## Section RS Advanced Notice Part I Risk Model

## Background on Part C model

The CMS-HCC Part C risk adjustment model is used to calculate risk scores that adjust capitated payments made for aged and disabled beneficiaries enrolled in Medicare Advantage (MA) plans and certain demonstrations. A risk score represents a beneficiary’s expected medical cost relative to the average expected medical cost of beneficiaries entitled to Part A and enrolled in Part B, excluding those beneficiaries who are in End Stage Renal Disease (ESRD) or hospice status. For beneficiaries who are enrolled in a Medicare Advantage plan, and who are not in ESRD status, risk scores are calculated with distinct sets of coefficients depending on which segment, or group of beneficiaries, a beneficiary is assigned to. There are eight segments in total:

* New enrollees (those with less than 12 months of Part B enrollment in the data collection year)
* Continuing enrollees (those with 12 months of Part B enrollment in the data collection year) who are residing in the community in the payment month, with six different segments depending on whether they are entitled to Medicare due to age or disability (based on age as of February 1 of the payment year) and depending on whether they are full-benefit dual, partial-benefit dual, or non-dual (based on the payment month)
* Continuing enrollees who are in a long-term institutional stay (based on the payment month).

Coefficients are estimated for each segment separately to reflect the unique cost and utilization patterns of beneficiaries within the segment.

The CMS-HCC risk adjustment model is prospective in that it uses health status in a base year (i.e., data collection year) to predict a beneficiary’s annual expected cost in the following year (payment year). Coefficients for continuing enrollees are estimated using cost from Original Medicare beneficiaries entitled to Part A and enrolled in Part B by regressing the total expenditures for Part A and B benefits for each beneficiary onto their demographic factors, condition categories (as indicated by their diagnoses), and interaction terms (combinations of conditions and/or demographic factors). Resulting dollar coefficients represent the marginal (additional) cost of the condition categories, demographic factors (for example, age/sex group), and interaction terms. We divide each dollar coefficient by the average annual expected cost of beneficiaries entitled to Part A and enrolled in Part B in a specific year (the “denominator year”) to create relative factors. The relative factors are the marginal expected cost of a condition or model variable relative to the average expected cost in Fee-For-Service (FFS). The sum of relative factors assigned to a beneficiary is the risk score and the average FFS risk score is set at 1.0 in the denominator year. In payment year 2019, the denominator used to create relative factors for all segments of the CMS-HCC model is $9,367.34 and is calculated using a 2015 cohort of FFS beneficiaries (2014 diagnoses).

The community and institutional segments have the same age/sex variables and Hierarchical Condition Categories (HCCs), with some differing interaction terms. CMS, in consultation with a panel of outside clinicians, creates HCCs by grouping ICD-9 diagnosis codes into condition categories, such that each condition category comprises diagnoses with similar clinical characteristics and cost implications. All ICD-9 diagnosis codes are grouped into at least one condition category. However, not all condition categories are included in the risk adjustment model for payment. In a final step, hierarchies are imposed on some sets of condition categories to ensure that more severe and costly forms of a condition have a coefficient of at least the same or higher value than conditions that are less severe. Hierarchies also ensure that when a beneficiary develops a more severe manifestation of a condition in a hierarchy within the data collection period, credit is not given for both conditions in the hierarchy.[[1]](#footnote-2)

## 21st Century Cures Act

Section 1853(a)(1)(I)(i)(I) of the Social Security Act (42 U.S.C. 1395w–23(a)(1)(I)(i)(I)), as added by section 17006(f) of the 21st Century Cures Act (Pub. L. 114-255), requires us to make improvements to Risk Adjustment for 2019 and subsequent years. The agency is, among other things,[[2]](#footnote-3) specifically directed to:

* Evaluate the impact of including in the risk adjustment model:

(1) Additional diagnosis codes related to mental health and substance use disorders, and   
(2) Including the severity of chronic kidney disease.

* Take into account the total number of diseases or conditions of an individual enrolled in an MA plan by making an additional adjustment as the number of diseases or conditions of an individual increases.
* Phase-in any changes to risk adjustment payment over a 3-year period, “beginning with 2019, with such changes being fully implemented for 2022 and subsequent years.”

In response to these requirements, we are proposing the following changes to the CMS-HCC Risk Adjustment model that is used to pay for aged and disabled beneficiaries enrolled in MA plans, including Medicare-Medicaid Plans (MMPs):

1. Add the following condition categories (HCCs) to the model:
   * Drug Abuse, Uncomplicated, Except Cannabis (HCC 56),
   * Reactive and Unspecified Psychosis (HCC 58 -- the current HCC 58 will be renumbered as HCC 59),
   * Personality Disorders (HCC 60),
   * Chronic Kidney Disease, Moderate (Stage 3) (HCC 138)
2. Add selected drug and alcohol “poisoning” (overdose) codes to existing “Drug/Alcohol Dependence,” to create “Drug/Alcohol Dependence, or Abuse/Use with Complications” (HCC 55).
3. Add new factors to the six community and single long term institutional (LTI) segments that take into account a beneficiary’s number of conditions that are in the payment model.

In conjunction with the implementation of the CMS-HCC Risk Adjustment model revisions required by the 21st Century Cures Act, CMS proposes to make the following changes under section 1853(a)(1)(C) of the Social Security Act:

1. Update the data years used to calibrate the model. The model implemented for payment year 2017 and maintained in payment year 2018 was calibrated with 2013 diagnoses predicting 2014 Fee-For-Service (FFS) costs. The model proposed in this notice is calibrated with 2014 diagnoses predicting 2015 FFS costs. The more recent data years ensure current diagnosis and cost patterns are better reflected in the updated model. While 2015 diagnosis and 2016 FFS cost data were available, we elected not to update the data years to 2015/2016, because we did not expect the diagnosis coding pattern in 2015, which was the first year ICD-10 diagnoses were implemented, to be sufficiently stable for use in model calibration.
2. Select 2014 diagnoses for calibration using the same approach we use to filter encounter data records. Specifically, in the models discussed in this Notice, we selected 2014 diagnoses that met CMS filtering criteria: diagnoses submitted on professional claims had to have a risk adjustment allowable CPT/HCPCS code;[[3]](#footnote-4) diagnoses submitted on outpatient claims had to have a risk adjustment allowable CPT/HCPCS code and type of bill; and diagnoses submitted on inpatient claims had to have a risk adjustment eligible type of bill. The following institutional types of bill were considered eligible:
   * For inpatient records 11x or 41x
   * For outpatient records 12x, 13x, 43x, 71x, 73x, 76x, 77x, or 85x

