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Potential Updates to HHS-HCCs for the HHS-operated Risk Adjustment Program

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EXECUTIVE SUMMARY

The Department of Health and Human Services Hierarchical Condition Category (HHS-HCC) diagnostic classification is the foundation of the HHS-operated risk adjustment program for the individual and small group markets under section 1343 of the Patient Protection and Affordable Care Act (PPACA). The HHS risk adjustment model uses patient diagnoses and demographic information, in addition to enrollment duration and a limited number of drugs for adults, to predict plan liability for medical and drug spending.

The current HHS-HCC clinical classification, in place since 2014, was based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes. In October 2015, the U.S. implemented ICD-10-CM diagnosis codes. This paper considers potential

changes to the current HHS-HCC classification to better incorporate ICD-10 diagnosis codes. It is part of HHS's continued assessment of modifications to its HHS-operated risk adjustment program for the individual and small group markets based on analysis of more recent data. In this paper, we describe our methodology for reviewing and restructuring the HHS-HCC classification to incorporate ICD-10 diagnosis codes, using the 2016 and 2017 benefit years masked enrollee-level External Data Gathering Environment (EDGE) claims data, which reflect the first two full years of ICD-10 diagnosis coding. This work was conducted by the Centers for Medicare and Medicaid Services (CMS) with our contractor, RTI International.

To conduct this reclassification analysis, we took the following the steps:

1) Reviewed the current HHS-HCC full classification and risk adjustment model classification (V05), including an examination of disease groups with extensive ICD-10 classification changes, HCCs whose counts had changed considerably following ICD-10 implementation, clinical areas of interest (e.g., substance use disorders), and model under-prediction or over-prediction as identified by predictive ratios.

2) Examined HCC reconfigurations, payment HCC designation, HCC Groups, and hierarchies to develop the preliminary regression analyses using 2016 data (V06).[1]

3) Conducted a series of clinical review calls to inform potential changes, discuss diagnosis and treatment of conditions, and review the potential classification changes.

4) Reviewed the payment model and full classification regressions to compare frequencies and predicted incremental costs of HCCs.

5) Repeated the preliminary regression analyses on 2017 data, reviewed regression results, and developed the new potential (V06a) HHS-HCC reclassification.[2]

This paper focuses on discussing the rationale for potentially updating the classification of HHS-HCCs, including the details and reasoning for key potential HHS-HCC changes as a result of the analysis described above. Specifically, Section 1 of this paper provides the overview and purpose for updating the HHS-HCC diagnostic classification. Section 2 introduces the HHS-HCC diagnostic classification and identifies the criteria used in its formation and review. Section 3 describes the review and reclassification process. Section 4 presents the potential updates to the HHS-HCC classification referred to as V06a. This section includes an overview of changes, comparing V06a to the current V05 HHS-HCC classification, and discusses potential key changes that we are considering proposing for the HHS-HCC risk adjustment models in future rulemaking. Section 5 features summary statistics that summarize the overall impact of the current V05 to the potential V06a classification changes. Section 6 describes other potential model considerations (non-linear and count model specifications; and enrollment duration factors), and concludes with next steps.

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[1] Payment HCCs are those included in the HHS-HCC risk adjustment model. The full classification includes both payment and non-payment HCCs. HCC Groups refers to HCCs that are grouped together in the HHS-HCC risk adjustment model.
[2] To further clarify, V05 is the current classification model, V06 was our initial assessment of potential revisions to the classification model developed using the 2016 benefit year data, and V06a was our reassessment of potential revisions to the classification model that included 2017 benefit year data.

Table ES.1 presents a summarized list of the potential HHS-HCC updates. These potential changes include adding 14 new payment HCCs, splitting one existing HCC into two HCCs, deleting one payment HCC, and modifying several HCC Groups and HCC hierarchies.[3] The net effect of these potential changes from the current V05 classification to the potential V06a classification is an increase in the number of enrollees with one or more payment HCCs in the HHS-HCC adult and child models, and a slight decrease in the corresponding counts in the infant model.[4] These HCC updates also slightly improve model prediction and fit.

Our intention is to contemplate these types of HHS-HCC updates to the risk adjustment model for the 2021 benefit year or beyond in future rulemaking. Therefore, in preparation for these types of future changes, we wanted to describe the analyses underlying potential updates to the HHS-HCCs. We intend to solicit comment on these types of HHS-HCC changes when we propose to implement them in future rulemaking as part of annual model updates.

Table ES.1 Overview of Potential Changes across Adult, Child and Infant Models

Adult Model Specific Changes			
Payment HCC change	+17	-	Net change of 18 HCCs added and 1 HCC deleted.
Severe Illness Interactions	-1 (other model variable)	-	Remove medium cost severe illness interaction term from payment model because its parameter estimate is usually very low or negative.
Child Model Specific Changes			
Payment HCC change	+12	-	Net change of 13 HCCs added and 1 HCC deleted.
Transplant *A Priori* Constraints	N/A	-	Revise *a priori* constraints applied to the transplant HCCs to better distinguish costs while improving estimate stability due to small sample sizes.
Infant Model Specific Changes			
Payment HCC change	+8	-	Net change of 9 HCCs added and 1 HCC deleted.
Categorical Model	N/A	-	Revise Severity Level assignments of a subset of HCCs to better reflect clinical severity and costs and assign new HCCs to Severity Levels.
		-	Reconfigure code assignments to newborn HCCs for subset of codes whose weeks gestation classification in ICD-10 differed from ICD-9.

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[3] 3 existing payment HCCs are also being added to the adult models that are already in the child and infant models. See Section 4.1 for a more detailed description.

[4] Because the infant model is categorical, the severity level of HCCs is more important than the number of payment HCCs.

Table ES.2 Summary of V06a HHS-HCC Risk Adjustment Model Changes

Condition	Payment HCC Change	Summary of Changes
Payment HCC Changes		
Substance Use Disorders	+3	- Add 2 new HCCs for alcohol use disorders and 1 new HCC for lower severity drug use disorders. - Reconfigure drug dependence HCC to include drug use disorders with non-psychotic complications and a subset of drug poisoning (overdose) codes. - Impose a new combined hierarchy on drug use and alcohol use HCCs.
Pregnancy	+3	- Add 3 (ongoing) pregnancy-without-delivery HCCs, leaving them ungrouped in the adult model (to reflect differences in costs by level of complications) and grouping them in the child model (to address small sample sizes and unstable estimates). - Revise two existing pregnancy HCC Groups, separating out the ectopic/molar pregnancy HCC and the uncomplicated pregnancy-with-delivery HCC to better distinguish incremental costs.
Diabetes: Type 1	+1	- Add diabetes type 1 additive HCC to the adult payment model to distinguish additional costs for diabetes type 1. - Remap hyperglycemia and hypoglycemia codes from the "chronic complications" HCC to the "without complication" HCC.
Asthma	+1	- Split current payment asthma HCC into two severity-specific HCCs. - Continue to group asthma HCCs with chronic obstructive pulmonary disease HCC in adult model and leave the 3 HCCs ungrouped to distinguish costs in child model.
Fractures	-1 +1	- Delete a payment HCC (pathological fractures) to address a clinical distinction that may be inconsistently diagnosed/coded. - Reconfigure an existing payment HCC (hip fractures) to better distinguish fracture codes by site. - Add a new payment HCC (vertebral fractures) to better predict vertebral fractures, which may be indicative of chronic disease and frailty.
Third Degree Burns and Major Skin Conditions	+2	- Reconfigure and add 2 HCCs (extensive third degree burns; major skin burns or conditions) to the payment model. - Impose a hierarchy. - Impose an *a priori* constraint[5] between extensive third degree burns and severe head injury in child model due to small sample size.
Coma and Severe Head Injury	+1	- Add a new severe head injury HCC (represents a condition with ongoing care costs; similar to the inclusion of other injury HCCs). - Place in a hierarchy above the coma/brain compression HCC. - Impose an *a priori* constraint between extensive third degree burns and severe head injury in the child model due to small sample size.
Traumatic Amputations	+1	- Add a new HCC and reconfigure codes between the new HCC and current payment amputation status HCC to better distinguish early treatment and complication costs from long-term costs. - Impose a hierarchy with amputation status HCC. - Leave HCCs ungrouped in the adult model; group them in the child model for coefficient stability purposes due to small sample size.
Narcolepsy and Cataplexy	+1	- Add HCC to both child and adult models because currently underpredicted and has associated treatment costs.

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[5] In *a priori* constraints, the HCC estimates are constrained to be equal to each other. These are applied to stabilize high cost estimates that may vary greatly due to small sample size.

Condition	Payment HCC Change	Summary of Changes
Exudative Macular Degeneration	+1	- Add HCC to adult model because currently underpredicted; costs are primarily related to drug treatments.
Congenital Heart Anomalies	new to adult	- Add 3 underpredicted HCCs to adult model (already in the child and infant models). Group them in the adult model only.
Changes in HCC Groups, Hierarchies		
Metabolic and Endocrine Disorders	N/A	- Group HCCs 26 and 27 together in both the child and adult models to distinguish their significantly higher incremental costs from other HCCs (HCCs 28-30) previously in the full group (HCCs 26 and 27 are currently underpredicted in the models due to grouping). - Ungroup HCCs 29 and 30 in the adult model as they have adequate sample sizes and clinical and cost distinctions. - Group HCCs 28-29 in the child model due to small sample sizes, clinical similarity, and similar predicted costs. - Leave HCC 30 ungrouped in the child model because it is clinically distinct from HCCs 28-29.
Necrotizing Fasciitis	N/A	- Ungroup the necrotizing fasciitis HCC (HCC 54) in the adult model to better predict higher incremental costs compared to HCC 55 (currently grouped with).
Blood Disorders	N/A	- Revise groups in both adult and child models to move HCC 69 from its previous grouping, with HCCs 70 and 71, to the group with HCCs 67 and 68 to better reflect clinical severity and associated costs. - Reconfigure HCCs 69 and 71 based on clinical input.
Mental Health	N/A	- Move delusional disorders/psychosis HCC above major depressive disorders (severe)/bipolar disorders HCC in the payment hierarchy and renumber the HCCs (i.e., HCCs 88 and 89 switch positions). - Relabel HCCs to align with ICD-10 categorizations.
Cerebral Palsy and Spina Bifida	N/A	- Refine hierarchies to exclude paralysis HCCs for enrollees with cerebral palsy HCCs, as ICD-10 coding guidelines prohibit these conditions from coding together. - Refine hierarchies to exclude hydrocephalus HCC for enrollees with spina bifida HCC for similar coding restriction purposes.
Pancreatitis	N/A	- Reconfigure acute pancreatitis HCC to differentiate higher cost conditions. - Revise the hierarchy for pancreas transplant HCC to remove exclusion of pancreatitis HCCs because pancreas transplants are done primarily for diabetes and insulin conditions rather than pancreatitis.
Liver	N/A	- Reconfigure codes in liver HCCs to reflect clinical distinctions. - Move acute liver failure HCC above chronic liver failure HCC in the hierarchy and renumber HCCs.

1.0   Overview

The Department of Health and Human Services Hierarchical Condition Category (HHS-HCC) diagnostic classification is the foundation of the models used in calculating transfers in the HHS-operated risk adjustment program established under section 1343 of the Patient Protection and Affordable Care Act (PPACA).[6] Except for annual diagnosis code updates and the reconfiguration of one HCC,[7] the HHS-HCC clinical classification has not been modified since the original HHS-HCC models were implemented in the 2014 benefit year. The purpose of this paper is to discuss possible HHS-HCC classification updates under consideration, along with other potential changes to the risk adjustment models[8], for future benefit years of the HHS-operated risk adjustment program.

