518	$44,422.26	$44,843.53	1.009
Second decile	19,518	$52,003.24	$52,090.04	1.002
Third decile	19,518	$57,084.58	$57,837.15	1.013
Fourth decile	19,517	$61,801.44	$63,460.60	1.027
Fifth decile	19,517	$67,083.61	$67,701.43	1.009
Sixth decile	19,517	$71,696.86	$72,852.45	1.016
Seventh decile	19,517	$77,143.66	$78,153.38	1.013
Eighth decile	19,517	$88,171.85	$88,152.53	1.000
Ninth decile	19,517	$103,813.65	$102,382.80	0.986
Tenth (highest)	19,517	$139,689.19	$136,074.58	0.974
Top 5%	9,758	$156,716.51	$152,281.55	0.972
Top 1%	1,951	$185,149.22	$185,274.12	1.001
Top 0.1%	195	$197,570.53	$224,910.01	1.138

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	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	325,235	$81,944.86	$81,944.86	1.000
First (lowest) decile	32,524	$45,546.53	$46,590.27	1.023
Second decile	32,524	$55,967.40	$55,387.08	0.990
Third decile	32,524	$63,024.61	$61,913.97	0.982
Fourth decile	32,524	$68,304.11	$68,036.96	0.996
Fifth decile	32,524	$74,552.56	$74,393.55	0.998
Sixth decile	32,523	$81,106.30	$81,354.90	1.003
Seventh decile	32,523	$88,856.98	$89,362.93	1.006
Eighth decile	32,523	$98,450.31	$99,176.88	1.007
Ninth decile	32,523	$112,555.36	$112,990.28	1.004
Tenth (highest)	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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
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
		2020 ESRD Model		
Entire sample	47,941	$72,242.65	$72,255.69	1.000
First decile (lowest)	4,795	$53,189.74	$52,830.43	0.993
Second decile	4,794	$60,767.28	$62,171.73	1.023
Third decile	4,794	$63,637.16	$65,125.89	1.023
Fourth decile	4,794	$68,049.20	$67,335.22	0.990
Fifth decile	4,794	$67,600.34	$70,948.41	1.050
Sixth decile	4,794	$75,181.33	$73,308.28	0.975
Seventh decile	4,794	$71,489.54	$74,056.32	1.036
Eighth decile	4,794	$77,191.55	$77,048.20	0.998
Ninth decile	4,794	$87,005.38	$84,232.07	0.968
Tenth (highest)	4,794	$98,353.13	$95,218.23	0.968
Top 5%	2,397	$97,345.33	$98,230.06	1.009
Top 1%	479	$100,698.09	$100,607.98	0.999
Top 0.1%	47	$105,702.30	$105,763.05	1.001

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	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	170,485	$86,661.90	$86,661.90	1.000
First decile (lowest)	17,049	$52,770.68	$52,429.80	0.994
Second decile	17,049	$64,914.80	$61,647.58	0.950
Third decile	17,049	$69,646.28	$67,900.87	0.975
Fourth decile	17,049	$74,899.98	$73,825.60	0.986
Fifth decile	17,049	$80,047.45	$79,838.22	0.997
Sixth decile	17,048	$86,231.69	$86,416.86	1.002
Seventh decile	17,048	$92,664.57	$93,893.98	1.013
Eighth decile	17,048	$101,719.41	$103,101.49	1.014
Ninth decile	17,048	$113,863.67	$116,002.27	1.019
Tenth (highest)	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	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	154,750	$77,213.11	$77,213.11	1.000
First decile (lowest)	15,475	$43,565.92	$43,889.81	1.007
Second decile	15,475	$50,351.78	$50,568.82	1.004
Third decile	15,475	$55,114.30	$56,054.16	1.017
Fourth decile	15,475	$60,868.68	$61,596.20	1.012
Fifth decile	15,475	$66,245.77	$67,554.93	1.020
Sixth decile	15,475	$73,291.13	$74,434.16	1.016
Seventh decile	15,475	$82,724.46	$82,847.20	1.001
Eighth decile	15,475	$92,456.37	$93,412.53	1.010
Ninth decile	15,475	$110,511.03	$108,552.04	0.982
Tenth (highest)	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	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	125,271	$91,345.35	$88,750.62	0.972
First decile (lowest)	12,528	$51,362.32	$51,499.59	1.003
Second decile	12,527	$61,774.78	$60,182.54	0.974
Third decile	12,527	$68,973.04	$67,191.37	0.974
Fourth decile	12,527	$75,370.31	$73,879.20	0.980
Fifth decile	12,527	$83,221.75	$80,844.81	0.971
Sixth decile	12,527	$90,901.05	$88,430.60	0.973
Seventh decile	12,527	$99,722.99	$97,048.02	0.973
Eighth decile	12,527	$112,539.77	$107,651.48	0.957
Ninth decile	12,527	$127,603.16	$122,426.85	0.959
Tenth (highest)	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	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	43,918	$76,371.00	$81,615.43	1.069
First decile (lowest)	4,392	$45,913.05	$49,728.97	1.083
Second decile	4,392	$52,126.71	$56,673.14	1.087
Third decile	4,392	$58,022.22	$62,382.09	1.075
Fourth decile	4,392	$62,932.41	$67,891.30	1.079
Fifth decile	4,392	$68,767.93	$73,716.40	1.072
Sixth decile	4,392	$74,522.25	$80,290.57	1.077
Seventh decile	4,392	$81,595.07	$88,000.86	1.079
Eighth decile	4,392	$89,221.26	$97,260.00	1.090
Ninth decile	4,391	$104,316.55	$110,337.21	1.058
Tenth (highest)	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	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	189,315	$80,422.33	$78,378.47	0.975
First decile (lowest	18,932	$43,702.18	$44,319.04	1.014
Second decile	18,932	$54,976.66	$52,974.46	0.964
Third decile	18,932	$62,635.21	$59,344.15	0.947
Fourth decile	18,932	$68,344.28	$65,277.79	0.955
Fifth decile	18,932	$73,886.27	$71,365.97	0.966
Sixth decile	18,931	$80,280.29	$78,054.19	0.972
Seventh decile	18,931	$87,627.13	$85,713.30	0.978
Eighth decile	18,931	$96,140.60	$95,107.43	0.989
Ninth decile	18,931	$109,367.11	$108,332.76	0.991
Tenth (highest)	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 ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

(continued)

Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

(continued)

Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

(continued)

Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

(continued)

Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

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Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

(continued)

Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

(continued)

Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

(continued)

Table 5-51 (continued)
Predictive ratios for all HCCs: All dialysis continuing enrollees
2019 and 2020 ESRD Models

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

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

2. Kidney disease group omitted because renal HCCs 132–141 are excluded from the dialysis model.

3. Other HCCs with missing data have a count of 0 or are not populated because they correspond to procedures or durable medical equipment.