In addition to evaluating additional diagnosis codes related to mental health, substance use disorder, and Chronic Kidney Disease, and making an additional adjustment as a beneficiary’s number of diseases or conditions increased, the 21st Century Cures Act also requires that, with respect to individuals dually eligible for Medicare and Medicaid, we make separate adjustments for each full-benefit dual eligible individual. We believe that splitting the community segment of the CMS-HCC model into six segments based on duals status, which was first done in payment year 2017, fulfills the directive established in the 21st Century Cures Act. We therefore, interpret this provision to allow us to continue to incorporate the changes that we made to the model starting in payment year 2017 that make explicit separate adjustments for full-benefit dual eligible individuals in the community. In continuing to use these changes, we have included in the proposed “Payment Condition Count” model additional HCCs in each segment, and have separately estimated additional adjustments as a beneficiary’s number of diseases or conditions increases for each segment of the model, including those who are full-benefit dual eligible. Thus, we are not proposing changes to the treatment of Medicaid status in the model for payment year 2019.

### **Clinical Evaluations**

To meet the requirements of the 21st Century Cures Act, we evaluated substance use disorder and mental health-related condition categories, and the four chronic kidney disease condition categories. We also reviewed subsets of diagnosis codes in other condition categories with clinical concepts (e.g., poisoning codes that indicated drug or alcohol overdose) that overlapped with the condition categories we evaluated.

Three criteria for assessing when and whether certain condition categories should be added to the model were adapted from the ten criteria that guided development of the original CMS-HCC risk adjustment model. We especially focused on criteria that guided the creation and ongoing assessment of the HCC classification system.[[4]](#footnote-5) Substance use disorder, mental health, and chronic kidney disease condition categories were evaluated against three criteria to determine if they should be in the model for payment:

1. ***The condition category should be clinically meaningful***. The group of diagnoses mapped to a condition category should relate to a reasonably well-specified disease or medical condition that defines the overall category. Condition categories should also include diagnoses that have similar levels of severity and expected costs over time.
2. ***The condition category should predict medical expenditures***. The condition category should produce a reasonable and statistically significant estimate of medical expenditures for Medicare Part A and B benefits. This assessment would include the number of people with the condition category, the level of predicted cost and whether it would have much effect on risk scores. In addition, we reviewed the accuracy of the prediction for people with the condition category; adding a condition category to the model should improve the accuracy of prediction for beneficiaries with that condition. However, a condition category may not need to be added to the model if the condition categories in the model already predict well for beneficiaries with that condition.
3. ***The condition category should not comprise discretionary diagnoses***. The condition category should include diagnoses where there is minimal clinical discretion and that are indicative of meaningful disease burden. The diagnoses included for payment typically are chronic conditions that can be diagnosed definitively.

For the conditions we were directed to review, we also evaluated whether subsets of diagnoses in existing condition categories that are not in the 2017 CMS-HCC model could be regrouped with another condition category that was already in the model, or become a new HCC that met our model inclusion criteria. By splitting HCCs that are currently not clinically meaningful, or that include discretionary diagnoses, we produced new HCCs that were more clinically specific and better predicted medical expenditures, and thus would be more likely to meet our model inclusion criteria. Each HCC was evaluated initially using a single combined community segment to assess inclusion, and then across the six community segments that are included in the 2017 risk adjustment model to assess impacts. The community population is the largest segment of the FFS population comprising our model sample. We determined that assessing the predictive accuracy of these HCCs for this population was the most direct way to assess the impact on the Medicare Advantage program.

#### *Mental Health*

We determined which HCCs to classify as mental health by identifying all psychiatric diagnosis codes from ICD-9-CM/ICD-10-CM Chapter 5: Mental, Behavioral and Neurodevelopment Disorders, and also some related codes from the Suicide and Self-Inflicted Injury group of ICD-9 codes (E950-E959). After determining which diagnoses were classified as mental health, we identified the HCCs these diagnoses mapped to. Seven HCCs were classified as Mental Health in the existing CMS-HCC model diagnosis-to-HCC mappings.

Two HCCs classified as mental health are included in the 2017 CMS-HCC model:

1. HCC 57 Schizophrenia
2. HCC 58 Major Depressive, Bipolar, and Paranoid Disorders

Five HCCs classified as mental health are not included in the 2017 CMS-HCC model:

1. HCC 59 Reactive and Unspecified Psychosis
2. HCC 60 Personality Disorders
3. HCC 61 Depression
4. HCC 62 Anxiety Disorders
5. HCC 63 Other Psychiatric Disorders

For payment year 2019, we propose to add HCC 59 Reactive and Unspecified Psychosis and HCC 60 Personality Disorders to the CMS-HCC model. HCC 59, Reactive and Unspecified Psychosis is a mix of acute and chronic conditions that cover a range of psychotic episodes with varying duration. In many cases, the diagnoses associated with HCC 59 are related to, but do not meet, the full criteria for schizophrenia or other specific psychotic disorders. On average, costs for HCC 59 are under predicted by the 2017 CMS-HCC model updated with 2014 diagnoses predicting 2015 FFS cost in the community population. The predictive ratio is 0.833 across the six community segments. Since HCC 59 predicts higher cost than HCC 58 and is clinically similar to HCC 57, the hierarchy would be re-ordered (and renumbered) so that “Reactive and Unspecified Psychosis” is above “Major Depressive, Bipolar, and Paranoid Disorders.” The order of condition categories in a hierarchy indicates the severity of a condition category relative to other condition categories in the hierarchy. More severe conditions are placed higher in the hierarchy. This ensures the most severe manifestation of a disease process is predicting cost in the model. Once re-ordered, a beneficiary coded with both the new HCC 58 Reactive and Unspecified Psychosis and the renumbered HCC 59 Major Depressive Disorder, will only receive credit for HCC 58 in their risk score.

HCC 60 includes a variety of personality disorders that are clinically-related and well defined. When included in the model, the HCC predicts reasonable costs and the coefficient is statistically significant. Additionally, on average, costs for HCC 60 are underpredicted by the updated 2017 CMS-HCC model in the community population with a predictive ratio of 0.835 across the six community segments.