1.1   Purpose and Structure of this Paper

This paper is designed to inform the public on the potential changes to the underlying HHS-HCC classification in the HHS-HCC risk adjustment models. Section 1 of this paper provides the overview and purpose for updating the HHS-HCC diagnostic classification. Section 2 introduces the HHS-HCC diagnostic classification and identifies the criteria used in its formation and review. Section 3 describes the review and reclassification process. Section 4 presents the potential updates to the HHS-HCC classification referred to as Version 06a (V06a). This section includes an overview of changes, comparing V06a to the current Version 05 (V05) HHS-HCC classification, and discusses potential key changes that we are considering proposing for the HHS-HCC risk adjustment models in future rulemaking. Section 5 features summary statistics that summarize the overall impact of the current V05 to the potential V06a classification changes. Section 6 describes other potential model considerations (including changes to the enrollment duration factors and the incorporation of non-linear and count model specifications), and concludes with next steps.

1.2   Purpose of ICD-10 Reclassification

The HHS-HCC clinical classification in the current HHS-HCC risk adjustment models, in place since 2014, was based on the International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM) diagnosis codes, an approved U.S. modification of the World Health Organization's classification system. That system was subsequently replaced by the International Classification of Diseases, 10th Revision (ICD-10-PCS) and International Classification of Diseases, 10th Revision, Clinical Modification (a corresponding U.S. clinical modification) (ICD-10-CM).

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[6] HHS is responsible for operating the risk adjustment program on behalf of any state that elected not to do so. See section 1321(c)(1) of the PPACA. HHS is currently responsible for risk adjustment in all 50 states and the District of Columbia.

[7] As detailed in the HHS Notice of Benefit and Payment Parameters for 2018 (the 2018 Payment Notice), beginning with the 2018 benefit year, HCC 37 - Chronic Hepatitis - was split into two HCCs to distinguish the treatment costs of chronic hepatitis C. See 81 FR 94058 at 94085 (December 22, 2016).

[8] Consistent with the HHS Notice of Benefit and Payment Parameters for 2020 (the 2020 Payment Notice), we also discuss potential updates to the enrollment duration factors and on potential alternative modeling methods involving non-liner or count models. See 84 FR 17454 at 17466 and 17483 (April 25, 2019).

When ICD-10-CM was implemented in the U.S. on October 1, 2015, ICD-10 codes were cross-walked to ICD-9 codes and to the existing ICD-9-based HHS-HCC clinical classification.[9]

One purpose for reclassifying HHS-HCCs as described in this paper is to update them to better incorporate coding changes made in the transition to ICD-10 diagnosis codes into the HHS-HCC models. This paper therefore considers potential changes to the current HHS-HCC classification for that purpose. We also used this opportunity to review and use the newly available 2016 and 2017 benefit years enrollee-level External Data Gathering Environment (EDGE) claims data[10], which reflect the first two full years of ICD-10 diagnosis coding on claims. This allows us to evaluate potential changes to the HHS-HCC model classification on the population for which the models are targeted.

ICD-10 includes new clinical and classification concepts. The ICD-10 code set differs from the ICD-9 classification in four key aspects:

1) Structure: ICD-10 codes are longer (7 characters versus 5) and use more alpha characters that allow for greater clinical detail and specificity (e.g., laterality) of codes;
2) Volume: There are more than 70,000 ICD-10 codes as compared to approximately 14,500 ICD-9 codes;
3) Multiple concepts within codes: ICD-10 has many more combination codes with two or more clinical concepts than ICD-9 did; and
4) Clinical currency: Terminology and disease classifications have been updated to be consistent with current clinical practice.

1.3 Other Revisions to the Clinical Classification

In addition to analyzing current ICD-10 code mappings to HHS-HCCs, this reclassification examined other components of the clinical classification:

1) Payment and non-payment HCCs;
2) Certain clinical hierarchies (e.g., substance use disorder; pregnancy);
3) HCC Groups[11] and *a priori* constraints on HCC coefficients; and
4) Severe illness and other HCC interactions affected by potential changes.

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[9] The abbreviations ICD-10 and ICD-10-CM are used interchangeably in this paper to refer to the Tenth Revision diagnosis codes. Similarly, the abbreviations ICD-9 and ICD-9-CM are used interchangeably to refer to the Ninth Revision diagnosis codes. As a starting point for initial 2015 HHS-HCC crosswalks, we used the General Equivalence Mappings (GEMs) to backward map ICD-10 to ICD-9. GEMs were a tool developed by the Centers for Medicare & Medicaid Services (CMS) and the Centers for Disease Control and Prevention (CDC) to assist with the conversion of ICD-9 codes to ICD-10.

[10] In the 2018 Payment Notice, we finalized a policy to collect and use masked enrollee-level EDGE data to recalibrate the HHS risk adjustment models and to help update the HHS risk adjustment methodology. See 81 FR at 94101.

[11] Note on nomenclature: Because the terms *group* and *groupings* are used in multiple contexts throughout this paper, we will use *HCC Groups* when referring to HCCs that are grouped together in the HHS-HCC risk adjustment models. See Section 2.3 for a more detailed description of these HCC Groups.

1.4 Outside the Scope of this Clinical Reclassification

The scope of this reclassification review was limited to the HHS-HCCs. This reclassification work did not review the Prescription Drug Categories (RXCs) and RXC interactions.

2.0 Brief Overview of HHS-HCC Diagnostic Classification and Criteria

A diagnostic classification system provides the framework for developing a risk adjustment model that uses patient diagnoses and demographic information to predict medical service and drug spending. This section describes the HHS-HCC diagnostic classification, how the HHS-HCCs were selected and grouped for the HHS-HCC risk adjustment models, and other key components of the models.

2.1 Criteria

Determining which diagnosis codes should be included, how they should be grouped, and how the diagnostic groupings should interact for risk adjustment purposes was a critical step in the development of the HHS-HCC risk adjustment models. The following 10 principles, which were discussed in the proposed 2014 Payment Notice, guided the creation of the original HHS-HCC diagnostic classification system[12] and were used to develop the HCC classification system for the Medicare risk adjustment model.[13] These principles, which also guided the current reclassification, include:

Principle 1 — Diagnostic categories should be clinically meaningful.

Principle 2 — Diagnostic categories should predict medical (including drug) expenditures.

Principle 3 — Diagnostic categories that will affect payments should have adequate sample sizes to permit accurate and stable estimates of expenditures.

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.

Principle 5 — The diagnostic classification should encourage specific coding.

Principle 6 — The diagnostic classification should not reward coding proliferation.

Principle 7 — Providers should not be penalized for recording additional diagnoses (monotonicity).

Principle 8 — The classification system should be internally consistent (transitive).

Principle 9 — The diagnostic classification should assign all diagnosis codes (exhaustive classification).

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[12] See the HHS Notice of Benefit and Payment Parameters for 2014, Proposed Rule, 77 FR 73118 at 73128 (December 7, 2012).

[13] Report to Congress: Risk Adjustment in Medicare Advantage (December 2018) also discusses these principles in Section 2.3 under Principle for Risk Adjustment Models from Pages 14-16 and is available at: https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/RTC-Dec2018.pdf.

Principle 10 — Discretionary diagnostic categories should be excluded from payment models.

2.2   Overall Framework

The HHS-HCC risk adjustment models use enrollee diagnoses and demographic information (in addition to enrollment duration and a limited number of drugs for adults) to predict medical and drug expenditure risk for health plans.[14] To obtain a clinically meaningful and statistically stable system, the tens of thousands of codes used to capture diagnoses are grouped into a smaller number of organized categories to produce a diagnostic profile of each person. The diagnostic classification is key in determining the ability of a risk adjustment model to distinguish high-cost from low-cost individuals. The classification also determines the sensitivity of the model to intentional or unintentional variations in diagnostic coding, an important consideration in risk adjustment.

2.3   Elements

Diagnostic Categories

The HHS-HCC diagnostic classification system first classifies all ICD-10-CM diagnosis codes into Diagnostic Groups, or DXGs (see *Figure 2.1*). Each DXG represents a well-specified medical condition or set of conditions, such as the DXG for *Type 2 Diabetes with Ketoacidosis or Coma*. DXGs are further aggregated into Condition Categories (CCs). CCs describe a broader set of similar diseases. Although CCs are not as homogeneous as DXGs, diseases within a CC are related clinically and with respect to cost. An example is the CC for *Diabetes with Acute Complications*, which includes the DXG for *Type 2 Diabetes with Ketoacidosis or Coma* and the DXGs for *Type 1 Diabetes* and *Secondary Diabetes* (each with ketoacidosis or coma).

Clinical Hierarchies

Hierarchies are used to group and order clinically-related CCs within the classification. Specifically, hierarchies are imposed among sets of related CCs, such that an enrollee is assigned only the most severe manifestation among related diseases based on the reported diagnosis codes. After imposing hierarchies, CCs become Hierarchical Condition Categories (HCCs). For CCs within a hierarchy, an enrollee can only receive one HCC. For example, diabetes diagnosis codes are organized in a Diabetes hierarchy, consisting of three CCs arranged in descending order of clinical severity and cost, from *CC 19 Diabetes with Acute Complications* to *CC 20 Diabetes with Chronic Complications* to *CC 21 Diabetes without Complication*. Thus, a person with diagnosis codes in CC 20 and CC 21 would have both CCs. However, once hierarchies are imposed that enrollee would only be assigned the single highest HCC in the hierarchy corresponding to the enrollee's CCs—in this case *HCC 20 Diabetes with Chronic Complications.* Although HCCs reflect hierarchies among related disease categories, for unrelated diseases, multiple HCCs can accumulate for those enrollees, i.e., the model is "additive." For example, a female with both *diabetes* and *asthma* has (at least) two separate HCCs coded, and her predicted cost will reflect increments for both conditions.

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[14] Specifically, the HHS-HCC risk adjustment model predicts plan liability—the health care expenditures for which plans are liable (excluding enrollee cost sharing). There are separate risk adjustment models to account for differences by subpopulation—adult (age 21+), child (age 2-10), and infant (age 0-1)—and differences by tiers of plan actuarial value (known as "metal levels"). Clinical classifications do not vary by metal level.

Because a single individual may be coded for zero, one, or more than one HCC, the HHS-HCC model can individually price millions of distinct clinical profiles. Thus, the model's structure provides, and predicts from a detailed comprehensive clinical profile for each enrollee.