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

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

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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

(continued)

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

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

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 ratios by count of chronic conditions: All dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	325,235	$81,944.86	$81,944.86	1.000
0 chronic eligible HCCs	14,562	$40,813.15	$47,213.09	1.157
1–3 chronic eligible HCCs	36,342	$53,745.17	$55,108.21	1.025
4–6 chronic eligible HCCs	63,706	$64,982.53	$65,359.49	1.006
7–9 chronic eligible HCCs	75,389	$77,547.83	$77,603.63	1.001
10+ chronic eligible HCCs	135,236	$106,038.87	$104,680.41	0.987

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-54
Predictive ratios by count of chronic conditions: Aged dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	170,485	$86,661.90	$86,661.90	1.000
0 chronic eligible HCCs	4,935	$41,387.19	$51,136.56	1.236
1–3 chronic eligible HCCs	12,780	$59,158.92	$59,434.93	1.005
4–6 chronic eligible HCCs	30,792	$69,398.26	$68,512.02	0.987
7–9 chronic eligible HCCs	42,169	$80,250.48	$79,809.24	0.995
10+ chronic eligible HCCs	79,809	$105,083.20	$105,007.36	0.999

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-55
Predictive ratios by count of chronic conditions: Non-aged dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	154,750	$77,213.11	$77,213.11	1.000
0 chronic eligible HCCs	9,627	$40,541.72	$45,357.94	1.119
1–3 chronic eligible HCCs	23,562	$50,971.06	$52,891.11	1.038
4–6 chronic eligible HCCs	32,914	$61,166.65	$62,635.22	1.024
7–9 chronic eligible HCCs	33,220	$74,415.39	$75,047.27	1.008
10+ chronic eligible HCCs	55,427	$107,288.18	$104,253.00	0.972

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-56
Predictive ratios by count of chronic conditions: Any Medicaid dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	160,672	$86,768.99	$86,768.99	1.000
0 chronic eligible HCCs	5,592	$47,269.19	$50,945.33	1.078
1–3 chronic eligible HCCs	17,841	$55,476.06	$57,980.95	1.045
4–6 chronic eligible HCCs	30,665	$66,304.38	$68,399.39	1.032
7–9 chronic eligible HCCs	36,371	$79,899.79	$80,936.20	1.013
10+ chronic eligible HCCs	70,203	$112,123.14	$109,571.29	0.977
2020 ESRD Model				
Entire sample	160,672	$86,768.99	$86,768.99	1.000
0 chronic eligible HCCs	5,592	$47,269.19	$50,945.33	1.078
1–3 chronic eligible HCCs	17,841	$55,476.06	$57,980.95	1.045
4–6 chronic eligible HCCs	30,665	$66,304.38	$68,399.39	1.032
7–9 chronic eligible HCCs	36,371	$79,899.79	$80,936.20	1.013
10+ chronic eligible HCCs	70,203	$112,123.14	$109,571.29	0.977

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-57
Predictive ratios by count of chronic conditions: Non-Medicaid dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	164,563	$76,933.93	$76,933.93	1.000
0 chronic eligible HCCs	8,970	$36,506.23	$44,723.26	1.225
1–3 chronic eligible HCCs	18,501	$51,972.38	$52,165.93	1.004
4–6 chronic eligible HCCs	33,041	$63,675.43	$62,353.52	0.979
7–9 chronic eligible HCCs	39,018	$75,205.59	$74,284.82	0.988
10+ chronic eligible HCCs	65,033	$99,025.91	$99,042.99	1.000

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-58
Predictive ratios by count of chronic conditions: Full benefit dual dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	125,271	$91,345.35	$88,750.62	0.972
0 chronic eligible HCCs	3,885	$49,853.97	$51,011.10	1.023
1–3 chronic eligible HCCs	12,770	$57,923.88	$58,250.10	1.006
4–6 chronic eligible HCCs	22,725	$69,221.76	$68,886.38	0.995
7–9 chronic eligible HCCs	28,050	$82,967.83	$81,487.53	0.982
10+ chronic eligible HCCs	57,841	$115,982.47	$110,893.01	0.956
2020 ESRD Model				
Entire sample	125,271	$91,345.35	$88,750.62	0.972
0 chronic eligible HCCs	3,885	$49,853.97	$51,011.10	1.023
1–3 chronic eligible HCCs	12,770	$57,923.88	$58,250.10	1.006
4–6 chronic eligible HCCs	22,725	$69,221.76	$68,886.38	0.995
7–9 chronic eligible HCCs	28,050	$82,967.83	$81,487.53	0.982
10+ chronic eligible HCCs	57,841	$115,982.47	$110,893.01	0.956

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-59
Predictive ratios by count of chronic conditions: Partial benefit dual dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	43,918	$76,371.00	$81,615.43	1.069
0 chronic eligible HCCs	1,964	$43,296.81	$50,816.22	1.174
1–3 chronic eligible HCCs	5,915	$51,592.71	$57,356.53	1.112
4–6 chronic eligible HCCs	9,498	$60,769.86	$67,177.75	1.105
7–9 chronic eligible HCCs	10,249	$73,325.56	$79,430.80	1.083
10+ chronic eligible HCCs	16,292	$101,719.02	$105,202.86	1.034