We are not proposing to include HCC 61, HCC 62, or HCC 63. HCC 61 includes a mix of long-term and short-term diagnoses, including a number of less severe conditions. When the current HCCs were developed, the ICD-9 code set distinguished major depressive disorder (HCC 58) from less severe depression (HCC 61). ICD-10 dropped this distinction among depression diagnoses, and HCC 61 now includes a mix of diagnoses with varying degrees of severity. In the updated 2017 CMS-HCC model, the predictive ratio for HCC 61 in the community population is 0.879 across the six community segments of the updated 2017 CMS-HCC model. When included in the model, HCC 61 predicts reasonable medical expenditures. However, given the range of treatments available for the diverse diagnoses that map to HCC 61, the coefficient for HCC 61 reflects an average cost with significant variation. In the future, when we prepare to calibrate a model with ICD-10 diagnoses, we will consider creating new HCCs using the ICD-10 diagnoses and we anticipate that the mental health HCCs will be reconfigured, allowing us to include the more severe conditions that currently map to HCC 61. Further, the predictive ratio for HCC 61 improves in the proposed “Payment Condition Count Model” to 0.887 across the six community segments, and in the discussed “All Condition Count Model” improves to 0.930 across the six community segments. HCC 62 and HCC 63 are not proposed because they have relatively low expected costs, and beneficiaries with these conditions are currently predicted accurately in the updated 2017 CMS-HCC model, with predictive ratios of 0.957 and 0.941 respectively across the six community segments of the updated 2017 CMS-HCC model. The predictive ratios for HCC 62 and HCC 63 as calculated with the proposed “Payment Condition Count Model” are similar to those calculated with the updated 2017 CMS-HCC model, with predictive ratios of 0.951 and 0.935 respectively. The predictive ratios for HCC 62 and HCC 63 in the discussed “All Condition Count Model” improve to 1.018 and 0.994 respectively across the six community segments. As proposed, all seven Mental Health HCCs would be in the same hierarchy, with a beneficiary being assigned only the highest HCC in the hierarchy for which they have a reported diagnosis code. HCC 60 would be the lowest HCC in the hierarchy considered for payment, and HCC 61 through HCC 63 would only be considered for payment when counting conditions in the “All Condition Count Model,” as discussed in more detail on pages 12 through 20.

#### *Substance Use Disorders*

There are three substance use disorder HCCs in the set of HCCs used to calibrate the 2017 CMS-HCC risk adjustment model. All ICD-9 diagnoses classified as substance abuse or dependence in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) are mapped to one of these HCCs.

Two substance use disorder HCCs are included in the 2017 CMS-HCC model:

1. HCC 54 Drug/Alcohol Psychosis
2. HCC 55 Drug/Alcohol Dependence

One substance use disorder HCC is not included in the 2017 CMS-HCC model:

1. HCC 56 Drug/Alcohol Abuse, Without Dependence

The substance use disorder HCCs form a hierarchy with psychosis at the top, dependence below psychosis, and nondependent abuse at the bottom. ICD-9 has separate diagnosis codes for substance abuse and substance-induced mental disorders. All substance-induced mental disorder ICD-9 diagnosis codes map to the higher payment HCC 54, Drug/Alcohol Psychosis. Dependence-level substance abuse ICD-9 diagnosis codes map to HCC 55 Drug/Alcohol Dependence. Non-dependent drug abuse ICD-9 diagnosis codes are currently not in the 2017 CMS-HCC model and map to HCC 56, Drug/Alcohol Abuse, Without Dependence.

For payment year 2019, CMS proposes to make two changes that will result in additional substance use disorder diagnoses being added to the model for payment. These changes better reflect the current ICD-10 diagnosis code classification, which bundles both the drug and level of dependence (dependence or abuse or use, unspecified) with the accompanying substance-induced disorder, if there is one.

1. We propose to add diagnoses to HCC 55 to better account for the costs related to accidental (unintentional) or undetermined overdose. Selected poisoning (overdose) codes for the following substances will be incorporated into HCC 55. HCC 55 will be renamed “Drug/Alcohol Dependence, or Abuse/Use with Complications” to reflect the inclusion of additional diagnoses, as well as the concepts introduced with the current ICD-10 code classification:

* Heroin
* Cocaine
* Opium and other opioids
* Methadone and other synthetic or unspecified narcotics
* Lysergide (LSD) and other or unspecified hallucinogens
* Psychostimulants
* Alcohol (ethanol)

1. We also propose to split HCC 56 into three HCCs, and include in the proposed model one of these HCCs: a new HCC 56 “Drug Abuse, Uncomplicated, Except Cannabis.” The other two additional HCCs, HCC 202 “Drug Use, Uncomplicated, Except Cannabis” and HCC 203 “Alcohol Abuse and Cannabis Use/Abuse, Uncomplicated, Non-Psychoactive Substance Abuse, and Nicotine Dependence,” would be excluded from the model for payment, but would be considered in the count of all conditions in the alternative model.

Including this new HCC 56 in the model and adding diagnoses to HCC 55 will allow the model to distinguish between psychoses due to substance abuse, complicated versus uncomplicated abuse, and specific substances abused. These proposed revisions would more comprehensively capture clinically significant substance use disorder diagnoses in the CMS-HCC model, including those related to opioids.

#### *Chronic Kidney Disease*

Chronic Kidney is identified by five stages of severity. Stage 1 indicates the lowest level of severity and Stage 5 indicates the highest level of severity.

Two stages of Chronic Kidney Disease are included in the 2017 CMS-HCC model:

* HCC 136 Chronic Kidney Disease, Stage 5
* HCC 137 Chronic Kidney Disease, Severe (Stage 4)

Three stages of Chronic Kidney Disease are not included in the 2017 CMS-HCC model:

* HCC 138 Chronic Kidney Disease, Moderate (Stage 3)
* HCC 139 Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)

The stage of Chronic Kidney Disease is diagnosed based on the glomerular filtration rate (GFR). In addition to GFR, there are albuminuria categories that indicate level of risk. Stage 3 is unique in that there are two levels, Stage 3a and 3b. Stage 3a is generally considered mild to moderate in terms of severity and is diagnosed based on a GFR of 45-59. Stage 3b is considered moderate to severe and is diagnosed based on a GFR of 30-44. Both Stage 3a and Stage 3b include categories of albuminuria that indicate low to high risk individuals. However, there is a single diagnosis code for Stage 3 (N183 *Chronic kidney disease, stage 3 (moderate)* in ICD-10; 5853 *Chronic kidney disease stage III* in ICD-9).[[5]](#footnote-6) According to the United States Renal Data System 2016 Annual Report on Chronic Kidney Disease, about half of Stage 3 patients saw a nephrologist in 2014.[[6]](#footnote-7) We note that HCC 138 is already predicted well by the updated 2017 CMS-HCC model, with a predictive ratio of 0.938. Since Chronic Kidney Disease Stage 3 is well specified, and for many beneficiaries will indicate significant medical expenditures, CMS proposes to include HCC 138 for payment in the CMS-HCC model. Including HCC 138 in the model ensures that beneficiaries with HCC 138 remain well predicted, however as observed, including HCC 138 does not substantially increase predicted cost.