Figure 2.1: HCC Aggregations of Diagnosis Codes
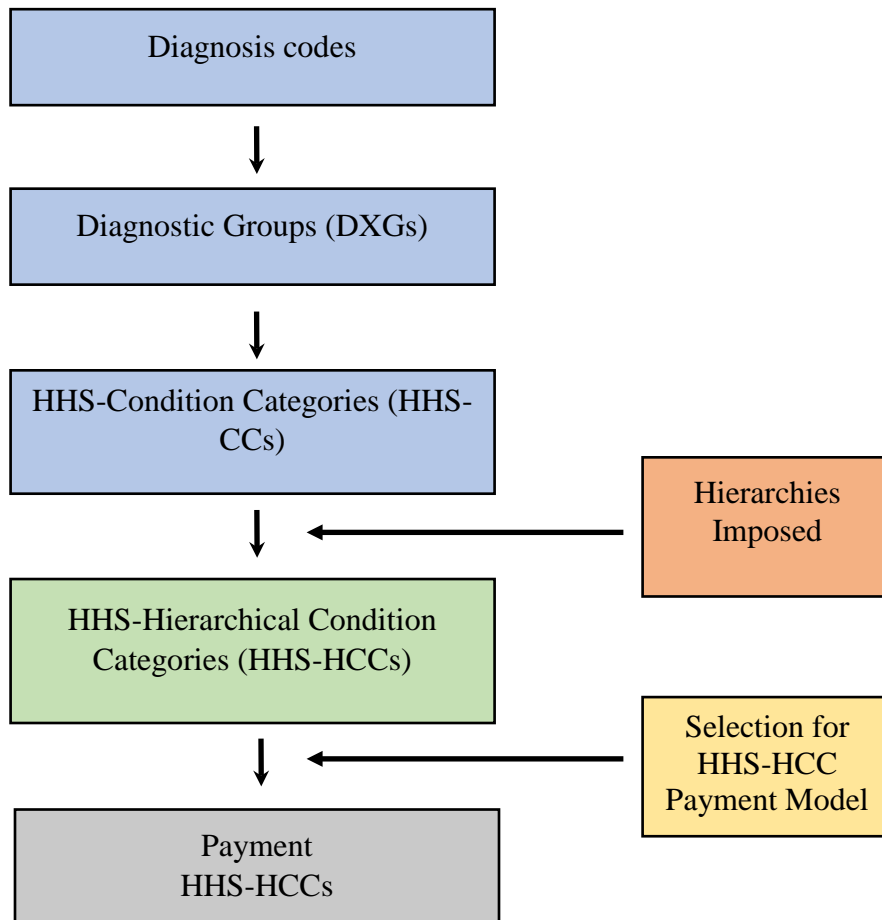
Payment and Non-Payment HCCs

There are 267 HHS-HCCs in the current V05 HHS-HCC full diagnostic classification, among which 128 HHS-HCCs are used for the HHS risk adjustment adult, child and infant models. In addition to the established criteria based on the principles of risk adjustment, we utilize further criteria for selecting a subset of HCCs to distinguish costliness of plan enrollees. This set of payment HHS-HCCs is designed to support the success of the single risk pool and should:[15]

1. represent clinically significant medical conditions with significant costs for the target population;

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[15] These criteria are the same criteria for selection described in the discussion paper for the March 31, 2016, HHS-Operated Risk Adjustment Methodology Meeting (March 24, 2016). A copy of this discussion paper is available at: https://www.cms.gov/cciio/resources/forms-reports-and-other-resources/downloads/ra-march-31-white-paper-032416.pdf.

2. contain sufficient sample size for stable results;

3. exclude (or limit the impact of) diagnoses particularly subject to discretionary coding;

4. exclude diagnoses that represent poor quality of care;

5. identify chronic or systematic conditions that represent insurance risk selection or risk segmentation, rather than random acute events that represent insurance risk; and

6. apply only to the appropriate model age group (infant, child, adult).

These criteria are intended to ensure that the payment HCCs target appropriate actuarial risk in the risk adjustment models.

HCC Groups and *A Priori* Constraints

To balance the competing goals of improving predictive power and limiting discretionary coding, as well as to create a risk adjustment model in which less experienced insurance carriers are not disadvantaged, a subset of payment HHS-HCCs are grouped into larger aggregate clusters, or HCC Groups. In HCC Groups, the HCC estimates are constrained to be equal to each other. We group payment HHS-HCCs for the following reasons:

1. To reduce model complexity by limiting the number of effective payment HHS-HCCs;

2. To avoid HHS-HCCs with low sample size and possibly unstable high-cost estimates;

3. To limit diagnostic upcoding by severity within an HCC hierarchy; and

4. To reduce additivity within disease groups (but not across disease groups) in order to decrease the sensitivity of the model to coding proliferation.

After grouping, the number of payment HHS-HCCs in the V05 risk adjustment model is effectively reduced from 128 to 104. From a single HCC Group, a person receives only one risk marker, i.e., the person receives a single indicator for the group if one or more of the constituent HCCs are present. The HHS-HCC model also incorporates a small number of "a priori constraints" (e.g., for organ transplants in the child model). HCC Group constraints and a priori constraints are applied in the initial phase of risk adjustment regression modeling. Other constraints may be applied in later stages depending on regression results. For example, HCCs may be constrained equal to each other if there is a hierarchy violation (a lower severity HCC has a higher estimate than a higher severity HCC in the same hierarchy). HCCs may be constrained to 0 if the estimates are negative. A priori constraints, on the other hand, are applied to stabilize estimates that might vary greatly due to small sample size.[16] These *a priori* constraints differ from the HCC Groups in how the corresponding estimates are counted. With a priori constraints, a person can have more than one indicated condition (each with the same magnitude coefficient) as long as the HCCs are not in the same hierarchy. With

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[16] For example, we previously finalized a constraint for the six transplant status HCC coefficients (other than kidney) in the child model, as the sample sizes of transplants are smaller in the child than the adult model. Because the levels and changes in the child transplant relative coefficients appeared to be dominated by random instability at the time, we believed the accuracy of the model was improved by constraining these coefficients. See the HHS Notice of Benefit and Payment Parameters for 2016, Final Rule, 80 FR 10749 (April 28, 2015).

HCC Groups, only one risk marker is triggered by the presence of one or more HCCs in the HCC Group.

Demographic Variables and Restrictions on Allowed Diagnostic Codes

Due to the inherent clinical and cost differences in the adult, child, and infant populations, we developed separate risk adjustment models for each group. The adult and child models have similar specifications, with age/sex demographic categories and HCCs (individual HCCs and HCC Groups) predicting annualized plan liability expenditures. Not all payment HHS-HCCs are applicable to certain age groups. For example, *HCC 64 Major Congenital Anomalies of Diaphragm, Abdominal Wall, and Esophagus, Age < 2* is applicable to the infant population. After applying age-related model restrictions, the V05 adult model has a total of 92 effective HCCs and the V05 child model has a total of 95 effective HCCs.

Because infants (ages 0-1) have low frequencies for most HCCs, which leads to unstable parameter estimates in an additive model, the V05 infant model uses a categorical approach. Infants are assigned a birth maturity (by length of gestation and birth weight as designated by their newborn payment HCC) or age 1 category, and a disease severity category (based on HCCs other than birth maturity). There are five maturity categories and five disease severity categories (based on clinical severity and associated costs). When cross-classified, these categories define 25 mutually-exclusive categories. Each infant is assigned to one of the 25 categories. Finally, there are two additive terms for sex, for age 0 males and age 1 males, which account for higher morbidity and infant mortality in the male infant population (females are the reference group for the mutually-exclusive categories).

HCC Interactions

HCC interaction terms capture an enrollee's severity of illness based on diagnostic markers in the adult risk adjustment model. The adult model includes these disease interaction terms to better reflect plan liability across metal levels and improve model performance.[17] To develop these interaction terms, based on empirical findings and clinical review, we created a set of eight diagnostic markers of severe illness: *HCC 2 Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock*; *HCC 42 Peritonitis/Gastrointestinal Perforation/Necrotizing Enterocolitis*; *HCC 120 Seizure Disorders and Convulsions; HCC 122 Non-Traumatic Coma, Brain Compression/Anoxic Damage*; *HCC 125 Respirator Dependence/Tracheostomy Status*; *HCC 126 Respiratory Arrest*; *HCC 127 Cardio-Respiratory Failure and Shock, Including Respiratory Distress Syndromes*; and *HCC 156 Pulmonary Embolism and Deep Vein Thrombosis*. A severe illness indicator variable was defined as having at least one of the eight diagnostic markers of severe illness.[18]

The severe illness indicator was then interacted with individual HCCs and HCC Groups.[19] The disease interactions that met minimum sample size and incremental predicted expenditure thresholds were included in the model. The incremental predicted expenditures for the disease interactions were categorized into medium and high cost categories. For each category, we included a binary indicator variable in the regression model for whether or not the enrollee had at least one

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[17] Disease interactions were empirically unimportant in the child model and were not included. The infant model is a categorical model.

[18] The diagnostic markers of severe illness are also included in the model not interacted with other diagnoses (i.e., as individual HCCs).

[19] High frequency, high incremental expenditure disease interactions tended to include severe illnesses.

disease interaction in the category. Finally, a hierarchy was imposed such that if an enrollee was in the high cost disease interaction category, the enrollee was excluded from the medium cost category. In sum, a person can have at most one disease interaction coefficient or incremental predicted expenditure in addition to the underlying HCCs. This constraint was imposed because clinical reasoning and empirical evidence indicated that a single one of the diagnostic markers sufficed to distinguish the most severely ill patients among those with the underlying interacted diagnosis.

Other Variables

To account for the observed underprediction of expenditures of people who are enrolled for less than the full year, beginning with the 2018 benefit year HHS risk adjustment methodology, the adult model included an enrollment duration factor as an additional risk factor. The enrollment duration factors are a series of 11 partial-year enrollment indicators. Variables ED_1, ED_2, etc., through ED_11 indicate people in the concurrent sample who are enrolled for one month, two months, and so on. Twelve months of enrollment (ED_12) is the reference group. The partial enrollment factors are not currently included in the child and infant models.

Beginning with the 2018 benefit year, the adult model also included 12 standalone prescription drug classes (RXCs), which were added as additional risk factors.[20] Ten of these RXCs (imputation/severity) enter the model specification separately as well as interacted with their related HCCs, while two of these RXCs are only included in interaction with their related HCCs (severity only). In the 2019 and 2020 benefit years, the severity only RXCs were dropped and the 10 imputation/severity prescription drug categories are included.

3.0   Review and Reclassification Process

This section describes the 2018-2019 review and reclassification process that we followed to develop the potential model changes outlined in this paper.

Analytic Files. For the initial analysis, separate analytic files were created using two data sources: 1) 2016 enrollee-level EDGE data and 2) 2016 Truven MarketScan® Commercial Claims and Encounter data.[21] The enrollee-level EDGE data includes enrollees who are part of the individual and small group single risk pool in states where HHS is operating the risk adjustment program. Issuers in those states[22] are responsible for uploading enrollment, pharmaceutical claims, medical claims and supplemental diagnosis information to their respective EDGE servers. The enrollee-level EDGE data used in this analysis are masked person-level claims and enrollment data.[23] MarketScan® data is from a national, proprietary database contributed to by large employers and health plans in all 50 states and the District of Columbia. MarketScan® data includes claims and enrollment information on employees,

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[20] The 2018 benefit year adult risk adjustment models included 12 RXCs; however, starting with the 2019 benefit year, the two severity-only RXCs are removed from the adult risk adjustment models. See 83 FR at 16941.

[21] We used the 2016 enrollee-level EDGE and MarketScan® datasets because they were the most recently available data when we began the reclassification analysis. We created separate 2017 EDGE and MarketScan® analytic files once those datasets were available.

[22] In the 2016 benefit year, HHS operated the PPACA risk adjustment program in all states and the District of Columbia, except for Massachusetts. Beginning with the 2017 benefit year, HHS began operating the PPACA risk adjustment program in all 50 states and the District of Columbia.

[23] 45 C.F.R. § 153.720.

spouses, and dependents covered by employer-sponsored private health plans. The MarketScan® data generally represent enrollees in the large self-insured employer plans.

For the analyses presented here, we focused on total expenditures, which are easier to interpret than plan liability when comparing relative costs of conditions and diseases. Using the 2016 analytic files, we calculated total person-level expenditure data for the full sample and three subpopulations— adults, children and infants. Results were presented at the ICD-10-CM diagnosis code level, DXG level, CC level, and HCC level. The total expenditure data included sample size, actual total expenditures, predicted total expenditures based on the current V05 HHS-HCC model, and predictive ratios.[24]

Internal Review. We conducted a comprehensive review of the current HHS-HCC classification, encompassing these areas:

- disease groups with extensive ICD-10 code classification changes (e.g., substance use disorder combination codes);
- disease groups with new ICD-10 code severity breakouts that may enable better cost distinction by HCC (e.g., asthma);
- ICD-10 codes whose initial mappings when based on GEMs suggested ICD-10 backward mappings to ICD-9 codes resulted in large changes in HCC counts (e.g., type 2 diabetes with hyperglycemia);
- ICD-10 codes that include episode of care (initial, subsequent, sequela);
- clinical areas of interest (e.g., substance use disorder, mental health, pregnancy); and
- model underprediction or overprediction as identified by predictive ratios at the HCC, CC, DXG, or ICD-10 code level.