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-60
Predictive ratios by count of chronic conditions: Non-dual dialysis continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	189,315	$80,422.33	$78,378.47	0.975
0 chronic eligible HCCs	10,134	$39,078.49	$45,479.50	1.164
1–3 chronic eligible HCCs	21,192	$53,739.49	$52,919.13	0.985
4–6 chronic eligible HCCs	37,623	$65,476.02	$63,087.10	0.964
7–9 chronic eligible HCCs	44,363	$77,509.34	$75,184.31	0.970
10+ chronic eligible HCCs	76,003	$104,151.71	$100,882.32	0.969

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-61
Predictive ratios by count of payment conditions: Aged dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	170,485	$86,661.90	$86,661.90	1.000
0 payment HCCs	9,527	$50,448.70	$51,912.27	1.029
1–3 payment HCCs	50,060	$68,475.85	$65,721.51	0.960
4–6 payment HCCs	52,713	$83,644.53	$83,609.96	1.000
7–9 payment HCCs	33,886	$101,457.17	$103,169.57	1.017
10+ payment HCCs	24,299	$129,704.19	$132,940.51	1.025

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-62
Predictive ratios by count of payment conditions: Non-aged dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	154,750	$77,213.11	$77,213.11	1.000
0 payment HCCs	16,818	$43,464.18	$45,678.84	1.051
1–3 payment HCCs	52,007	$57,874.50	$58,297.76	1.007
4–6 payment HCCs	41,194	$76,683.22	$77,208.47	1.007
7–9 payment HCCs	25,068	$98,990.20	$98,564.56	0.996
10+ payment HCCs	19,663	$136,426.01	$132,500.83	0.971

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-63
Predictive ratios by count of payment conditions: Full benefit dual dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	125,271	$91,345.35	$88,750.62	0.972
0 payment HCCs	7,728	$51,600.26	$51,005.41	0.988
1–3 payment HCCs	34,794	$66,115.90	$64,651.18	0.978
4–6 payment HCCs	35,597	$85,536.65	$83,432.39	0.975
7–9 payment HCCs	25,116	$107,440.30	$104,021.75	0.968
10+ payment HCCs	22,036	$142,447.78	$137,193.13	0.963

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-64
Predictive ratios by count of payment conditions: Partial benefit dual dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	43,918	$76,371.00	$81,615.43	1.069
0 payment HCCs	3,821	$46,370.71	$50,811.81	1.096
1–3 payment HCCs	14,799	$58,510.50	$63,356.86	1.083
4–6 payment HCCs	12,642	$75,704.51	$81,801.91	1.081
7–9 payment HCCs	7,675	$96,302.39	$102,059.22	1.060
10+ payment HCCs	4,981	$128,950.28	$133,001.42	1.031

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-65
Predictive ratios by count of payment conditions: Non-dual dialysis continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
Entire sample	189,315	$80,422.33	$78,378.47	0.975
0 payment HCCs	17,320	$45,036.53	$46,059.93	1.023
1–3 payment HCCs	61,834	$63,796.30	$60,008.50	0.941
4–6 payment HCCs	54,929	$80,851.63	$78,930.97	0.976
7–9 payment HCCs	32,719	$99,814.51	$99,141.76	0.993
10+ payment HCCs	22,513	$131,185.33	$129,354.37	0.986
		2020 ESRD Model		
Entire sample	189,315	$80,422.33	$78,378.47	0.975
0 payment HCCs	17,320	$45,036.53	$46,059.93	1.023
1–3 payment HCCs	61,834	$63,796.30	$60,008.50	0.941
4–6 payment HCCs	54,929	$80,851.63	$78,930.97	0.976
7–9 payment HCCs	32,719	$99,814.51	$99,141.76	0.993
10+ payment HCCs	22,513	$131,185.33	$129,354.37	0.986

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-66
Predictive ratios by deciles of predicted risk (sorted low to high): All functioning graft enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
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
		2020 ESRD Model		
Entire sample	105,059	$24,863.86	$24,907.11	1.002
First (lowest) decile	10,506	$9,821.03	$10,735.67	1.093
Second decile	10,506	$12,549.31	$13,780.25	1.098
Third decile	10,506	$15,381.94	$16,340.27	1.062
Fourth decile	10,506	$17,743.03	$18,800.47	1.060
Fifth decile	10,506	$20,666.05	$21,130.33	1.022
Sixth decile	10,506	$23,306.35	$23,904.22	1.026
Seventh decile	10,506	$26,721.06	$27,468.64	1.028
Eighth decile	10,506	$32,399.91	$32,335.05	0.998
Ninth decile	10,506	$39,501.19	$39,286.40	0.995
Tenth (highest)	10,505	$64,486.32	$57,652.11	0.894
Top 5%	5,252	$76,720.97	$66,969.49	0.873
Top 1%	1,050	$105,523.87	$88,347.09	0.837
Top 0.1%	105	$139,967.18	$116,802.87	0.835

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	38,609	$26,964.08	$27,024.13	1.002
First (lowest) decile	3,861	$10,525.86	$13,876.80	1.318
Second decile	3,861	$14,577.83	$16,323.27	1.120
Third decile	3,861	$17,382.05	$18,587.82	1.069
Fourth decile	3,861	$18,872.58	$20,413.77	1.082
Fifth decile	3,861	$21,177.19	$22,896.07	1.081
Sixth decile	3,861	$25,130.30	$25,866.98	1.029
Seventh decile	3,861	$29,021.29	$29,539.87	1.018
Eighth decile	3,861	$35,342.91	$34,408.23	0.974
Ninth decile	3,861	$43,580.87	$41,743.42	0.958
Tenth (highest)	3,860	$70,453.67	$59,624.85	0.846
Top 5%	1,930	$83,331.87	$68,659.59	0.824
Top 1%	386	$113,306.59	$87,598.87	0.773
Top 0.1%	38	$172,327.20	$112,239.19	0.651