Note that, when a condition count variable is added to the model in such a way that the count variables are positive, the coefficients for all HCCs decrease, and in the discussed “All Condition Count” model, the coefficient for HCC 138 becomes negative and is constrained to zero across all segments. While HCC 138 does not predict additional marginal cost in the “All Condition Count” model, because predicted cost for a beneficiary is the sum of all model factors, the discussed “All Condition Count Model” accurately predicts the total annual cost for beneficiaries with HCC 138. Across all community segments, the predictive ratio for beneficiaries with HCC 138 is 1.016. In the proposed “Payment Condition Count Model” the predictive ratio is 1.001.

HCC 139, which includes Chronic Kidney Disease Stage 1, 2, and unspecified, does not meet our criteria of clinical meaningfulness, since there are a wide range of diagnoses mapped to the HCC that vary in severity. Further, the predictive ratio for HCC 139 across the six community segments of the updated 2017 CMS-HCC model is 0.915. While HCC 139 is predicted sufficiently well across the six community segments of the updated 2017 CMS-HCC model, it is not as well predicted as HCC 138. The additional underprediction of HCC 139 is the result of unspecified chronic kidney disease, which is likely a more severe manifestation of chronic kidney disease that has not been coded to specificity. We do not propose including HCC 139 for payment in the CMS-HCC model for two reasons: (1) our intention is to encourage specific coding, and (2) the HCC includes such a wide range of severity levels that the actual cost of many conditions that fall into this HCC would not be predicted well by the average expected cost of conditions mapped to this HCC. In the proposed “Payment Condition Count” model, the predictive ratio of for HCC 139 remains similar to the updated 2017 CMS-HCC model with a predictive ratio of 0.912 and, in the discussed “All Condition Count” model, the predictive ratio for HCC 139 improves to 0.956.

### Taking Into Account the Number of Conditions of an Individual

We interpreted the statutory requirement to “take into account the total number of diseases or conditions of an individual" to mean that, in addition to the increase in the risk score that occurs today for each additional condition in the payment model that a beneficiary has, the CMS-HCC risk adjustment model should also account for the number or *count* of conditions a beneficiary has. Since the model is already additive, and already effectively providing an adjustment as the number of conditions increases, this requirement means that payment conditions are taken into account in two different ways in CMS-HCC models that have count variables: once with a coefficient for the specific condition included in the model, and a second time with a coefficient for a variable that counts the number of conditions a beneficiary has. When a count of conditions is introduced into the CMS-HCC model, the total predicted expenditures for each beneficiary would be the result of demographic variables, the specific conditions the beneficiary has that are in the model, as well as the count of the number of conditions that the beneficiary has.

#### *Initial Model Research*

To assess how to add a count of conditions to the model, we initially estimated over twenty different models using a single community segment and the set of 79 HCCs included in the 2017 CMS-HCC model. These models were calibrated using 2014 diagnoses predicting 2015 costs for a FFS population, and were compared to a single community segment that was also calibrated with 2014 diagnoses predicting 2015 FFS cost and without condition count variables. We estimated a number of models that varied by (a) which HCCs were counted: either the conditions in the 2017 CMS-HCC model (“payment conditions”), or all conditions (which includes both payment conditions plus non-payment conditions); and (b) how the conditions were counted: either a single continuous integer count variable (i.e., a coefficient C that is applied by multiplying it by the number of conditions a beneficiary has, for example, a beneficiary with 1 condition has 1 x C, a beneficiary with 2 conditions had 2 x C, etc.), individual dummy variables (individual coefficients estimated separately for 1, 2, 3, 4 conditions etc.), variables for grouped ranges of counts (a coefficient estimated for 0-3, 4-6, 7-10 conditions etc.), or a single variable for more than a specified number of conditions (a coefficient estimated for 5+, 10+, etc.). Because the model development work was conducted in parallel to the evaluation of the mental health, substance use disorder, and Chronic Kidney Disease HCCs, we utilized the current version of the HCCs, which include 79 payment HCCs, and 201 total HCCs, of which 186 are conditions. Hierarchies were applied prior to counting conditions, which is the same as when we calculate risk scores today: if a beneficiary was coded with multiple conditions in the same hierarchy, then only the most severe manifestation of the condition was attributed to the risk score.

In our initial research, models that counted “payment conditions” included 79 condition categories (HCCs) in the count, and models that counted “all conditions” included 186 out of 201 condition categories in the count. All ICD-9 diagnosis codes (which were used in the model calibration) are mapped to a condition category, which are groupings of clinically similar diagnosis codes. However, not all condition categories are unique conditions, and some are not conditions. Therefore, some “non-payment” condition categories (i.e., conditions not included in the payment model) are not counted in the “all conditions” model. Some diagnosis codes are symptoms resulting from a condition, are causes of conditions, are treatments or devices, indicate a status, or indicate a history of disease rather than a current condition. The HCCs that these “non-condition” diagnosis codes map to were excluded from the count of all conditions. Further, one HCC was duplicative of other condition categories. Thus, in order to count only unique conditions, we excluded 18 non-payment HCCs from the count of all conditions in the discussed “All Condition Count” model. Table 1 lists the 18 condition categories that were excluded from the discussed “All Condition Count” model, along with the reason for their exclusion. The list of 18 non-payment HCCs in Table 1 includes the 15 non-payment HCCs we originally excluded in our research.