Analyses of Alternative Reclassifications. We examined various potential revisions at the HCC level. These revisions included: changing HCC payment status; removing, revising, or adding HCC Groups; changing HCC hierarchies; applying model restrictions (adult, child, infant) to new HCCs or removing model restrictions (e.g., congenital heart condition HCCs in the adult model); and revising infant model severity category assignments. Interim analyses were done, such as cross-tabulations of HCCs, to better understand the prevalence and overlap of conditions. We also considered and applied "within HCC" changes—splitting apart HCCs, deleting HCCs and redistributing their codes; and adding diagnoses to or removing diagnoses from payment and non-payment HCCs. Occasionally, for example when studying traumatic amputations, HCCs were temporarily split apart to better distinguish frequencies and costs by episode of care (initial encounter versus subsequent encounter).

For some disease groups, such as substance use disorders and pregnancy, we explored multiple model variations. In evaluating the options, we considered the predictive power, model complexity, and coding incentives. For substance use disorders, we tested different configurations to add new drug use disorder HCCs and alcohol use disorder HCCs to the HHS-HCC risk adjustment model—a single

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[24] Predictive ratios are calculated as the predicted expenditures divided by the actual expenditures. They reflect the accuracy of the model's prediction for the given diagnostic group.

hierarchy; two hierarchies (drug and alcohol HCCs being additive); interaction terms; and for each of these iterations, grouping HCCs or leaving them ungrouped. For pregnancy, we tested different configurations for adding ongoing pregnancy HCCs to the model, which already includes miscarriage HCCs and completed pregnancy HCCs. These configurations included a single hierarchy or separate additive HCCs to distinguish pregnancy care from delivery; interactions between completed and ongoing pregnancy HCCs to account for when in the episode of care complications occur; and removal of or changes to HCC Groups to better reflect cost distinctions.

Clinician Input. We conducted a series of clinical review calls, early in the process, to inform potential changes and later to review and discuss results. Questions posed to clinicians related to (1) criteria and usual practice for diagnosing conditions; (2) prevalence and severity of conditions; (3) clinical validity and interpretation of empirical results; (4) clinical similarities and differences of specific diseases; (5) medical or drug treatments for a given condition; (6) diagnosis and treatment differences by subpopulation; (7) severity and chronicity of illness, including cost implications in a concurrent versus prospective model; (8) criteria, discretion, and variability in diagnosis; and (9) gameability of specific diagnoses or disease groups.

The reclassification was an iterative process, involving clinician input and review and discussions between CMS and its contractor, RTI International. Reclassification changes were applied based on clinical input, background research, empirical analyses, policy implications, and judgment.

Data Validation. We conducted our initial regression analyses using 2016 EDGE data. To evaluate the stability of diagnostic coding and the stability of model estimates, we repeated the preliminary regression analyses using 2016 MarketScan® data, 2017 enrollee-level EDGE data, and 2017 MarketScan® data. This evaluation was important because we did not want to base reclassification changes on a single year of data, especially the 2016 data year, which was the first full year with ICD-10 diagnoses codes after the transition from ICD-9. These preliminary regression analyses, Version 06 (V06), informed the revised Version 06a (V06a) classification. Then, we ran updated V06a payment model regressions on 2016 and 2017 enrollee-level EDGE data.[25]

Data Tables. In this paper, we present the total expenditure regression model results, where relevant, comparing the current V05 HHS-HCC risk adjustment models to the potential updates to V06a HHS-HCC risk adjustment models. As noted earlier, the actual HHS-HCC risk adjustment models estimate plan liability. For these analyses, we focused on total expenditures, which are easier to interpret than plan liability when comparing relative costs of conditions and diseases. The model regressions presented in this paper were conducted for the 2020 benefit year using 2017 enrollee-level EDGE data.

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[25] As discussed in the 2020 Payment Notice, beginning with the 2021 benefit year, our intention is to propose to transition to three consecutive years of EDGE datasets for risk adjustment model annual recalibrations. See 84 FR at 17464.

4.0   Potential V06a HHS-HCC Classification Updates

4.1   Summary

The V06a HHS-HCC reclassification resulted in these potential changes to the risk adjustment model used for payment:

14 HCCs were added as payment HCCs:

- *HCC 22 Type 1 Diabetes Mellitus, add-on to Diabetes HCCs 19-21* (adult model only)
- *HCC 83 Alcohol Use with Psychotic Complications[26]*
- *HCC 84 Alcohol Use Disorder, Moderate/Severe, or Alcohol Use with Specified Non-Psychotic Complications*
- *HCC 85 Drug Use Disorder, Mild, Uncomplicated, Except Cannabis*
- *HCC 123 Narcolepsy and Cataplexy* (adult and child models only)
- *HCC 174 Exudative Macular Degeneration* (adult model only)
- *HCC 210 (Ongoing) Pregnancy without Delivery with Major Complications* (adult and child models only)
- *HCC 211 (Ongoing) Pregnancy without Delivery with Complications* (adult and child models only)
- *HCC 212 (Ongoing) Pregnancy without Delivery with No or Minor Complications* (adult and child models only)
- *HCC 218 Extensive Third Degree Burns*
- *HCC 219 Major Skin Burn or Condition*
- *HCC 223 Severe Head Injury*
- *HCC 228 Vertebral Fractures without Spinal Cord Injury*
- *HCC 234 Traumatic Amputations and Amputation Complications*

1 existing payment HCC was split apart into 2 HCCs:

- *HCC 161.1 Severe Asthma*
- *HCC 161.2 Asthma, Except Severe*

3 existing payment HCCs were newly added to the adult model (i.e., adult model restriction removed; these HCCs are already in the child and infant models):

- *HCC 137 Hypoplastic Left Heart Syndrome and Other Severe Congenital Heart Disorders*
- *HCC 138 Major Congenital Heart/Circulatory Disorders*
- *HCC 139 Atrial and Ventricular Septal Defects, Patent Ductus Arteriosus, and Other Congenital Heart/Circulatory Disorders*

1 payment HCC was deleted:

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[26] We continue to include all payment substance use disorder HCCs in the infant model. Although most infants who are affected by the mother's substance use via placenta or breast milk are coded with a newborn-specific ICD-10 code from the P04 set, which in V06a maps to HCC 82, some infants are coded with substance use codes from the ICD-10 F10-F19 code sets, which map to V06a HCCs 81–86.4.

- *HCC 227 Pathological Fractures, Except of Vertebrae, Hip, or Humerus*

In addition to the payment model designation changes, we also made code level changes to both payment and non-payment HCCs, hierarchy changes, and revisions to HCC Groups in the HHS-HCC risk adjustment model. *Table 4-1* provides HCC, HCC Group, and ICD-10 code level summary statistics for the V05 and potential updates to V06a HHS-HCC classifications.

Table 4-1. Summary Statistics for the V05 and V06a HHS-HCC Classifications

Category	V05 HHS-HCC Classification	V06a HHS-HCC Classification
Total number of HCCs in full classification	267	274
Total number of payment HCCs in risk adjustment model	128	142
Adult model	115	132
Child model	119	131
Infant model	117	125
Number of HCC Groups in risk adjustment model		
Adult model	17	16
Child model	17	20
Effective number of payment HCCs in risk adjustment model (each HCC Group is counted as 1 HCC)		
Adult model	92	112
Child model	95	107
Total number of unique Fiscal Year (FY) 2019 ICD-10 codes in full classification	71,932	71,932
Total number of unique FY2019 ICD-10 codes in risk adjustment model	8,203	10,632
Adult model	7,929	10,449
Child model	8,116	10,529
Infant model	6,812	7,852

4.2   Discussion of Key Payment Model Changes

In this section, we discuss the potential substantive changes to the HHS-HCC risk adjustment models, including new payment HCCs, revised HCC Groups, and changes to HCC composition or hierarchies. Sections 4.2.1 and 4.2.2 focus more on how the V06a potential changes affect the adult and child models. Section 4.2.3 discusses potential V06a changes in the context of the infant categorical model.

4.2.1   New Payment HCCs and New or Revised HCC Groups

Substance Use Disorders

The current V05 HHS-HCC risk adjustment model includes two substance use HCCs:

HCC Group 9:
- *HCC 81 Drug Psychosis*

- *HCC 82 Drug Dependence*

These two HCCs are grouped, effectively creating a single substance use HCC in the current model. Notably, alcohol use disorder diagnoses are absent from the current model.

The overall motivation for the potential V06a updates detailed below is to risk adjust for a larger number of substance use diagnoses, and to reflect the revised conceptualization of substance use disorders in the ICD-10 and in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5),[27] while continuing to limit opportunities for inappropriate coding of substance use diagnoses.

The potential updates to V06a adult and child models include five substance use HCCs. These five HCCs are in a strict hierarchy from top to bottom: an enrollee can receive at most one of these HCCs. In the adult model, none of the five HCCs are grouped; each has separately-estimated incremental predicted expenditures. In the child model, because of small frequencies, the HCCs are grouped into two HCC Groups based on similar incremental costs. A child enrollee will be assigned only one group based on the corresponding HCC.

V06a Substance Use Disorder payment HCC hierarchy:

- *HCC 81 Drug Use with Psychotic Complications*
- *HCC 82 Drug Use Disorder, Moderate/Severe, or Drug Use with Non-Psychotic Complications*
- *HCC 83 Alcohol Use with Psychotic Complications*
- *HCC 84 Alcohol Use Disorder Moderate/Severe, or Alcohol Use with Specified Non-Psychotic Complications*
- *HCC 85 Drug Use Disorder, Mild, Uncomplicated, Except Cannabis*

In section 4.1, V06a includes two new HCCs for alcohol use disorders: HCCs 83 and 84. They are lower in the hierarchy than the top two existing drug use disorder HCCs (81, 82), meaning that an enrollee diagnosed with both drug and alcohol use disorder from this set would receive only the drug use disorder HCC.   The reason for the strict hierarchy among the drug and alcohol use disorder HCCs is the high prevalence of both drugs and alcohol use among those with alcohol or drug use disorders. The more severe drug use disorder HCCs (81, 82) take precedence over the alcohol use disorder HCCs (83, 84) because the drug use disorder HCCs have greater incremental cost estimated than the lower alcohol use disorder HCCs. Similarly, the reason that the two more severe alcohol use disorder HCCs (83, 84) take precedence over the newly-added mild drug use disorder HCC (85) is also because of higher incremental cost.

V06a *HCC 81 Drug Use with Psychotic Complications* and *HCC 83 Alcohol Use with Psychotic Complications*, respectively, are largely the same conceptually as their V05 versions. V06a

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[27] ICD-10 conceptualizes substance misuse diagnoses along the hierarchy of dependence/abuse/use, while the DSM-5 conceptualization is substance use disorder mild/moderate/severe (and substance use without substance use disorder). ICD-10-CM has cross-walked the DSM-5 substance use disorder codes to select ICD-10 codes; e.g., "opioid use disorder, mild" is coded as ICD-10 F11.10, "opioid abuse, uncomplicated"; "opioid use disorder moderate/severe" is coded as ICD-10 F11.20, "opioid dependence, uncomplicated."

HCCs 82 and 84, like their V05 counterparts, include drug and alcohol dependence (addiction) diagnoses. They also include drug and alcohol abuse and use with non-psychotic complication diagnoses (a smaller selected set of diagnoses in the case of alcohol). Additionally, V06a HCC 82, unlike V05 HCC 82, includes the diagnoses of drug poisoning (overdose) for select drugs, namely, opioids/narcotics (e.g., heroin, fentanyl, oxycodone), cocaine, hallucinogens (e.g., LSD), and psychostimulants (e.g., amphetamines, methamphetamines, MDMA/ecstasy).