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	66,450	$23,450.62	$23,482.56	1.001
First (lowest) decile	6,645	$8,941.06	$10,084.27	1.128
Second decile	6,645	$12,105.39	$12,314.87	1.017
Third decile	6,645	$14,891.64	$14,817.27	0.995
Fourth decile	6,645	$16,534.26	$17,444.75	1.055
Fifth decile	6,645	$20,192.13	$20,084.12	0.995
Sixth decile	6,645	$22,912.23	$22,704.54	0.991
Seventh decile	6,645	$25,855.33	$26,177.85	1.012
Eighth decile	6,645	$30,728.50	$30,985.92	1.008
Ninth decile	6,645	$35,773.34	$37,786.27	1.056
Tenth (highest)	6,645	$61,072.88	$56,396.94	0.923
Top 5%	3,322	$72,553.57	$65,870.69	0.908
Top 1%	664	$102,662.20	$88,880.38	0.866
Top 0.1%	66	$130,483.41	$119,198.26	0.914

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

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	97,806	$24,786.13	$24,831.56	1.002
First (lowest) decile	9,781	$9,687.87	$10,611.14	1.095
Second decile	9,781	$12,296.37	$13,530.67	1.100
Third decile	9,781	$14,970.69	$15,931.05	1.064
Fourth decile	9,781	$17,417.94	$18,381.54	1.055
Fifth decile	9,781	$20,326.02	$21,054.41	1.036
Sixth decile	9,781	$23,111.74	$24,048.51	1.041
Seventh decile	9,780	$27,039.61	$27,711.20	1.025
Eighth decile	9,780	$32,473.59	$32,460.65	1.000
Ninth decile	9,780	$40,138.86	$39,639.06	0.988
Tenth (highest)	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 ratios by deciles of predicted risk (sorted low to high): Functioning graft institutional continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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%	*			
		2020 ESRD Model		
Entire sample	906	$51,704.15	$51,722.00	1.000
First (lowest) decile	91	$30,055.04	$27,480.72	0.914
Second decile	91	$30,351.03	$33,317.34	1.098
Third decile	91	$40,251.17	$37,336.69	0.928
Fourth decile	91	$44,729.44	$41,634.31	0.931
Fifth decile	91	$43,837.32	$46,086.64	1.051
Sixth decile	91	$46,310.91	$51,277.82	1.107
Seventh decile	90	$59,685.21	$57,252.53	0.959
Eighth decile	90	$54,641.70	$64,934.92	1.188
Ninth decile	90	$68,901.36	$75,776.38	1.100
Tenth (highest)	90	$115,090.90	$98,588.22	0.857
Top 5%	45	$114,875.71	$107,996.63	0.940
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 ratios by deciles of predicted risk (sorted low to high): Functioning graft new enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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%	*			
		2020 ESRD Model		
Entire sample	6,779	$22,921.40	$22,922.77	1.000
First (lowest) decile	678	$18,347.81	$17,942.71	0.978
Second decile	678	$16,401.55	$19,056.28	1.162
Third decile	678	$16,804.00	$19,472.44	1.159
Fourth decile	678	$23,183.02	$20,488.67	0.884
Fifth decile	678	$23,934.99	$20,934.29	0.875
Sixth decile	678	$24,564.42	$22,066.91	0.898
Seventh decile	678	$26,153.62	$23,754.72	0.908
Eighth decile	678	$26,798.69	$26,095.61	0.974
Ninth decile	678	$30,841.07	$34,025.96	1.103
Tenth (highest)	677	$34,140.56	$38,501.62	1.128
Top 5%	338	$32,692.82	$40,145.64	1.228
Top 1%	67	$34,903.47	$42,335.73	1.213
Top 0.1%	*			

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 ratios by deciles of predicted risk (sorted low to high): Aged functioning graft community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	36,600	$27,000.69	$27,065.02	1.002
First (lowest) decile	3,660	$10,324.06	$13,801.71	1.337
Second decile	3,660	$14,354.33	$16,137.95	1.124
Third decile	3,660	$17,409.44	$18,437.98	1.059
Fourth decile	3,660	$19,193.72	$20,691.70	1.078
Fifth decile	3,660	$21,379.30	$23,185.60	1.084
Sixth decile	3,660	$25,283.05	$26,187.48	1.036
Seventh decile	3,660	$29,080.27	$29,836.07	1.026
Eighth decile	3,660	$36,024.30	$34,643.15	0.962
Ninth decile	3,660	$43,630.48	$42,003.19	0.963
Tenth (highest)	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 ratios by deciles of predicted risk (sorted low to high): Non-aged functioning graft community continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (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
		2020 ESRD Model		
Entire sample	61,206	$23,290.54	$23,323.20	1.001
First (lowest) decile	6,121	$8,669.30	$9,996.74	1.153
Second decile	6,121	$11,864.08	$12,030.43	1.014
Third decile	6,121	$14,651.57	$14,309.67	0.977
Fourth decile	6,121	$15,663.66	$16,791.21	1.072
Fifth decile	6,121	$19,316.14	$19,501.94	1.010
Sixth decile	6,121	$22,718.49	$22,604.89	0.995
Seventh decile	6,120	$25,729.41	$26,285.55	1.022
Eighth decile	6,120	$30,801.81	$31,020.90	1.007
Ninth decile	6,120	$36,549.59	$38,095.65	1.042
Tenth (highest)	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 ratios by deciles of predicted risk (sorted low to high): Full benefit dual functioning graft continuing enrollees

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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%	*			
		2020 ESRD Model		
Entire sample	27,855	$30,081.30	$26,921.79	0.895
First (lowest) decile	2,786	$11,522.14	$11,281.80	0.979
Second decile	2,786	$16,137.19	$14,108.70	0.874
Third decile	2,786	$17,637.95	$17,044.93	0.966
Fourth decile	2,786	$21,240.65	$19,826.87	0.933
Fifth decile	2,786	$24,632.94	$22,864.10	0.928
Sixth decile	2,785	$28,131.70	$26,176.46	0.930
Seventh decile	2,785	$32,387.75	$30,157.37	0.931
Eighth decile	2,785	$38,163.41	$35,315.44	0.925
Ninth decile	2,785	$49,702.10	$42,997.47	0.865
Tenth (highest)	2,785	$78,241.59	$63,381.75	0.810
Top 5%	1,392	$89,334.45	$73,473.45	0.822
Top 1%	278	$119,736.13	$96,313.95	0.804
Top 0.1%	*			