**Table 1: HCCs excluded when counting all conditions**

| **HCC** | **HCC Label** | **Reason for exclusion** |
| --- | --- | --- |
| 20 | Type I Diabetes Mellitus | Duplicate condition category. Beneficiaries coded with this condition will also be mapped to HCC 17 Diabetes with Acute Complications, HCC 18 Diabetes with Chronic Complications or HCC 19 Diabetes without Complication. |
| 132 | Kidney Transplant Status | These condition categories indicate ESRD status. Beneficiaries with ESRD status receive a risk score calculated using a separate model. |
| 133 | End Stage Renal Disease (ESRD) |
| 178 | Major Symptoms, Abnormalities | These two condition categories are symptoms, not diseases or conditions. The condition causing the symptom would be captured in an HCC that is already included in the count. |
| 179 | Minor Symptoms, Signs, Findings |
| 185 | Major Organ Transplant (procedure) | These condition categories are treatments or devices, not diseases or conditions. |
| 191 | Post-Surgical States/Aftercare/Elective |
| 192 | Radiation Therapy |
| 193 | Chemotherapy |
| 194 | Rehabilitation |
| 195 | Screening/Observation/Special Exams |
| 196 | History of Disease | This condition category does not represent active disease. |
| 197 | Supplemental Oxygen | These condition categories are treatments, devices, or causes of conditions, not diseases or conditions. |
| 198 | CPAP/IPPB/Nebulizers |
| 199 | Patient Lifts, Power Operated Vehicles, Beds |
| 200 | Wheelchairs, Commodes |
| 201 | Walkers |
| 204 | External Causes of Morbidity, Except Self-Inflicted Injury |

#### *Initial Model Evaluation*

We evaluated the performance of each model using several approaches, including comparing parameter estimates, the R-squared of each model, and the mean absolute prediction error for individual conditions and the model overall. However, primarily we evaluated predictive ratios, a measure of accuracy calculated by dividing predicted cost by actual cost for subgroups of beneficiaries in the population.[[7]](#footnote-8) We typically look at predictive ratios for deciles of predicted risk (all beneficiaries in the model sample sorted into ten equal groups by predicted cost), and continued to do so in this research. Also, because we believe the 21st Century Cures Act was focused on improving risk adjustment for beneficiaries with multiple chronic conditions, as discussed by stakeholders who submitted comments to the Senate Chronic Care Work Group, we evaluated how well the models predicted cost for beneficiaries with multiple chronic conditions.[[8]](#footnote-9)

In order to assess the model performance for beneficiaries with multiple chronic conditions, we needed to identify beneficiaries’ chronic conditions. The lack of a unanimous definition for “chronic condition” required empirical analyses and clinical judgment to determine which conditions within the condition categories (HCCs) to count as chronic. With the methods outlined below, each unique condition and condition category – a grouping of clinically similar ICD-9 diagnosis codes – was classified as chronic or non-chronic.

1. First, we weighted each ICD-9 code in each unique health condition category by the number of beneficiaries in our model sample with that ICD-9 code. We then identified which diagnoses were chronic with the AHRQ HCUP Chronic Condition Indicator (CCI).[[9]](#footnote-10) CCI categorizes each ICD-9-CM diagnosis code as either chronic or non-chronic. In some cases many diagnosis codes map to a single HCC, and while diagnoses within an HCC are clinically similar, not all diagnoses in an HCC were considered chronic by AHRQ’s Chronic Condition Indicator. For each HCC we counted, the count of unique beneficiary-chronic ICD-9 code combinations was divided by the total count of unique beneficiary- ICD-9 code combinations within an HCC based on the Medicare 2014 community sample. When the resulting percentage was larger than 51%, the condition category was classified as chronic.
2. The second empirical method relied on the duration of a condition to determine its chronicity. The number of individuals with a condition category in two consecutive years (Medicare 2013-2014 sample) was divided by the number of individuals with the condition category in the base year, 2013. Condition categories were categorized as chronic when more than 51% of beneficiaries with the HCC were coded in 2013 and 2014.
3. The third empirical method compared the coefficient for the condition category using a prospective model to the coefficient using a concurrent model. Prospective models use demographic information and diagnoses collected in a base year (2014) to predict medical expenditures in the following year (2015). They tend to emphasize the influence of chronic conditions on costs, whereas concurrent models use diagnoses and expenditures from the same year (2015) and reflect the costs of acute health events. If the ratio of prospective to concurrent coefficient was larger than 0.8, a condition category was considered chronic.
4. In the event that there was disagreement in the categorization of a condition among empirical methods, CMS sought the input of clinicians to make the final determination.

This method resulted in our determination that 122 out of the total number of HCCs (204 – three non-payment HCCs were created as a result of the evaluation) were chronic. Of the 186 conditions that are counted in the discussed “All Condition Count” Model, 116 are chronic conditions. Seventy-six percent of the model sample was determined to have three or more chronic conditions and 54% of the model sample was determined to have five or more chronic conditions. In the proposed “Payment Condition Count,” model 64 of the 83 payment HCCs are considered chronic.

In our initial model evaluation, none of the models that counted either payment conditions or all (payment and non-payment) conditions consistently improved all evaluation statistics relative to the base model. In general, each of the condition count models resulted in a small increase in R-squared, a slight reduction in the mean average prediction error, and some improvement in the predictive accuracy of the model for beneficiaries with a high number of chronic conditions. We selected for further evaluation the model that most improved predictive accuracy for each of the two types of model: one model that counted all conditions, and one model that counted only payment conditions. We determined which model in each category performed best by comparing the number of deciles of predicted risk with predictive ratios that improved (closer to 1.0), and whether or not the predictive ratio for beneficiaries with three or more chronic conditions improved.

After selecting two models, we calibrated seven full risk segments with condition count variables (six community and one Long Term Institutional) and again assessed whether or not the model improved accuracy relative to the 2017 CMS-HCC model with updated data years and no condition count variables. For each model and segment, we evaluated model performance by assessing the number of deciles with a predictive ratio closer to 1.0, and whether or not the predictive ratio for beneficiaries with different counts of chronic conditions was closer to 1.0.

#### *Final Model Specifications*

In the two HCC count models we evaluated, count variables are included in addition to the demographic and HCC variables. Like all of the other variables in the CMS-HCC models, the count variables are dummy variables, meaning that a beneficiary either meets the criteria for having the coefficient added to their risk score, or they do not. There are separate variables included in the models for different numbers of conditions that a beneficiary may have, and a coefficient is estimated from the subgroup of beneficiaries in the model sample with the specific count of conditions for each count variable in the model. For example, all beneficiaries with five conditions would receive a coefficient that is estimated independently of the coefficient for beneficiaries with six conditions.

By design, the average risk score in FFS is 1.0 regardless of which CMS-HCC model is used to calculate the risk score. When the model changes, costs are redistributed among the variables in the model. Coefficients for some variables will increase and some will decrease, but the result remains a model with an average FFS risk score of 1.0. Which variables’ coefficients will increase or decrease depends on how variables are correlated within the model. In the condition count models, there is correlation between the individual dummy count variables and the conditions in the model for payment. The degree of correlation varies by HCC count type (payment or all conditions). Correlation is stronger between “payment conditions” and the count of payment conditions than it is between “payment conditions” and the count of all conditions. Including individual dummy count variables starting from a count of one condition results in negative coefficients for the payment HCC count dummy variables across all segments, while the all-condition count dummy variables are positive for some segments. The negative coefficients for the count variables occur in order to set uniform coefficients for all beneficiaries with the same number of conditions, and are offset by higher coefficients for HCCs and other variables in the model in order to predict the same overall cost.