Drug use disorder moderate/severe is included in V06a HCC 82 and drug use disorder, mild, is included in HCC 85.[28] Cannabis use disorder, mild, uncomplicated, is excluded from V06a HCC 85 because of concern about opportunities for gaming/overcoding of this diagnosis. Cannabis use disorder moderate/severe, or with complications, is included in HCC 82 (or HCC 81 in the presence of psychotic complications). The drug use, unspecified, uncomplicated code set is excluded from the HHS-HCC risk adjustment model because of lack of specificity of the ICD-10 codes as to the diagnosis or reason for treatment.

Alcohol use disorder moderate/severe is included in V06a HCC 84. Alcohol use disorder, mild, is excluded from the V06a model for empirical reasons (low estimated incremental predicted expenditures) and because of concern about opportunities for gaming/overcoding this diagnosis. The ICD-10 code for simple drunkenness (F10.129, alcohol abuse with intoxication, unspecified) and the alcohol poisoning (toxic effect of ethyl alcohol) codes are similarly excluded from the payment model because such diagnoses might be due to accidental overuse rather than indicative of higher than average actuarial risk enrollees.

Nicotine dependence (tobacco products) and non-psychoactive substance abuse are also excluded from the payment model.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
81 Drug Psychosis	3,180	$13,473	G09	81 Drug Use with Psychotic Complications	3,180	$23,201	
82 Drug Dependence	148,753	$13,473	G09	82 Drug Use Disorder, Moderate/Severe, or Drug Use with Non-Psychotic Complications	174,478	$12,376	
				83 Alcohol Use with Psychotic Complications	5,224	$6,505	
				84 Alcohol Use Disorder, Moderate/Severe, or Alcohol Use with Specified Non-Psychotic Complications	88,825	$5,249	
				85 Drug Use Disorder, Mild, Uncomplicated, Except Cannabis	22,910	$3,758	

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[28] Note that ICD-10 maps both moderate and severe substance use disorders to the same codes, so it is not possible to distinguish moderate and severe use disorders of the same substance in ICD-10.

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
81 Drug Psychosis	375	$25,060	G09	81 Drug Use with Psychotic Complications	356	$14,539	G09A
82 Drug Dependence	3,504	$25,060	G09	82 Drug Use Disorder, Moderate/Severe, or Drug Use with Non-Psychotic Complications	8,213	$14,539	G09A
				83 Alcohol Use with Psychotic Complications	11	$2,461	G09B
				84 Alcohol Use Disorder, Moderate/Severe, or Alcohol Use with Specified Non-Psychotic Complications	819	$2,461	G09B
				85 Drug Use Disorder, Mild, Uncomplicated, Except Cannabis	1,932	$2,461	G09B

Pregnancy

The current V05 HHS-HCC model includes six pregnancy HCCs, which are consolidated into two groups:

HCC Group 17:
- *HCC 203 Ectopic and Molar Pregnancy, Except with Renal Failure, Shock, or Embolism*
- *HCC 204 Miscarriage with Complications*
- *HCC 205 Miscarriage with No or Minor Complications*

HCC Group 18:
- *HCC 207 Completed Pregnancy With Major Complications*
- *HCC 208 Completed Pregnancy With Complications*
- *HCC 209 Completed Pregnancy with No or Minor Complications*

Pregnancy diagnosis codes differ between ICD-9 and ICD-10 classification systems in three key aspects:

	ICD-9	**ICD-10**
Episode of care	Fifth character identified delivered or not	Separate codes for pregnancy by trimester; childbirth; and puerperium (the period of about six weeks after childbirth)
Multiple gestation	Separate codes	Seventh character designation in subset of pregnancy or complications of delivery codes
Ectopic or molar pregnancy complications	Subset of codes combined with miscarriage codes	Separate codes for complications following ectopic/molar pregnancy versus miscarriage

We would add three (ongoing) pregnancy without delivery HCCs to the payment model (HCCs 210-212) to reflect the cost of care for ongoing pregnancies that do not end in miscarriage or delivery within the plan year. To help clarify the distinction between HCCs 207-209 and HCCs 210-212, we have relabeled the sets. For the adult model, we would leave HCCs 210-212 ungrouped to distinguish differences in incremental costs by types of complications. In the child model, we would add HCCs 210-212 as HCC Group 19A due to small sample sizes and unstable estimates. HCCs 210-212 are in a hierarchy with HCCs for miscarriage or pregnancy with delivery excluding them. A woman with a pregnancy resulting in a delivery or miscarriage would receive only the completed pregnancy HCC in her diagnostic profile (i.e., one of these HCCs: 203, 204, 205, 207, 208, or 209), not the (ongoing) pregnancy without delivery HCC (210, 211, or 212). A woman with a completed pregnancy (delivery or miscarriage) earlier in the year followed by a subsequent pregnancy within the same calendar year would also receive only the completed pregnancy in her diagnostic profile. Only a woman without a completed pregnancy HCC at any time during the year can receive an (ongoing) pregnancy without delivery HCC (210, 211, or 212).

We would separate *HCC 203 Ectopic and Molar Pregnancy* from HCC Group 17 because of its considerably higher incremental costs. We also simplified its HCC label. We leave HCCs 207 and 208 (Pregnancy with Delivery with Complications) grouped because of their similar incremental costs, but separate out the lower-cost *HCC 209 Pregnancy with Delivery with No or Minor Complications* from HCC Group 18.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
203 Ectopic and Molar Pregnancy, Except with Renal Failure, Shock, or Embolism	6,800	$4,349	G17	203 Ectopic and Molar Pregnancy	6,805	$9,679	
204 Miscarriage with Complications	2,110	$4,349	G17	204 Miscarriage with Complications	2,110	$3,723	G17A
205 Miscarriage with No or Minor Complications	42,811	$4,349	G17	205 Miscarriage with No or Minor Complications	42,811	$3,723	G17A
207 Completed Pregnancy with Major Complications	8,829	$16,121	G18	207 Pregnancy with Delivery with Major Complications	8,824	$21,015	G18A
208 Completed Pregnancy with Complications	63,100	$16,121	G18	208 Pregnancy with Delivery with Complications	64,443	$21,015	G18A
209 Completed Pregnancy with No or Minor Complications	136,248	$16,121	G18	209 Pregnancy with Delivery with No or Minor Complications	134,907	$13,434	
				210 (Ongoing) Pregnancy without Delivery with Major Complications	15,825	$4,501	
				211 (Ongoing) Pregnancy without Delivery with Complications	41,456	$3,364	
				212 (Ongoing) Pregnancy without Delivery with No or Minor Complications	118,464	$1,544	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
203 Ectopic and Molar Pregnancy, Except with Renal Failure, Shock, or Embolism	170	$3,911	G17	203 Ectopic and Molar Pregnancy	170	$7,452	
204 Miscarriage with Complications	56	$3,911	G17	204 Miscarriage with Complications	56	$3,383	G17A
205 Miscarriage with No or Minor Complications	825	$3,911	G17	205 Miscarriage with No or Minor Complications	825	$3,383	G17A
207 Completed Pregnancy with Major Complications	170	$13,670	G18	207 Pregnancy with Delivery with Major Complications	170	$18,156	G18A
208 Completed Pregnancy with Complications	1,129	$13,670	G18	208 Pregnancy with Delivery with Complications	1,161	$18,156	G18A
209 Completed Pregnancy with No or Minor Complications	2,290	$13,670	G18	209 Pregnancy with Delivery with No or Minor Complications	2,258	$10,773	
				210 (Ongoing) Pregnancy without Delivery with Major Complications	346	$1,626	G19A
				211 (Ongoing) Pregnancy without Delivery with Complications	936	$1,626	G19A
				212 (Ongoing) Pregnancy without Delivery with No or Minor Complications	4,566	$1,626	G19A

Diabetes

Diabetes conditions are captured in three HCCs in the current V05 risk adjustment model as a single group:

HCC Group 1:
- *HCC 19 Diabetes with Acute Complications*
- *HCC 20 Diabetes with Chronic Complications*
- *HCC 21 Diabetes without Complication*

We would add *HCC 22 Type 1 Diabetes Mellitus, add-on to Diabetes HCCs 19-21* to the adult payment model. HCC 22 would be an additive HCC to HCC Group 1 and distinguish additional costs for Type 1 diabetes. Type 1 diabetes would continue to appear in HCC Group 1 but have separate additive incremental costs with HCC 22. This reconfiguration would not affect the existing payment model diabetes HCC Group. Our clinical consultants recommended this change, indicating current coding and diagnosis practices clearly distinguish Type 1 diabetes from Type 2 diabetes. The change is applied to the adult model only. Because of the prevalence of Type 1 diabetes for children or infants with diabetes (e.g., ~91% in 2017 enrollee-level EDGE child model), its costs are already adequately predicted by the existing payment model HCCs 19-21 in the child and infant models. In addition to the additive HCC, we would also reclassify in the adult model a subset of diabetes codes (with hyperglycemia; with hypoglycemia without coma; and with unspecified complications) from *HCC 20 Diabetes with Chronic Complications* to *HCC 21 Diabetes without Complications* based on clinical input.

Potential updates to V06a HHS-HCC adult diabetes HCCs:

HCC Group 1:
- *HCC 19 Diabetes with Acute Complications*
- *HCC 20 Diabetes with Chronic Complications*
- *HCC 21 Diabetes without Complication*

Ungrouped:

- *HCC 22 Type 1 Diabetes Mellitus, add-on to Diabetes HCCs 19-21*

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
19 Diabetes with Acute Complications	21,981	$1,809	G01	19 Diabetes with Acute Complications	21,981	$1,774	G01
20 Diabetes with Chronic Complications	598,343	$1,809	G01	20 Diabetes with Chronic Complications	319,169	$1,774	G01
21 Diabetes without Complication	627,506	$1,809	G01	21 Diabetes without Complication	906,680	$1,774	G01
				22 Type 1 Diabetes Mellitus, add-on to Diabetes HCCs 19-21	116,159	$2,046	

Asthma

The current V05 HHS-HCC model includes one asthma HCC (HCC 161), which is in a hierarchy and HCC Group with HCC 160, where HCC 160 excludes HCC 161:

HCC Group 15:
- *HCC 160 Chronic Obstructive Pulmonary Disease, Including Bronchiectasis*
- *HCC 161 Asthma*

Asthma has new clinical distinctions in the ICD-10 diagnosis codes, specifying severity level (mild intermittent, mild persistent, moderate persistent, and severe persistent). For a given severity level, the codes distinguish between uncomplicated, with acute exacerbation, or with status asthmaticus.[29] Higher severity asthma is expected to be associated with more frequent physician visits, hospitalizations, and more intensive monitoring and management of drug treatments. In the child population specifically, severe asthma is characterized by sustained symptoms despite treatment by high doses of inhaled corticosteroids or oral corticosteroids.[30] The ICD-10 codes for severe asthma showed underprediction in our empirical analyses of the current V05 HHS-HCC models.

To distinguish cost differences by severity, we would split apart and replace *HCC 161 Asthma* with two HCCs, imposing a hierarchy with *HCC 161.1 Severe Asthma* excluding *HCC 161.2 Asthma, Except Severe*. Empirically this cost distinction is more important in the child model (and infant model), which is dominated in frequency by the lower cost HCC 161.2. In the child model, we would leave HCCs 160, 161.1, and 161.2 ungrouped to account for the cost distinctions between these clinical conditions. In the child population, HCC 160's higher predicted costs are associated with bronchiectasis. Approximately 25 percent of children with HCC 160 have bronchiectasis diagnoses as opposed to less than 5 percent of adults with HCC 160. In V05 when HCC 160 and HCC 161 were grouped together, HCC 161's much larger frequency (~99% of the HCC Group in the child model) resulted in the HCC Group's estimate being nearly equal to that of HCC 161's.