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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%	*			
		2020 ESRD Model		
Entire sample	11,339	$25,364.84	$25,293.65	0.997
First (lowest) decile	1,134	$11,919.62	$11,295.05	0.948
Second decile	1,134	$13,911.23	$13,762.26	0.989
Third decile	1,134	$15,044.69	$16,467.39	1.095
Fourth decile	1,134	$17,299.27	$18,990.51	1.098
Fifth decile	1,134	$19,846.99	$21,721.36	1.094
Sixth decile	1,134	$24,166.58	$24,747.21	1.024
Seventh decile	1,134	$26,682.74	$28,317.02	1.061
Eighth decile	1,134	$33,529.95	$33,261.68	0.992
Ninth decile	1,134	$41,973.71	$40,386.83	0.962
Tenth (highest)	1,133	$66,283.81	$59,042.20	0.891
Top 5%	566	$76,501.88	$68,294.51	0.893
Top 1%	113	$100,705.12	$89,096.88	0.885
Top 0.1%	*			

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

Deciles	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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
		2020 ESRD Model		
Entire sample	66,344	$23,843.30	$24,327.14	1.020
First (lowest) decile	6,635	$9,051.25	$10,295.96	1.138
Second decile	6,635	$11,365.08	$13,348.58	1.175
Third decile	6,635	$14,340.72	$15,563.95	1.085
Fourth decile	6,635	$16,951.16	$17,901.17	1.056
Fifth decile	6,634	$18,824.48	$20,487.21	1.088
Sixth decile	6,634	$22,254.53	$23,354.20	1.049
Seventh decile	6,634	$25,586.58	$26,973.82	1.054
Eighth decile	6,634	$31,968.12	$31,617.37	0.989
Ninth decile	6,634	$38,197.30	$38,720.92	1.014
Tenth (highest)	6,634	$63,290.42	$56,643.82	0.895
Top 5%	3,317	$76,116.01	$65,576.00	0.862
Top 1%	663	$107,497.41	$85,771.74	0.798
Top 0.1%	66	$181,649.39	$111,904.22	0.616

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

Table 5-77a
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				98,280	$24,956.69	$24,948.20	1.000
HCC1	HIV/AIDS	Y	Y	762	$30,245.38	$30,717.29	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
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	28,327	$29,685.89	$29,754.28	1.002

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC24	Disorders of Fluid/Electrolyte/Acid-Base Balance			36,566	$36,405.97	$32,759.58	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
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

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC48	Coagulation Defects and Other Specified Hematological Disorders	Y	Y	10,902	$37,390.22	$35,756.91	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	*			
HCC66	Moderate Intellectual Disability/Developmental Disorder		Y	66	$29,375.25	$25,009.46	0.851

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Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC67	Mild Intellectual Disability, Autism, Down Syndrome		Y	473	$27,108.87	$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 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC89	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease		Y	22,797	$33,372.55	$30,341.16	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 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC111	Chronic Obstructive Pulmonary Disease	Y	Y	7,924	$41,704.13	$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	.	.	.	.
HCC135	Acute Renal Failure			.	.	.	.

(continued)

Table 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC136	Chronic Kidney Disease, Stage 5		Y	.	.	.	.
HCC137	Chronic Kidney Disease, Severe (Stage 4)		Y	.	.	.	.
HCC138	Chronic Kidney Disease, Moderate (Stage 3)		Y	.	.	.	.
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1–2 or Unspecified)		Y	.	.	.	.
HCC140	Unspecified Renal Failure		Y	.	.	.	.
HCC141	Nephritis		Y	.	.	.	.
HCC142	Urinary Obstruction and Retention			12,588	$36,786.39	$32,713.43	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 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	Y	Y	482	$67,780.46	$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 5-77a (continued)
Predictive ratios for all HCCs: All functioning graft continuing enrollees
2019 ESRD Model

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
HCC180	Extremely Immature Newborns, Including Birthweight < 1000 Grams		Y	.	.	.	.
HCC181	Premature Newborns, Including Birthweight 1000–1499 Grams		Y	.	.	.	.
HCC182	Serious Perinatal Problem Affecting Newborn		Y	97	$42,699.17	$34,767.78	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			.	.	.	.

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

2. Kidney disease group omitted because renal HCCs 132–141 are excluded from the functioning graft model.

3. Other HCCs with missing data have a count of 0 or are not populated because they correspond to procedures or durable medical equipment.

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

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

HCC	HCC label	In payment model	Chronic	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
Entire sample				98,280	$24,956.69	$25,001.95	1.002
HCC1	HIV/AIDS	Y	Y	762	$30,245.38	$30,791.55	1.018
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	Y		8,994	$49,549.16	$43,614.86	0.880
HCC3	Bacterial, Fungal, and Parasitic Central Nervous System Infections			856	$49,687.94	$41,342.16	0.832
HCC4	Viral and Late Effects Central Nervous System Infections			242	$35,609.63	$38,706.94	1.087
HCC5	Tuberculosis			284	$36,505.22	$35,667.70	0.977
HCC6	Opportunistic Infections	Y		4,629	$35,462.40	$40,619.93	1.145
HCC7	Other Infectious Diseases			36,364	$33,031.45	$30,678.23	0.929
HCC8	Metastatic Cancer and Acute Leukemia	Y	Y	773	$61,516.55	$59,154.62	0.962
HCC9	Lung and Other Severe Cancers	Y	Y	997	$42,906.93	$43,494.25	1.014
HCC10	Lymphoma and Other Cancers	Y	Y	1,167	$37,757.47	$37,856.12	1.003
HCC11	Colorectal, Bladder, and Other Cancers	Y	Y	2,307	$31,534.37	$32,448.52	1.029
HCC12	Breast, Prostate, and Other Cancers and Tumors	Y	Y	3,952	$28,534.87	$29,069.43	1.019
HCC13	Other Respiratory and Heart Neoplasms			248	$44,490.31	$34,555.82	0.777
HCC14	Other Digestive and Urinary Neoplasms			6,334	$29,799.28	$27,774.72	0.932
HCC15	Other Neoplasms			11,405	$24,851.12	$24,552.20	0.988
HCC16	Benign Neoplasms of Skin, Breast, Eye			7,375	$23,251.65	$23,854.88	1.026
HCC17	Diabetes with Acute Complications	Y	Y	1,960	$47,214.92	$37,642.26	0.797
HCC18	Diabetes with Chronic Complications	Y	Y	34,704	$32,037.65	$30,477.92	0.951
HCC19	Diabetes without Complication	Y	Y	14,235	$23,228.94	$23,636.32	1.018
HCC20	Type I Diabetes Mellitus		Y	17,993	$34,367.33	$31,600.25	0.919
HCC21	Protein-Calorie Malnutrition	Y		3,228	$57,987.08	$51,957.24	0.896
HCC22	Morbid Obesity	Y	Y	5,494	$36,063.61	$33,515.62	0.929
HCC23	Other Significant Endocrine and Metabolic Disorders	Y	Y	28,327	$29,685.89	$29,809.45	1.004