Although a model with negative coefficients would produce accurate risk scores, we are concerned that negative coefficients might create a disincentive to report diagnosis codes by suggesting that having more conditions could reduce predicted expenditures. In addition, we wanted to avoid scenarios where the risk score could actually decrease with the reporting of additional diagnoses. For example, in the all condition count model, if the coefficients for the count variables were negative, a beneficiary’s risk score would decrease as the number of non-payment HCCs increased. In the payment condition count model, it is possible that, with a negative count coefficient, the increase from the coefficient of an additional payment HCC could be less than the decrease from the next count variable. Our goal for the model is not only to predict accurately and reduce selection incentives, but also to encourage accurate and complete coding. Thus, we started the count variables in each segment of the model at a high enough number of conditions to result in positive coefficients for the count variables that were also statistically significant (t-statistic greater than two). In the discussed “All Condition Count Model,” the count variables begin with between one and eight conditions in the six community segments, and begin with 10 conditions in the long term institutional segment. In the proposed “Payment Condition Count Model,” the count variables begin with between four and six conditions in the six community segments, and begin with six conditions in the long term institutional segment. Where the count variables begin in each model segment was determined independently by iteratively dropping the lowest count variables until the minimum positive and statistically significant coefficient was reached. Effectively this is the same as starting the count at one, but constraining the coefficient for lower count variables to zero. Note that when the count variables start at a high enough number so that count variable coefficients are positive, the coefficients for many HCCs in the model are lower than in a model without count variables. This is because the model is predicting the same total cost and any variable that is correlated with the count variables must decrease in order to offset the positive coefficient for the count variable.

In addition to starting the condition count variables at more than one condition in some segments, we also capped the count variables, meaning that we did not include dummy variables up to the highest possible count of conditions in each segment. The last count variable in each model is for that number of conditions, plus any more. For example, in the proposed “Payment Condition Count” model, 10 conditions is the last dummy variable in each segment. It applies for 10 or more conditions.

We determined where to cap the count variables for each segment in the proposed “Payment Condition Count Model” and the discussed “All Condition Count Model” in this Notice with only statistical criteria. The count was stopped when the estimate was not statistically reliable – because either the sample size had become too small (less than 1,000 beneficiaries), or including an additional dummy variable in the count resulted in a coefficient for the highest dummy variable that was less than the coefficient for the second highest dummy variable (i.e., the count variable was no longer monotonically increasing).

Applying only the statistical criteria, the count for the all condition count model stops at between 27 and 32 conditions in the six community segments, and 38 conditions in the institutional segment. However, when the count increases to these levels, the coefficients for the individual HCCs decrease substantially. For example, in the non-dual aged segment of the discussed “All Condition Count” model, the HCC coefficients decreased by 42% on average. Further, 22 of the HCCs in this segment decreased by over 50%. When only the statistical criteria are applied, the cap for the “Payment Condition Count Model” is between 11 and 16 conditions in the six community segments, and 15 conditions in the institutional segment. The HCC coefficients in the non-dual aged segment of the payment condition count model decreased by nine percent on average, one HCC decreased by more than 50%.

We are concerned that if we included all count variables that met the statistical criteria, the clinical nature of the model would be significantly reduced. Risk adjustment is intended to account for the risk faced by plans when enrolling sicker beneficiaries, by differentiating payments for individual beneficiaries by the expected cost of the specific conditions that they have. This is intended to compensate plans for the cost of providing benefits to enrollees who are sicker. The CMS-HCC model is intended to compensate plans with additional funds that are aligned with the risk of their enrolled beneficiaries’ specific chronic conditions and with those conditions’ levels of severity. Including count variables in the model appears to differentiate levels of disease burden, given the number of conditions, but it may no longer be sufficient to differentiate relative expected cost differences between conditions when the coefficients for the individual condition categories are significantly reduced. For example, in the “All Condition Count Model,” beneficiaries with four severe conditions would receive the same adjustment as beneficiaries with four non-severe acute conditions. The additional amount added to the beneficiary’s risk score for having four conditions is only modestly tied to the actual medical conditions the beneficiary has (i.e., the average additional expected medical cost of all beneficiaries with four conditions is reflected in the coefficient). If emphasis in the model is placed on the count of conditions, the beneficiary’s risk score will instead be increased mainly by the number of the conditions he or she has, regardless of what those conditions are, and may or may not appropriately reflect the expected cost of providing care to that beneficiary.

We capped the count of conditions in the models lower than the statistical criteria would suggest to address several concerns with using only statistical, and not clinical, considerations. First, with the significant drop in HCC coefficients, and without having had enough time to fully evaluate the interaction between increasing the number of count variables and change in risk scores, we are concerned that including condition count variables that met only statistical considerations would result in wide swings in contract-level risk scores. Second, the clinicians with whom we consulted did not think it was clinically meaningful to distinguish between beneficiaries with, for example, 15 versus 38 conditions (the maximum number of conditions with at least 1,000 beneficiaries in the “All Condition Count Model”) when counting “All conditions,” because many of the conditions included in the “All Condition Count” model are non-severe and non-chronic. The clinicians concurred that after 15 conditions an individual is considered to be complex; each additional condition would not indicate a significant increase in the degree of clinical complexity and recommended that higher counts not be added to the count of conditions.

In the “Payment Condition Count” Model proposed in this Notice, we capped the count of conditions at 10 payment conditions. In the “All Condition Count Model” also discussed in this Notice, we capped the six community and single long term institutional segments at 15 conditions. With a cap on the condition count at 15 conditions, the HCC coefficients in the non-dual aged segment of the “All Condition Count” model decrease by 21% on average. Given the already severe and chronic nature of most payment conditions, the clinicians with whom we consulted did not think it was clinically meaningful to distinguish between 10 and 16 conditions (the maximum number of payment conditions with at least 1,000 beneficiaries) in the “Payment Condition Count” model for the same reasons explained on page 20. With a cap on the condition count at 10 conditions, the HCC coefficients in the non-dual aged segment of the payment condition count model decrease by three percent on average. When the cap on the count variables resulted in one of the count variables becoming either statistically insignificant or no longer monotonically increasing, we constrained the count variable to the coefficient for the previous count variable. For example, if the coefficient for seven conditions was lower than the coefficient for six conditions, the coefficient for seven conditions was constrained to the same value as the coefficient for six conditions.