We would retain the grouping of Chronic Obstructive Pulmonary Disease (COPD) and asthma in the adult model. Although mean expenditures for adults with HCC 160 are higher than those for adults with HCCs 161.1 or 161.2, the model's parameter estimate (incremental prediction) for HCC 160 was lower than that for the lower severity HCCs 161.1 or 161.2 (hierarchy violations). This occurred because adults with the more severe COPD condition are more likely to have associated comorbidities and thus additional payment HCCs picking up a portion of their associated costs.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
160 Chronic Obstructive Pulmonary Disease, Including Bronchiectasis	260,035	$4,418	G15	160 Chronic Obstructive Pulmonary Disease, Including Bronchiectasis	260,035	$4,377	G15A
161 Asthma	643,581	$4,418	G15				
				161.1 Severe Asthma	14,574	$4,377	G15A
				161.2 Asthma, Except Severe	629,007	$4,377	G15A

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[29] Unlike severity levels, complication distinctions also occurred in ICD-9.

[30] Guilbert TW, Bacharier LB, and AM Fitzpatrick. Severe Asthma in Children. *J Allergy Clin Immunol Pract.* 2014; 2(5): 489-500.

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
160 Chronic Obstructive Pulmonary Disease, Including Bronchiectasis	1,907	$2,158	G15	160 Chronic Obstructive Pulmonary Disease, Including Bronchiectasis	1,907	$17,139	
161 Asthma	206,752	$2,158	G15				
				161.1 Severe Asthma	5,097	$5,558	
				161.2 Asthma, Except Severe	201,655	$1,956	

Fractures

The current V05 HHS-HCC model includes these fracture HCCs:

- *HCC 226 Hip Fractures and Pathological Vertebral or Humerus Fractures*
- *HCC 227 Pathological Fractures, Except of Vertebrae, Hip, or Humerus*

We would reconfigure HCC 226 to be clinically more specific. The hip fracture codes will be retained in this HCC. We would move the vertebral pathologic fracture codes to the newly designated payment HCC 228 described below and the humerus pathological fractures to nonpayment *HCC 233 Major Injury to Upper Limbs*. As part of these potntiachanges, HCC 226 would be relabeled *HCC 226 Hip and Pelvic Fractures* to better reflect the content.

We would delete *HCC 227 Pathological Fractures, Except of Vertebrae, Hip, or Humerus*. We would no longer differentiate between traumatic and pathological fractures at the HCC level because this distinction may be inconsistently diagnosed and coded. Other than at hip, pelvic, or vertebral sites, the pathological fractures codes would be remapped to lower nonpayment HCCs.

V05 *HCC 228 Vertebral Fractures without Spinal Cord Injury, Except Pathological* would be reconfigured to include the pathological vertebral fracture codes that had been in payment HCC 226. As part of the potential changes, it would be relabeled to *HCC 228 Vertebral Fractures without Spinal Cord Injury* to better reflect its content. We would add HCC 228 to the payment model because vertebral fractures are currently underpredicted in the V05 HHS-HCC model predictive ratios and vertebral fractures may indicate chronic disease and frailty.

Potential V06a HHS-HCC model fracture HCCs:

- *HCC 226 Hip and Pelvic Fractures*
- *HCC 228 Vertebral Fractures without Spinal Cord Injury*

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
226 Hip Fractures and Pathological Vertebral or Humerus Fractures	17,330	$34,537		226 Hip and Pelvic Fractures	10,881	$36,699	
227 Pathological Fractures, Except of Vertebrae, Hip, or Humerus	5,139	$24,098					
				228 Vertebral Fractures without Spinal Cord Injury	25,988	$20,456	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
226 Hip Fractures and Pathological Vertebral or Humerus Fractures	984	$44,848		226 Hip and Pelvic Fractures	1,508	$21,703	
227 Pathological Fractures, Except of Vertebrae, Hip, or Humerus	435	$10,969					
				228 Vertebral Fractures without Spinal Cord Injury	1,626	$19,329	

Third Degree Burns and Major Skin Conditions

HCC 218 Severe Skin Burn or Condition and *HCC 219 Moderate Skin Burn or Condition* are currently non-payment HCCs and not included in the risk adjustment adult or child models. These HCCs, which are currently underpredicted, contain chronic conditions or burns that involve long-term follow up care. We are reconfiguring these HCCs and adding them to the payment model in a hierarchy, with HCC 218 excluding HCC 219. HCC 218 is reconfigured to only contain extensive third degree burns (burns that cover greater than 10% of an individual's body) and relabeled as Extensive Third Degree Burns to better specify the conditions. HCC 219 is reconfigured to contain less extensive third degree burns by site, extensive non-third degree burns, and other serious and chronic skin conditions. It would be relabeled *HCC 219 Major Skin Burn or Condition* to better reflect its revised content. Because HCC 218 has a small sample size and high associated costs, we are also considering a constraint to its parameter estimate for stability purposes in the child model as described in the Severe Head Injury section below.

Potential updates to V06a HHS-HCC payment model:

- *HCC 218 Extensive Third Degree Burns*
- *HCC 219 Major Skin Burn or Condition*

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
				218 Extensive Third Degree Burns	472	$93,112	
				219 Major Skin Burn or Condition	5,341	$14,468	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
				218 Extensive Third Degree Burns	77	$55,358	
				219 Major Skin Burn or Condition	870	$14,604	

Coma and Severe Head Injury

We would add *HCC 223 Severe Head Injury* to the risk adjustment adult and child models. It represents a condition with ongoing care costs, similar to other injury HCCs currently included in the V05 models (e.g., hip fractures and vertebral fractures). HCC 223's costs are substantially underpredicted in the current V05 HHS risk adjustment models. HCC 223 has a small sample size, and a large proportion of the persons with HCC 223 are additionally coded with coma, HCC 122. Costs for severe head injury are similar but higher than for coma, and severe head injury is a more specific diagnosis. Hence, we would place the two HCCs in a hierarchy with HCC 223 above HCC 122. Additionally, we would relabel HCC 122 to account for the ongoing inclusion of coma codes that may be associated with a traumatic injury.

Revised V06a HCC label and new HCC:

- *HCC 122 Coma/Brain Compression, Anoxic Damage*
- *HCC 223 Severe Head Injury*

Two of the new injury-related HCCs (Extensive Third Degree Burns and Severe Head Injury) that we would add to the HHS-HCC risk adjustment models are similar in that they have small sample sizes, high associated costs, and ongoing treatment costs. For stability of their estimates across years, we would constrain these two HCCs to have the same estimated coefficient in the child model where sample sizes are smaller. With this *a priori* constraint (as opposed to an HCC Group), each HCC is counted individually, but the two HCCs are constrained to have the same coefficient.

For the child model, we would also include of *HCC 218 Extensive Third Degree Burns* as part of the *a priori* constraint in addition to the *HCC 223 Severe Head Injury:*

- *HCC 218 Extensive Third Degree Burns*
- *HCC 223 Severe Head Injury*

This *a priori* constraint would not include *HCC 122 Coma/Brain Compression, Anoxic Damage.*

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
122 Non-Traumatic Coma and Brain Compression/Anoxic Damage	25,503	$34,299		122 Coma/Brain Compression, Anoxic Damage	25,185	$31,900	
				223 Severe Head Injury	740	$77,738	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
122 Non-Traumatic Coma and Brain Compression/Anoxic Damage	3,492	$21,082		122 Coma/Brain Compression, Anoxic Damage	3,444	$19,621	
				218 Extensive Third Degree Burns	77	$55,358	
				223 Severe Head Injury	87	$55,358	

Amputations

The current V05 HHS-HCC payment model includes one Amputation HCC:

- *HCC 254 Amputation Status, Lower Limb/Amputation Complications*

Amputation-related HCCs (in Injury and in Amputations disease categories) were reviewed in the context of evaluating how traumatic amputation episode of care codes (initial encounter, subsequent encounter, sequela) were mapped and the associated costs by episode. Similarly, amputation complication codes were analyzed by associated costs and timing. We also identified and analyzed codes indicating amputation status or encounters for prosthetics. Further, we distinguished amputation codes by site, focusing on major limb components (i.e., excluding fingers and toes).

Traumatic amputations represent an acute event with ongoing (chronic) status, potential complications that overlap or extend beyond the initial episode of care, and ongoing costs related to care and prosthetic fittings. Although the V05 classification includes only the status and complications HCC, some costs of the omitted initial episode codes were pulled in via subsequent encounter codes in HCC 254. To address underprediction of the initial encounter codes for traumatic amputations of upper limb or lower limb and to better delineate costs between the initial episode and those for complications

and care for ongoing status care, we would include two reconfigured HCCs in the V06a classification in a hierarchy. The HCCs would be ungrouped in the adult model. Because amputations are rare in the child population, we would group the HCCs as a new HCC Group in the child model for coefficient stability purposes.

Revised V06a HCC label and new HCC:

- *HCC 234 Traumatic Amputations and Amputation Complications*
- *HCC 254 Amputation Status, Upper Limb or Lower Limb*

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
				234 Traumatic Amputations and Amputation Complications	3,033	$18,224	
254 Amputation Status, Lower Limb/Amputation Complications	10,514	$11,132		254 Amputation Status, Upper Limb or Lower Limb	4,818	$10,403	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
				234 Traumatic Amputations and Amputation Complications	136	$18,536	G22
254 Amputation Status, Lower Limb/Amputation Complications	306	$14,963		254 Amputation Status, Upper Limb or Lower Limb	185	$18,536	G22

Narcolepsy and Cataplexy

We would add *HCC 123 Narcolepsy and Cataplexy* to the HHS risk adjustment adult and child models. This HCC was significantly underpredicted in the V05 HHS-HCC model. Narcolepsy is a chronic neurological condition for which currently there is no cure. The primary treatment for narcolepsy is drug therapy (combination of drugs) to address its different clinical features—excessive daytime sleepiness, cataplexy (sudden episodic loss of muscle tone), sleep paralysis, sleep hallucinations, and disrupted nocturnal sleep. We would not add HCC 123 to the infant model as only adult and child age groups are diagnosed and treated for this condition.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
				123 Narcolepsy and Cataplexy	11,390	$20,436	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
				123 Narcolepsy and Cataplexy	678	$15,429	

Exudative Macular Degeneration

We would add *HCC 174 Exudative Macular Degeneration* (also known as wet macular degeneration) to the adult risk adjustment model. This condition is an age-related form of macular degeneration with onset usually after age 50. The incremental costs for this HCC are currently underpredicted in the adult model. Its costs are primarily related to drug treatments specific to the condition. If detected at an early stage, the condition may respond to drug therapies to reverse some vision loss or slow the disease progression.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
				174 Exudative Macular Degeneration	4,902	$7,590	

Congenital Heart Anomalies

These HCCs are currently in the V05 HHS-HCC child and infant models only:

- *HCC 137 Hypoplastic Left Heart Syndrome and Other Severe Congenital Heart Disorders*
- *HCC 138 Major Congenital Heart/Circulatory Disorders*
- *HCC 139 Atrial and Ventricular Septal Defects, Patent Ductus Arteriosus, and Other Congenital Heart/Circulatory Disorders*

These HCCs were underpredicted in the adult model, indicating their costs were not being sufficiently picked up in the existing heart condition payment HCCs that the enrollee might also have. Clinical consultants supported adding these HCCs to the adult model. Clinicians consulted noted that although the highest severity conditions requiring surgery are treated soon after birth or during childhood, many enrollees require lifelong monitoring and follow-up care. These HCCs had sufficient

sample size (~50,000) and high predicted incremental expenditures (~$12,500) in the adult model to support inclusion. We would add the HCCs to the V06a adult models as a new HCC Group. We would group them because of the small sample size of HCC 137 and the similar costs of HCCs 138 and 139 in the adult population. The HCCs will remain ungrouped in the child model where HCC 137 has sufficient sample size and there are cost distinctions between the three HCCs.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
				137 Hypoplastic Left Heart Syndrome and Other Severe Congenital Heart Disorders	696	$12,553	G21
				138 Major Congenital Heart/Circulatory Disorders	25,504	$12,553	G21
				139 Atrial and Ventricular Septal Defects, Patent Ductus Arteriosus, and Other Congenital Heart/Circulatory Disorders	24,362	$12,553	G21

Metabolic and Endocrine Disorders

The current V05 HHS-HCC models include this set of metabolic and endocrine disorders HCCs as a single group:

- *HCC 26 Mucopolysaccharidosis*
- *HCC 27 Lipidoses and Glycogenosis*
- *HCC 28 Congenital Metabolic Disorders, Not Elsewhere Classified*
- *HCC 29 Amyloidosis, Porphyria, and Other Metabolic Disorders*
- *HCC 30 Adrenal, Pituitary, and Other Significant Endocrine Disorders*

The difference between the V05 adult and child models is that HCC 28 is currently excluded from the adult model.