(continued)

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

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

(continued)

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

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

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

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

(continued)

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

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

(continued)

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

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

(continued)

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

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

(continued)

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

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

(continued)

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

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

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

2. Kidney disease group omitted because renal HCCs 132–141 are excluded from the functioning graft model.

3. Other HCCs with missing data have a count of 0 or are not populated because they correspond to procedures or durable medical equipment.

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

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

Body system label	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		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

(continued)

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

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

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 ratios by count of chronic conditions: All functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	98,280	$24,956.69	$24,948.20	1.000
0 chronic eligible HCCs	2,804	$6,828.84	$12,241.56	1.793
1–3 chronic eligible HCCs	15,137	$12,661.70	$14,514.36	1.146
4–6 chronic eligible HCCs	27,447	$17,381.37	$19,103.41	1.099
7–9 chronic eligible HCCs	25,247	$24,172.45	$25,117.56	1.039
10+ chronic eligible HCCs	27,645	$42,437.75	$38,100.28	0.898
2020 ESRD Model				
Entire sample	98,280	$24,956.69	$25,001.95	1.002
0 chronic eligible HCCs	2,804	$6,828.84	$12,246.17	1.793
1–3 chronic eligible HCCs	15,137	$12,661.70	$14,518.93	1.147
4–6 chronic eligible HCCs	27,447	$17,381.37	$19,115.46	1.100
7–9 chronic eligible HCCs	25,247	$24,172.45	$25,147.09	1.040
10+ chronic eligible HCCs	27,645	$42,437.75	$38,253.73	0.901

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-80
Predictive ratios by count of chronic conditions: Aged functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	36,883	$27,231.59	$27,201.39	0.999
0 chronic eligible HCCs	797	$5,196.13	$14,177.46	2.728
1–3 chronic eligible HCCs	3,480	$12,869.18	$16,461.21	1.279
4–6 chronic eligible HCCs	9,195	$17,287.33	$20,164.13	1.166
7–9 chronic eligible HCCs	10,491	$24,748.31	$25,569.03	1.033
10+ chronic eligible HCCs	12,920	$43,101.08	$38,320.33	0.889
2020 ESRD Model				
Entire sample	36,883	$27,231.59	$27,279.17	1.002
0 chronic eligible HCCs	797	$5,196.13	$14,186.60	2.730
1–3 chronic eligible HCCs	3,480	$12,869.18	$16,471.27	1.280
4–6 chronic eligible HCCs	9,195	$17,287.33	$20,187.30	1.168
7–9 chronic eligible HCCs	10,491	$24,748.31	$25,615.06	1.035
10+ chronic eligible HCCs	12,920	$43,101.08	$38,494.07	0.893

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-81
Predictive ratios by count of chronic conditions: Non-aged functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	61,397	$23,411.83	$23,418.07	1.000
0 chronic eligible HCCs	2,007	$7,644.17	$11,274.82	1.475
1–3 chronic eligible HCCs	11,657	$12,587.66	$13,819.56	1.098
4–6 chronic eligible HCCs	18,252	$17,435.91	$18,488.28	1.060
7–9 chronic eligible HCCs	14,756	$23,706.23	$24,752.04	1.044
10+ chronic eligible HCCs	14,725	$41,801.27	$37,889.14	0.906
2020 ESRD Model				
Entire sample	61,397	$23,411.83	$23,455.50	1.002
0 chronic eligible HCCs	2,007	$7,644.17	$11,277.17	1.475
1–3 chronic eligible HCCs	11,657	$12,587.66	$13,822.16	1.098
4–6 chronic eligible HCCs	18,252	$17,435.91	$18,493.87	1.061
7–9 chronic eligible HCCs	14,756	$23,706.23	$24,768.21	1.045
10+ chronic eligible HCCs	14,725	$41,801.27	$38,023.11	0.910

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-82
Predictive ratios by count of chronic conditions: Any Medicaid functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	37,245	$28,301.84	$26,288.34	0.929
0 chronic eligible HCCs	774	$11,390.95	$13,270.94	1.165
1–3 chronic eligible HCCs	5,940	$14,344.37	$15,166.21	1.057
4–6 chronic eligible HCCs	10,524	$19,713.77	$20,044.10	1.017
7–9 chronic eligible HCCs	9,385	$26,801.25	$26,308.69	0.982
10+ chronic eligible HCCs	10,622	$47,834.85	$40,089.04	0.838
2020 ESRD Model				
Entire sample	37,245	$28,301.84	$26,418.74	0.933
0 chronic eligible HCCs	774	$11,390.95	$13,281.34	1.166
1–3 chronic eligible HCCs	5,940	$14,344.37	$15,174.17	1.058
4–6 chronic eligible HCCs	10,524	$19,713.77	$20,071.74	1.018
7–9 chronic eligible HCCs	9,385	$26,801.25	$26,384.46	0.984
10+ chronic eligible HCCs	10,622	$47,834.85	$40,455.24	0.846