### Improving Risk Adjustment

Section 17006(f), the provision of the 21st Century Cures Act amending the Part C risk adjustment requirements in section 1853(a)(1) of the Act, bears the heading, “Improvements to Risk Adjustment under Medicare Advantage;” we believe this evidences that the goal of these provisions is to improve risk adjustment by aligning the risk adjustment payments to the actual expected costs of providing care to enrollees. Section 1853(a)(3) directed, in connection with the initial development of methodologies to risk adjust payments to MA plans, that such adjustments “account[] for variations in per capita costs based on health status.” Therefore, the goal of the CMS-HCC risk adjustment model is to accurately differentiate between beneficiaries who have annual costs that are higher or lower than the average annual cost of providing Medicare Parts A and B benefits in the Original Medicare program. We interpreted the statute’s directive to improve risk adjustment to mean improving the accuracy of the risk adjustment model.

Adding a count of payment conditions improves the risk adjustment model by improving accuracy across deciles of predicted risk, by either decreasing over-prediction observed in some deciles or decreasing under-prediction in other deciles. However, this model slightly increases the under prediction for beneficiaries with five or more chronic conditions. Adding a count of all conditions improves predictive accuracy for beneficiaries with five or more chronic conditions, but reduces predicted accuracy for beneficiaries with fewer than 5 chronic conditions, and reduces predictive accuracy across almost all deciles of predicted risk (both low and high). Thus, overall, we consider the “All Condition” count model to reduce, rather than improve, the accuracy of risk adjustment.

In Tables 1 - 3 of the attachment, we provide predictive ratios – across the seven segments – for different versions of the CMS-HCC model:

* A model with updated data (2014 diagnoses selected with filtering logic applied as we do with encounter data, e.g., using CPT/HCPCS codes to identify risk adjustment eligible diagnoses on professional encounters, predicting 2015 costs), and additional mental health, substance use disorder, and chronic kidney disease HCCs;
* A model with updated data (2014 diagnoses selected with filtering logic applied as we do with encounter data, e.g., using CPT/HCPCS codes to identify risk adjustment eligible diagnoses on professional encounters, predicting 2015 costs), additional mental health, substance use disorder, and chronic kidney disease HCCs, and variables counting all conditions; and
* The proposed model with updated data (2014 diagnoses selected with filtering logic applied as we do with encounter data, e.g., using CPT/HCPCS codes to identify risk adjustment eligible diagnoses on professional encounters, predicting 2015 costs), additional mental health, substance use disorder, and chronic kidney disease HCCs, and variables counting payment conditions.

### Risk Score Impacts

In addition to evaluating the model accuracy, we assessed the impact on MA risk scores of adding count variables to the model. We first isolated the impact of adding count variables by comparing risk scores from the updated version of the 2017 CMS-HCC model to risk scores from the preliminary models with the two approaches to counting conditions. For models with non-payment conditions in the count variables, we included risk adjustment eligible diagnoses from encounter data as an additional source of diagnosis codes to amend the RAPS data used to calculate the risk scores under each model. Including diagnoses from encounter data allowed us to better estimate the payment impact since not all plans report non-model diagnoses to RAPS.

In isolation, adding either “Payment Condition” or “All Condition” count variables to the model did not change the mean MA risk score appreciably. However, at a contract level, the range of risk score impacts differs by model and the contract’s clinical profile, including how many conditions their enrollees have. In some cases, there is noticeable variation among risk scores for the same contract under each of the model approaches.

### CMS-HCC Risk Adjustment Model Proposal

For 2019, we propose to implement a model with additional HCCs for mental health, substance use disorder, and Chronic Kidney Disease, individual dummy variables counting payment conditions, and 2014 FFS diagnoses, selected using the same filtering logic that we apply to encounter data records, predicting 2015 FFS cost. We believe counting payment conditions (i.e., those conditions included in the 2017 model, plus the additional conditions we propose to include for payment in this Advance Notice) best meets the statute’s directive to improve risk adjustment. Further, we believe that this approach maintains stability in risk adjustment system.

We also believe that the risk adjustment requirements in section 1853(a)(1)(I) can be interpreted as all HCCs that are conditions. Thus, for payment year 2019, an alternative interpretation of the statutory requirement would be to count all conditions. We have also provided coefficients for another model that counts “All Conditions” so that stakeholders can comment on this interpretation. The “All Condition Count” model is calibrated with additional HCCs for mental health, substance use disorder, and Chronic Kidney Disease, individual dummy variables counting the 83 payment conditions in the proposed “Payment Condition Count” model plus 103 non-payment conditions, and 2014 diagnoses selected using the filtering logic applied to encounter data records predicting 2015 cost.

The conditions in the payment model tend to be more clinically severe and most are chronic conditions. As previously discussed, counting all conditions would count many conditions that do not meet our criteria to be included for payment. For example, there are “non-payment” condition categories for some infections that are acute, and would typically be treated and cured in a single course of therapy. If included in the model, the predicted cost would not be substantive or consistent over time. Thus, we would not expect such an HCC to predict cost accurately in a prospective model. Further, between the two models that count conditions, counting only payment conditions would better maintain the clinical nature of the model.

Three sets of model coefficients can be found in Attachment 1:

1. The proposed model with count variables for payment conditions,
2. A model that is identical to the proposed model, but with count variables for all conditions, and
3. For comparison, a model without count variables, but with updates to the 2017 CMS-HCC model based on our authority under section 1853(a)(1)(C)(i):

* Adding additional HCCs for mental health, substance use disorder, and Chronic Kidney Disease,
* Using 2014 diagnoses to predict 2015 costs, and
* Using diagnoses selected using the filtering logic applied to encounter data records.

### Three Year Phase-In (2019-2022)

The 21st Century Cures Act requires that any changes to risk adjusted payments under section 1853(a)(1)(C)(i) resulting from the implementation of section 1853(a)(1)(I) must be phased-in over a 3-year period, beginning with 2019, with such changes being fully implemented for 2022 and subsequent years. The statute thus requires a three year phase-in over a four year period. Given this, we interpret the statute’s direction to mean that the proposed changes to the risk adjustment model under section 1853(a)(1)(C)(i) resulting from the proposed implementation of section 1853(a)(1)(I) for 2019 could be implemented without the required provisions from section 1853(a)(1)(I), or could be implemented with provisions from section 1853(a)(1)(I) and further modified in 2020. The model finalized for 2020 would then be phased-in, in that modified form, over three years such that 100% of risk adjusted payments to Medicare Advantage organizations in 2022 are based on the risk adjustment model finalized for 2020.