Because HCCs 26 and 27 have low sample sizes, their higher costs were significantly underpredicted when grouped with HCCs 28-30 (HCC 30 has the greatest frequency and lowest predicted costs of the HCCs in the HCC Group, resulting in the HCC Group's estimate being similar to that of HCC 30 alone). We examined the predicted costs for the HCCs ungrouped and in alternative HCC groupings. In both the adult and child models, HCCs 26 and 27 have similar costs to each other and significantly higher costs than the lowest cost HCC in the HCC Group (on the magnitude of between 6 and 15 times higher). We would continue to group HCCs 26 and 27 together in both the adult and child models because they have small sample sizes and similar costs. In the adult model, because HCCs 29 and 30 have sufficiently large sample sizes, are clinically distinct, and have significant differences in predicted costs, we would leave those HCCs ungrouped. We continue to exclude HCC 28 from the adult model because its conditions are treated primarily in the infant and child populations. In the child model, we would group HCCs 28 and 29 together, as they have

relatively small sample sizes and similar predicted costs. Even though HCC 30 has similar costs to HCCs 28 and 29, we would leave it ungrouped and additive in the child model. HCC 30 has a large sample size and is clinically distinct (endocrine disorders).

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
26 Mucopoly-saccharidosis	369	$11,057	G02A	26 Mucopoly-saccharidosis	369	$104,083	G02B
27 Lipidoses and Glycogenosis	2,279	$11,057	G02A	27 Lipidoses and Glycogenosis	2,279	$104,083	G02B
28 Congenital Metabolic Disorders, Not Elsewhere Classified				28 Congenital Metabolic Disorders, Not Elsewhere Classified			
29 Amyloidosis, Porphyria, and Other Metabolic Disorders	12,508	$11,057	G02A	29 Amyloidosis, Porphyria, and Other Metabolic Disorders	13,589	$23,836	
30 Adrenal, Pituitary, and Other Significant Endocrine Disorders	142,884	$11,057	G02A	30 Adrenal, Pituitary, and Other Significant Endocrine Disorders	142,884	$8,034	

Potential changes included in the V06a child model and their impact:

HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
26 Mucopoly-saccharidosis	107	$27,645	G02	26 Mucopoly-saccharidosis	107	$185,695	G02B
27 Lipidoses and Glycogenosis	307	$27,645	G02	27 Lipidoses and Glycogenosis	307	$185,695	G02B
28 Congenital Metabolic Disorders, Not Elsewhere Classified	3,470	$27,645	G02	28 Congenital Metabolic Disorders, Not Elsewhere Classified	3,470	$24,384	G02D
29 Amyloidosis, Porphyria, and Other Metabolic Disorders	1,161	$27,645	G02	29 Amyloidosis, Porphyria, and Other Metabolic Disorders	1,307	$24,384	G02D
30 Adrenal, Pituitary, and Other Significant Endocrine Disorders	12,051	$27,645	G02	30 Adrenal, Pituitary, and Other Significant Endocrine Disorders	12,051	$24,078	

Necrotizing Fasciitis

The current V05 HHS-HCC risk adjustment model includes these two musculoskeletal disorder HCCs as HCC Group 03 in both the adult and child models:

- *HCC 54 Necrotizing Fasciitis*
- *HCC 55 Bone/Joint/Muscle Infections/Necrosis*

In the adult V05 model, HCC 54 is underpredicted. Its incremental expenditures when ungrouped (~$55,000) are approximately twice as high as those of HCC 55 (~$23,000). Because HCC 54 is clinically distinct and has a sufficient sample size, we would remove the HCC Group for HCCs 54 and 55 in the V06a adult models. In contrast, HCC 54 has a very low sample size in the child model. Thus, we will retain Group 03 in the child model for stability purposes.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
54 Necrotizing Fasciitis	1,319	$23,704	G03	54 Necrotizing Fasciitis	1,319	$55,459	
55 Bone / Joint / Muscle Infections / Necrosis	37,135	$23,704	G03	55 Bone / Joint / Muscle Infections / Necrosis	37,135	$23,057	

Blood Disorders

The current V05 HHS-HCC risk adjustment model includes 9 blood disorders HCCs, including these five that comprise two groups:

HCC Group 06:

- *HCC 67 Myelodysplastic Syndromes and Myelofibrosis*
- *HCC 68 Aplastic Anemia*

HCC Group 07:
- *HCC 69 Acquired Hemolytic Anemia, Including Hemolytic Disease of Newborn*
- *HCC 70 Sickle Cell Anemia (Hb-SS)*
- *HCC 71 Thalassemia Major*

Within HCC Group 07, *HCC 69 Acquired Hemolytic Anemia, Including Hemolytic Disease of Newborn* was significantly underpredicted and *HCC 71 Thalassemia Major* was overpredicted. We examined code sets within these HCCs and explored ungrouped HCCs and alternative groupings. Based on clinical input and empirical analyses, we would make code level changes to HCC 69 and to also reconfigure HCC 71 to include only the higher-severity beta thalassemia major subset. We revised HCC 71's label to *Beta Thalassemia Major* to better reflect its content. We would also change the group designation for HCC 69, adding it to new HCC Group 06A and including it in the severity illness interaction term for that HCC Group.

The potential V06a classification updates would reconfigure these blood disorder HCCs as shown here:

HCC Group 06A:

- *HCC 67 Myelodysplastic Syndromes and Myelofibrosis*
- *HCC 68 Aplastic Anemia*
- *HCC 69 Acquired Hemolytic Anemia, Including Hemolytic Disease of Newborn*

HCC Group 07A:
- *HCC 70 Sickle Cell Anemia (Hb-SS)*
- *HCC 71 Beta Thalassemia Major*

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
67 Myelodysplastic Syndromes and Myelofibrosis	3,942	$49,555	G06	67 Myelodysplastic Syndromes and Myelofibrosis	3,942	$51,884	G06A
68 Aplastic Anemia	2,658	$49,555	G06	68 Aplastic Anemia	2,658	$51,884	G06A
69 Acquired Hemolytic Anemia, Including Hemolytic Disease of Newborn	4,038	$33,163	G07	69 Acquired Hemolytic Anemia, Including Hemolytic Disease of Newborn	4,043	$51,884	G06A
70 Sickle Cell Anemia (Hb-SS)	2,177	$33,163	G07	70 Sickle Cell Anemia (Hb-SS)	2,177	$9,473	G07A
71 Thalassemia Major	2,640	$33,163	G07	71 Beta Thalassemia Major	1,889	$9,473	G07A

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
67 Myelodysplastic Syndromes and Myelofibrosis	192	$73,377	G06	67 Myelodysplastic Syndromes and Myelofibrosis	192	$61,749	G06A
68 Aplastic Anemia	321	$73,377	G06	68 Aplastic Anemia	321	$61,749	G06A
69 Acquired Hemolytic Anemia, Including Hemolytic Disease of Newborn	423	$30,524	G07	69 Acquired Hemolytic Anemia, Including Hemolytic Disease of Newborn	424	$61,749	G06A
70 Sickle Cell Anemia (Hb-SS)	444	$30,524	G07	70 Sickle Cell Anemia (Hb-SS)	444	$17,880	G07A
71 Thalassemia Major	272	$30,524	G07	71 Beta Thalassemia Major	174	$17,880	G07A

4.2.2   Significantly Reconfigured HCCs or Significant Hierarchy Changes

Mental Health

The ICD-9 and ICD-10 classification differs for mental health in that several depression and mood disorder codes have been redefined in ICD-10. ICD-10 has largely eliminated the ICD-9 distinction between "major depression" and "depression". Additionally, the category of Mood [Affective] Disorders includes concepts in ICD-10 that were previously separated into two categories in ICD-9 (Episodic Mood Disorders and Neurotic Disorders, Personality Disorders, and Other Nonpsychotic Mental Disorders).

In the V06a HHS-HCC classification, we would relabel some HCCs that were originally created with ICD-9 in mind, in order to better align with distinctions made in ICD-10, as follows:

HCC	Old HCC Label	New HCC Label
88	Major Depressive and Bipolar Disorders	Major Depressive Disorder, Severe, and Bipolar Disorders
89	Reactive and Unspecified Psychosis, Delusional Disorders	Delusional and Other Specified Psychotic Disorders, Unspecified Psychosis

We would also move *HCC 89 Delusional and Other Specified Psychotic Disorders, Unspecified Psychosis* above *HCC 88 Major Depressive Disorder, Severe, and Bipolar Disorders* numerically (i.e., the HCCs are renumbered) and in the HCC hierarchy in both the adult and child models. The reason for this change is that the costs and diagnoses associated with *HCC 89 Delusional and Other Specified Psychotic Disorders, Unspecified Psychosis* are more aligned with those of *HCC 87 Schizophrenia.*

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
88 Major Depressive and Bipolar Disorders	265,783	$7,859		88 Delusional and Other Specified Psychotic Disorders, Unspecified Psychosis	18,727	$12,744	
89 Reactive and Unspecified Psychosis, Delusional Disorders	9,706	$7,514		89 Major Depressive Disorder, Severe, and Bipolar Disorders	256,617	$6,813	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
88 Major Depressive and Bipolar Disorders	30,067	$14,109		88 Delusional and Other Specified Psychotic Disorders, Unspecified Psychosis	3,013	$22,453	
89 Reactive and Unspecified Psychosis, Delusional Disorders	1,183	$14,109		89 Major Depressive Disorder, Severe, and Bipolar Disorders	28,193	$13,515	

Cerebral Palsy and Spina Bifida

There are not potential changes from current V05 HHS-HCCs in the diagnoses mapped to the cerebral palsy and spina bifida HCCs in V06a:

- *HCC 112 Quadriplegic Cerebral Palsy*
- *HCC 113 Cerebral Palsy, Except Quadriplegic*
- *HCC 114 Spina Bifida and Other Brain/Spinal/Nervous System Congenital Anomalies.*