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-83
Predictive ratios by count of chronic conditions: Non-Medicaid functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	61,035	$23,021.95	$24,173.09	1.050
0 chronic eligible HCCs	2,030	$5,312.87	$11,899.51	2.240
1–3 chronic eligible HCCs	9,197	$11,615.18	$14,108.95	1.215
4–6 chronic eligible HCCs	16,923	$16,008.38	$18,549.67	1.159
7–9 chronic eligible HCCs	15,862	$22,715.71	$24,457.49	1.077
10+ chronic eligible HCCs	17,023	$39,215.74	$36,913.02	0.941
2020 ESRD Model				
Entire sample	61,035	$23,021.95	$24,182.51	1.050
0 chronic eligible HCCs	2,030	$5,312.87	$11,902.20	2.240
1–3 chronic eligible HCCs	9,197	$11,615.18	$14,111.40	1.215
4–6 chronic eligible HCCs	16,923	$16,008.38	$18,552.54	1.159
7–9 chronic eligible HCCs	15,862	$22,715.71	$24,461.40	1.077
10+ chronic eligible HCCs	17,023	$39,215.74	$36,939.45	0.942

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-84
Predictive ratios by count of chronic conditions: Full benefit dual functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	27,855	$30,081.30	$26,746.45	0.889
0 chronic eligible HCCs	560	$12,125.49	$13,235.99	1.092
1–3 chronic eligible HCCs	4,402	$15,121.60	$15,200.56	1.005
4–6 chronic eligible HCCs	7,698	$20,677.83	$20,209.32	0.977
7–9 chronic eligible HCCs	6,942	$28,328.22	$26,431.78	0.933
10+ chronic eligible HCCs	8,253	$49,975.08	$40,486.05	0.810
2020 ESRD Model				
Entire sample	27,855	$30,081.30	$26,921.79	0.895
0 chronic eligible HCCs	560	$12,125.49	$13,250.51	1.093
1–3 chronic eligible HCCs	4,402	$15,121.60	$15,211.46	1.006
4–6 chronic eligible HCCs	7,698	$20,677.83	$20,247.56	0.979
7–9 chronic eligible HCCs	6,942	$28,328.22	$26,534.86	0.937
10+ chronic eligible HCCs	8,253	$49,975.08	$40,956.14	0.820

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-85
Predictive ratios by count of chronic conditions: Partial benefit dual functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	11,339	$25,364.84	$25,281.54	0.997
0 chronic eligible HCCs	243	$11,412.13	$13,396.71	1.174
1–3 chronic eligible HCCs	1,818	$13,211.78	$15,098.73	1.143
4–6 chronic eligible HCCs	3,370	$17,906.69	$19,623.86	1.096
7–9 chronic eligible HCCs	2,947	$24,679.97	$26,009.81	1.054
10+ chronic eligible HCCs	2,961	$44,234.54	$39,032.60	0.882
2020 ESRD Model				
Entire sample	11,339	$25,364.84	$25,293.65	0.997
0 chronic eligible HCCs	243	$11,412.13	$13,396.71	1.174
1–3 chronic eligible HCCs	1,818	$13,211.78	$15,099.30	1.143
4–6 chronic eligible HCCs	3,370	$17,906.69	$19,627.17	1.096
7–9 chronic eligible HCCs	2,947	$24,679.97	$26,013.09	1.054
10+ chronic eligible HCCs	2,961	$44,234.54	$39,073.16	0.883

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-86
Predictive ratios by count of chronic conditions: Non-dual functioning graft continuing enrollees

Number of chronic eligible HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Entire sample	66,344	$23,843.30	$24,308.86	1.020
0 chronic eligible HCCs	2,190	$5,769.14	$11,982.32	2.077
1–3 chronic eligible HCCs	10,121	$12,011.01	$14,185.86	1.181
4–6 chronic eligible HCCs	18,382	$16,555.47	$18,628.95	1.125
7–9 chronic eligible HCCs	17,179	$23,524.27	$24,641.29	1.047
10+ chronic eligible HCCs	18,472	$40,713.40	$37,185.75	0.913
2020 ESRD Model				
Entire sample	66,344	$23,843.30	$24,327.14	1.020
0 chronic eligible HCCs	2,190	$5,769.14	$11,986.12	2.078
1–3 chronic eligible HCCs	10,121	$12,011.01	$14,189.10	1.181
4–6 chronic eligible HCCs	18,382	$16,555.47	$18,632.94	1.125
7–9 chronic eligible HCCs	17,179	$23,524.27	$24,650.35	1.048
10+ chronic eligible HCCs	18,472	$40,713.40	$37,238.39	0.915

NOTE:
1. Kidney disease group omitted from count of chronic conditions for both the 2019 and 2020 ESRD models 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 5-87
Predictive ratios by count of payment conditions: Aged functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
Entire sample	36,883	$27,231.59	$27,201.39	0.999
0 payment HCCs	3,469	$10,756.42	$14,247.57	1.325
1–3 payment HCCs	17,096	$18,950.02	$20,652.42	1.090
4–6 payment HCCs	10,360	$30,819.80	$31,403.24	1.019
7–9 payment HCCs	4,028	$51,921.49	$44,486.52	0.857
10+ payment HCCs	1,930	$77,428.88	$63,298.75	0.818
		2020 ESRD Model		
Entire sample	36,883	$27,231.59	$27,279.17	1.002
0 payment HCCs	3,469	$10,756.42	$14,250.36	1.325
1–3 payment HCCs	17,096	$18,950.02	$20,673.08	1.091
4–6 payment HCCs	10,360	$30,819.80	$31,475.84	1.021
7–9 payment HCCs	4,028	$51,921.49	$44,685.99	0.861
10+ payment HCCs	1,930	$77,428.88	$63,929.34	0.826