For Payment Year 2019, we propose to begin implementation of proposed changes to the risk adjustment model by calculating risk scores by summing:

* 25% of the risk score calculated with the proposed “Payment Condition Count” CMS-HCC model with
* 75% of the risk score calculated with the 2017 CMS-HCC model.

Table 2 provides a proposed model phase-in schedule.

**Table 2: Proposed Model Phase-In Schedule**

|  | Proposed “Payment Condition Count” CMS-HCC model | 2017 CMS-HCC model |
| --- | --- | --- |
| 2019 | 25% | 75% |
| 2020 | 50% | 50% |
| 2021 | 75% | 25% |
| 2022 | 100% | NA |

We seek comment on which model – the “Payment Condition Count Model” or the “All Condition Count Model” – would be most appropriate to implement and why, and the criteria we should use when determining which model best improves risk adjustment. As explained above, we believe that the Payment Condition Count Model” is most consistent with the statutory intent and requirements. Comments on clinical considerations regarding the most appropriate model to adopt are also invited. We also note that we interpret the statutory language regarding the implementation timeline to authorize us to not change our risk adjustment model for 2019 or to implement changes based on our authority under section 1853(a)(1)(C)(i) (i.e., to begin the phase-in of section 1853(a)(1)(I) in 2020, after discussing the model changes in this CY2019 Advance Notice) and implement additional specifications in 2020. Specifically, we believe that the statutory language requiring us to phase-in the model over three years between 2019 and 2022 (i.e., a four year time period), may allow us to use the 2019 Advance Notice and comment process to collect comments and reconsider options to propose for 2020. We welcome comments on this approach as well.

## Encounter Data as a Diagnosis Source for 2019

For PY 2018, CMS calculated risk scores by adding 15% of the risk score calculated using encounter data and FFS diagnoses with 85% of the risk score calculated using RAPS and FFS diagnoses. For PY 2019, CMS proposes to calculate risk scores by adding 25% of the risk score calculated using diagnoses from encounter data and FFS diagnoses with 75% of the risk score calculated with diagnoses from RAPS and FFS diagnoses.

Specifically, we propose to calculate the encounter data-based risk scores as follows:

* With the proposed “Payment Condition Count” CMS-HCC model,
* Using diagnoses from encounter data and FFS, and amended (as an additional source) with RAPS inpatient diagnoses. CMS observes that Encounter Data inpatient submissions are low compared to corresponding RAPS inpatient submissions. Amending inpatient diagnoses from Encounter Data with inpatient diagnoses from RAPS will improve the completeness of the data for payment in 2019.

RAPS risk scores would be calculated as follows:

* With the 2017 CMS-HCC model,
* Using diagnoses from RAPS and FFS.

Thus, as proposed, encounter data based risk scores only would be calculated with only the “Payment Condition Count” model proposed in this Notice.

For PACE organizations for PY 2019, we propose to continue the same method of calculating risk scores that we have been using since PY 2015, which is to pool risk adjustment-eligible diagnoses from the following sources to calculate a single risk score (with no weighting): (1) encounter data, (2) RAPS, and (3) FFS claims. We are not proposing to change the model used to calculate risk scores for PACE organizations in PY 2019.

## Additional 21st Century Cures Act Risk Adjustment Requirements

The 21st Century Cures Act also requires CMS to evaluate the risk adjustment model, including the ESRD model. This initial evaluation, required to be completed by December 31st, 2018, will include a discussion of the model criteria that CMS uses to develop models and to determine incremental changes. These criteria, which are considered together, have been published in several publications, including “Risk Adjustment of Medicare Capitation Payments Using the CMS-HCC Model” (Pope, 2004)[[10]](#footnote-11) and our 2011 risk adjustment evaluation. As part of this effort, we will produce a wide range of predictive ratios, for various subgroups, including very high and very low cost enrollees, groups defined by the number of chronic conditions for enrollees, and for each condition category, similar to our 2011 evaluation.

1. While CMS maps ICD-10 codes to HCCs in order to calculate risk scores, the current HCCs were created using ICD-9 codes, meaning that the research conducted to determine which diagnoses should be grouped in each condition category was conducted using ICD-9 codes. Further, the models discussed in this Notice were calibrated using 2014 diagnoses (ICD-9 diagnoses) to predict 2015 costs. [↑](#footnote-ref-2)
2. In connection with MA payment policies, the 21st Century Cures Act also requires that the Secretary evaluate whether other factors should be taken into account in determining the capitation and risk adjustment payments for ESRD enrollees pursuant to section 1853(a)(1)(H). [↑](#footnote-ref-3)
3. For the list of allowable CPT/HCPCS codes in 2014, see <https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Risk-Adjustors-Items/CPT-HCPCS.html?DLPage=1&DLEntries=10&DLSort=0&DLSortDir=descending>. [↑](#footnote-ref-4)
4. 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):121-122, Summer, 2004. See also, “Evaluation of the CMS-HCC Risk Adjustment Model,” March 2011, available at <https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Evaluation_Risk_Adj_Model_2011.pdf>. [↑](#footnote-ref-5)
5. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Official Journal of the International Society of Nephrology. 3(1): 2013. Available at <http://www.kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_GL.pdf>. [↑](#footnote-ref-6)
6. 2016 USRDS Annual Data Report: Epidemiology of Kidney Disease in the United States. Volume 1: CKD in the United States. Available at <https://www.usrds.org/2016/download/v1_CKD_16.pdf>. [↑](#footnote-ref-7)
7. For additional discussion of the use of predictive ratios in the measuring performance of the risk adjustment model, please see “Evaluation of the CMS-HCC Risk Adjustment Model,” March 2011, available at <https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Evaluation_Risk_Adj_Model_2011.pdf>. [↑](#footnote-ref-8)
8. For background, see congressional testimony: “A Pathway to Improving Care for Medicare Patients with Chronic Conditions: Hearings before the Committee on Finance, Senate, 114th Cong. 1 (2015), and “The Bipartisan Chronic Care Working Group Policy Options Document” (December 2015) with related comments. [↑](#footnote-ref-9)
9. AHRQ. *Chronic Condition Indicator (CCI) for ICD-9-CM*. 4/11/2017], available at <https://www.hcup-us.ahrq.gov/toolssoftware/chronic/chronic.jsp>. [↑](#footnote-ref-10)
10. Pope, G. C., Kautter, J., Ellis, R. P., Ash, A. S., Ayanian, J. Z., Iezzoni, L. I., Robst, J. (2004). Risk Adjustment of Medicare Capitation Payments Using the CMS-HCC Model. Health Care Financing Review, 25(4), 119–141. [↑](#footnote-ref-11)