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-88
Predictive ratios by count of payment conditions: Non-aged functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
Entire sample	61,397	$23,411.83	$23,418.07	1.000
0 payment HCCs	7,951	$10,058.41	$11,042.41	1.098
1–3 payment HCCs	29,575	$17,114.63	$17,666.66	1.032
4–6 payment HCCs	15,636	$28,302.14	$28,958.86	1.023
7–9 payment HCCs	5,749	$43,991.95	$41,956.89	0.954
10+ payment HCCs	2,486	$71,543.77	$61,422.79	0.859
		2020 ESRD Model		
Entire sample	61,397	$23,411.83	$23,455.50	1.002
0 payment HCCs	7,951	$10,058.41	$11,043.62	1.098
1–3 payment HCCs	29,575	$17,114.63	$17,670.87	1.033
4–6 payment HCCs	15,636	$28,302.14	$28,987.10	1.024
7–9 payment HCCs	5,749	$43,991.95	$42,062.85	0.956
10+ payment HCCs	2,486	$71,543.77	$61,924.64	0.866

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-89
Predictive ratios by count of payment conditions: Full benefit dual functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
Entire sample	27,855	$30,081.30	$26,746.45	0.889
0 payment HCCs	2,741	$12,860.76	$12,405.04	0.965
1–3 payment HCCs	12,710	$20,831.96	$19,417.87	0.932
4–6 payment HCCs	7,632	$32,586.72	$30,593.58	0.939
7–9 payment HCCs	3,211	$52,936.76	$43,647.70	0.825
10+ payment HCCs	1,561	$84,143.75	$63,834.29	0.759
		2020 ESRD Model		
Entire sample	27,855	$30,081.30	$26,921.79	0.895
0 payment HCCs	2,741	$12,860.76	$12,410.06	0.965
1–3 payment HCCs	12,710	$20,831.96	$19,452.19	0.934
4–6 payment HCCs	7,632	$32,586.72	$30,747.23	0.944
7–9 payment HCCs	3,211	$52,936.76	$44,043.47	0.832
10+ payment HCCs	1,561	$84,143.75	$65,233.72	0.775

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-90
Predictive ratios by count of payment conditions: Partial benefit dual functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
Entire sample	11,339	$25,364.84	$25,281.54	0.997
0 payment HCCs	1,226	$12,744.68	$12,574.98	0.987
1–3 payment HCCs	5,422	$17,538.95	$19,165.79	1.093
4–6 payment HCCs	3,026	$30,026.59	$30,094.72	1.002
7–9 payment HCCs	1,167	$48,303.93	$43,019.34	0.891
10+ payment HCCs	498	$72,396.29	$62,763.06	0.867
		2020 ESRD Model		
Entire sample	11,339	$25,364.84	$25,293.65	0.997
0 payment HCCs	1,226	$12,744.68	$12,574.98	0.987
1–3 payment HCCs	5,422	$17,538.95	$19,169.04	1.093
4–6 payment HCCs	3,026	$30,026.59	$30,100.50	1.002
7–9 payment HCCs	1,167	$48,303.93	$43,049.05	0.891
10+ payment HCCs	498	$72,396.29	$62,916.39	0.869

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-91
Predictive ratios by count of payment conditions: Non-dual functioning graft continuing enrollees

Number of payment HCCs	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
		2019 ESRD Model		
Entire sample	66,344	$23,843.30	$24,308.86	1.020
0 payment HCCs	8,252	$9,568.88	$12,019.04	1.256
1–3 payment HCCs	31,835	$17,296.62	$18,627.43	1.077
4–6 payment HCCs	17,294	$28,990.77	$29,761.93	1.027
7–9 payment HCCs	6,189	$46,151.05	$42,832.53	0.928
10+ payment HCCs	2,774	$72,751.90	$61,496.72	0.845
		2020 ESRD Model		
Entire sample	66,344	$23,843.30	$24,327.14	1.020
0 payment HCCs	8,252	$9,568.88	$12,020.69	1.256
1–3 payment HCCs	31,835	$17,296.62	$18,632.14	1.077
4–6 payment HCCs	17,294	$28,990.77	$29,776.65	1.027
7–9 payment HCCs	6,189	$46,151.05	$42,881.47	0.929
10+ payment HCCs	2,774	$72,751.90	$61,708.72	0.848

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-92
Predictive ratios by post-graft factor: Functioning graft community continuing enrollees

Post-graft factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 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

NOTE:
1. Kidney disease group omitted from count of payment HCCs for both the 2019 and 2020 ESRD models 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 5-93
Predictive ratios by post-graft factor: Functioning graft institutional continuing enrollees

Post-graft factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	906	$51,704.15	$51,722.00	1.000
Aged < 65, 4–9 months since transplant	*			
Aged < 65, 10+ months since transplant	325	$52,923.88	$55,418.51	1.047
Aged 65+, 4–9 months since transplant	*			
Aged 65+, 10+ months since transplant	563	$51,146.61	$49,246.97	0.963

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 ratios by post-graft factor: Functioning graft new enrollees

Post-graft factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
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
2020 ESRD Model				
Entire sample	6,779	$22,921.40	$22,922.77	1.000
Aged < 65, 4–9 months since transplant	1,181	$32,198.55	$36,454.65	1.132
Aged < 65, 10+ months since transplant	3,872	$22,683.24	$21,643.27	0.954
Aged 65+, 4–9 months since transplant	146	$32,535.57	$37,162.86	1.142
Aged 65+, 10+ months since transplant	1,580	$20,181.24	$20,385.19	1.010

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

Table 5-95
Predictive ratios by kidney transplant factor: Kidney transplant enrollees

Kidney transplant factor	Sample size	Mean actual expenditure	Mean predicted expenditure	Predictive ratio (Ratio predicted to actual)
2019 ESRD Model				
Kidney transplant month 1	9,606	$41,260.76	$41,260.76	1.000
Kidney transplant month 2	9,405	$7,274.64	$6,126.29	0.842
Kidney transplant month 3	9,246	$4,958.20	$6,126.29	1.236
Kidney transplant months 2 and 3	8,481	$12,096.78	$12,252.58	1.013
2020 ESRD Model				
Kidney transplant month 1	9,606	$41,260.76	$41,260.76	1.000
Kidney transplant month 2	9,405	$7,274.64	$6,126.29	0.842
Kidney transplant month 3	9,246	$4,958.20	$6,126.29	1.236
Kidney transplant months 2 and 3	8,481	$12,096.78	$12,252.58	1.013

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