However, a V06a change is made in the HCC clinical hierarchies involving these HCCs in the adult and child models. The cerebral palsy HCCs (112, 113) would now exclude (take precedence over) the paralysis HCCs (*107 Quadriplegia, 109 Paraplegia, 150 Hemiplegia/ Hemiparesis*). The spina bifida HCC (114) would exclude the hydrocephalus HCC (121). These exclusions follow ICD-10 "Excludes 1" coding rules that state, for example, that cerebral palsy and quadriplegia cannot both be coded for the same person. That is, the V06a HCC clinical hierarchies, in this case, implement ICD-10 rules prohibiting "double coding" of the same condition. In statistical estimation of the V05 HHS-HCC adult regression model, the cerebral palsy and spina bifida HCCs sometimes had anomalously low or even negative coefficients. A major contributor was the double counting of these conditions with other conditions in multiple HCCs. With the revised V06a HCC clinical hierarchies, the negative coefficient anomaly is less likely to occur. In the child model, a large percentage of children in V05 HCC 107 were also in HCC 112 as is shown in the table below where the count for HCC 107 dropped from 588 (in V05) to 194 (in V06a). The imposed V06a hierarchy resulted in V06a HCC 107's estimate being much higher when restricted to quadriplegia that does not include cerebral palsy. Because the newly excluded paralysis HCCs and hydrocephalus HCC have higher coefficients than the corresponding cerebral palsy and spina bifida HCCs, this potential hierarchy change may provide a perverse incentive for issuers to code quadriplegia, paraplegia, or hemiplegia rather than cerebral palsy with those conditions or to code hydrocephalus rather than spina bifida with hydrocephalus. However, this would be a violation of coding guidelines which state to code to the highest number of characters available (level of detail) and to the level of certainty known based on clinical knowledge of the patient's health condition.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model					V06a Adult Model				
HCC	Count	Parameter Estimate	Group	Hierarchy	HCC	Count	Parameter Estimate	Group	Hierarchy
106 Traumatic Complete Lesion Cervical Spinal Cord	100	$48,356	G10	107, 108, 109, 110, 150, 151	106 Traumatic Complete Lesion Cervical Spinal Cord	100	$53,077	G10	107, 108, 109, 110, 150, 151, 228
107 Quadriplegia	3,940	$48,356	G10	109, 110, 150, 151	107 Quadriplegia	3,622	$53,077	G10	109, 110, 150, 151, 228
108 Traumatic Complete Lesion Dorsal Spinal Cord	126	$34,252	G11	109, 110, 151	108 Traumatic Complete Lesion Dorsal Spinal Cord	126	$35,984	G11	109, 110, 151, 228
109 Paraplegia	4,014	$34,252	G11	110, 151	109 Paraplegia	3,947	$35,984	G11	110, 151, 228
110 Spinal Cord Disorders/ Injuries	23,600	$22,458			110 Spinal Cord Disorders/ Injuries	23,554	$23,495		228
112 Quadriplegic Cerebral Palsy	757	$0		113	112 Quadriplegic Cerebral Palsy	757	$2,089		107, 109, 110, 113, 150, 151, 228
113 Cerebral Palsy, Except Quadriplegic	3,970	$0			113 Cerebral Palsy, Except Quadriplegic	3,970	$2,089		107, 109, 110, 150, 151, 228
114 Spina Bifida and Other Brain / Spinal / Nervous System Congenital Anomalies	9,186	$3,031			114 Spina Bifida and Other Brain / Spinal / Nervous System Congenital Anomalies	9,186	$5,754		121
121 Hydrocephalus	6,249	$32,222			121 Hydrocephalus	5,531	$35,460		

Potential changes included in the V06a child model and their impact:

V05 Child Model					V06a Child Model				
HCC	**Count**	**Parameter Estimate**	**Group**	**Hierarchy**	**HCC**	**Count**	**Parameter Estimate**	**Group**	**Hierarchy**
106 Traumatic Complete Lesion Cervical Spinal Cord	*	$33,510	G10	107, 108, 109, 110, 150, 151	106 Traumatic Complete Lesion Cervical Spinal Cord	*	$65,396	G10	107, 108, 109, 110, 150, 151, 228
107 Quadriplegia	588	$33,510	G10	109, 110, 150, 151	107 Quadriplegia	194	$65,396	G10	109, 110, 150, 151, 228
108 Traumatic Complete Lesion Dorsal Spinal Cord	11	$26,559	G11	109, 110, 151	108 Traumatic Complete Lesion Dorsal Spinal Cord	11	$37,925	G11	109, 110, 151, 228
109 Paraplegia	277	$26,559	G11	110, 151	109 Paraplegia	235	$37,925	G11	110, 151, 228
110 Spinal Cord Disorders/ Injuries	1,550	$18,177			110 Spinal Cord Disorders/ Injuries	1,515	$19,329		228
112 Quadriplegic Cerebral Palsy	1,383	$1,099		113	112 Quadriplegic Cerebral Palsy	1,383	$11,146		107, 109, 110, 113, 150, 151, 228
113 Cerebral Palsy, Except Quadriplegic	3,726	$0			113 Cerebral Palsy, Except Quadriplegic	3,726	$987		107, 109, 110, 150, 151, 228
114 Spina Bifida and Other Brain / Spinal / Nervous System Congenital Anomalies	5,372	$6,352			114 Spina Bifida and Other Brain / Spinal / Nervous System Congenital Anomalies	5,372	$9,078		121
121 Hydrocephalus	2,189	$16,079			121 Hydrocephalus	1,400	$15,626		

*Count suppressed because of small sample size.

Pancreatitis

The current V05 HHS-HCC model includes one pancreas transplant HCC and two pancreatitis HCCs:

- *HCC 18 Pancreas Transplant Status/Complications*
- *HCC 46 Chronic Pancreatitis*
- *HCC 47 Acute Pancreatitis/Other Pancreatic Disorders and Intestinal Malabsorption*

To distinguish cost differences, we would move codes for other pancreatic disorders and intestinal malabsorption out of HCC 47 and into *HCC 53 Other Gastrointestinal Disorders*. We would

also relabel the HCC to *HCC 47 Acute Pancreatitis* to better align with the revised content of HCC 47. These potential changes would apply to both the adult and child models.

We would also reconfigure the pancreas-related HCC hierarchies for both the adult and child models. In the V05 HHS-HCC classification, HCC 18 excludes pancreatitis (HCCs 46 and 47). The revised V06a classification would remove this exclusion because pancreas transplants are done primarily for diabetes and insulin conditions rather than pancreatitis and would rename *HCC 18 Pancreas Transplant Status/Complications* to *HCC 18 Pancreas Transplant Status*.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
18 Pancreas Transplant Status / Complications	913	$16,113		18 Pancreas Transplant Status	913	$7,385	
46 Chronic Pancreatitis	13,197	$16,113		46 Chronic Pancreatitis	13,233	$16,154	
47 Acute Pancreatitis / Other Pancreatic Disorders and Intestinal Malabsorption	99,071	$8,707		47 Acute Pancreatitis	23,807	$14,886	

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
18 Pancreas Transplant Status / Complications	11	$123,735		18 Pancreas Transplant Status	11	$66,050	
46 Chronic Pancreatitis	189	$123,735		46 Chronic Pancreatitis	193	$98,466	
47 Acute Pancreatitis / Other Pancreatic Disorders and Intestinal Malabsorption	10,077	$11,153		47 Acute Pancreatitis	590	$37,231	

Liver

The current V05 HHS-HCC model includes six liver HCCs:

- *HCC 34 Liver Transplant Status/Complications*
- *HCC 35 End Stage Liver Disease*
- *HCC 36 Cirrhosis of Liver*
- *HCC 37.1 Chronic Viral Hepatitis C*
- *HCC 37.2 Chronic Hepatitis, Except Chronic Viral Hepatitis C*

- *HCC 38 Acute Liver Failure/Disease, Including Neonatal Hepatitis*

For the liver HCCs, we reviewed placement of ICD-10 codes for which a subset of codes had more detailed information than the ICD-9 counterparts. For example, in the V05 classification, the toxic liver disease set of ICD-10 codes had mapped comparable to the ICD-9 set to non-payment *HCC 39 Other Hepatitis and Liver Disease*. Some of the ICD-10 toxic liver disease codes denote accompanying conditions, such as with cirrhosis or with chronic persistent hepatitis; thus, we would remap combination liver codes to the higher corresponding liver condition HCC in both the adult and child models. Additionally, we extensively reviewed the composition of the liver failure HCCs with clinicians. Because chronic liver failure and acute liver failure are clinically distinct and have different disease progressions and treatments, the clinicians recommended and we would retain them as separate HCCs. We would also slightly reconfigure, in both the adult and child models, the HCCs' code composition to align with clinical input and revise the label of V05 HCC 35 (potential updated to V06a HCC 35.2).

To address the cost implications of chronic versus acute liver failure in the concurrent models, we would also move the acute liver failure HCC above the chronic liver failure HCC in the hierarchy and would renumber the HCCs to reflect the changes. V05 HCCs 38 and 35 were reconfigured in V06 HHS-HCC model as these:

- *HCC 35.1 Acute Liver Failure/Disease, Including Neonatal Hepatitis*
- *HCC 35.2 Chronic Liver Failure/End Stage Liver Disorders*

These potential changes would also be made to both the adult and child models.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
HCC	Count	Parameter Estimate	Group	HCC	Count	Parameter Estimate	Group
34 Liver Transplant Status/Complications	4,451	$47,385		34 Liver Transplant Status/Complications	4,451	$46,283	
				35.1 Acute Liver Failure/Disease, Including Neonatal Hepatitis	7,659	$41,365	
35 End Stage Liver Disease	22,996	$19,632		35.2 Chronic Liver Failure/End Stage Liver Disorders	20,499	$13,730	
38 Acute Liver Failure/Disease, Including Neonatal Hepatitis	10,461	$19,632					

Potential changes included in the V06a child model and their impact:

V05 Child Model				V06a Child Model			
HCC	**Count**	**Parameter Estimate**	**Group**	**HCC**	**Count**	**Parameter Estimate**	**Group**
34 Liver Transplant Status/Complications	320	$123,735		34 Liver Transplant Status/Complications	320	$66,050	
				35.1 Acute Liver Failure/Disease, Including Neonatal Hepatitis	129	$66,050	
35 End Stage Liver Disease	199	$123,735		35.2 Chronic Liver Failure/End Stage Liver Disorders	176	$66,050	
38 Acute Liver Failure/Disease, Including Neonatal Hepatitis	113	$49,686					

Severe Illness Interactions in Adult Model

The V05 adult model has two severe illness interaction terms that estimate the additional incremental costs of combinations of high severity HCCs. The two terms aggregate pairs of interactions, distinguishing between high cost and medium cost. For empirical reasons, we would remove the medium cost severe illness interaction term in the V06a classification. Its parameter estimate is usually very low. In the enrollee-level 2017 EDGE data, the medium cost severe illness interaction term's estimate was negative and constrained to $0.

Potential changes included in the V06a adult model and their impact:

V05 Adult Model				V06a Adult Model			
Variable	**Count**	**Parameter Estimate**	**Group**	**Variable**	**Count**	**Parameter Estimate**	**Group**
Severe Illness Interaction Group_High	57,485	$29,614		Severe Illness Interaction Group_High	57,939	$30,009	
Severe Illness Interaction Group_Medium	31,339	$0					

Transplant *A Priori* Constraints in Child Model

Because of small sample sizes in the child model, we apply *a priori* constraints to the transplant HCCs to improve the estimate's stability. The transplants are clinically similar in the post-transplant need for anti-rejection and maintenance immunosuppressive drugs. The transplant HCCs in the child model are constrained to be equal to each other; but they are not part of a transplant HCC Group. This means a child with different organ transplants or transplant status in the same year will get additive credit for each transplant. In V05, *HCC 183 Kidney Transplant Status* had a sufficient sample size to be unconstrained. All other payment transplant HCCs formed a single *a priori* constraint for stability purposes.

In the V06a reclassification, we would separate the transplant HCCs in the child model into two sets of *a priori* constraints to better distinguish costs. We would also revise HCC labels for consistency and to better reflect HCC content based on ICD-10 transplant codes. Notably, there is no longer a unique diagnosis code (or code set) for pancreas transplant complications as there was in ICD-9. In ICD-10, "transplant failure or rejection of pancreas" is subtext to a broader diagnosis code set (T86.89 Complications of other transplanted tissue) that may include other tissue types and thus does not map to *HCC 18 Pancreas Transplant Status*.

The current V05 and potential V06a *a priori* transplant constraints for the child model:

V05 Transplant Constraints	V06a Transplant Constraints
Unconstrained • HCC 183 Kidney Transplant Status Transplant Stability Constraint 1 (S1) • HCC 18 Pancreas Transplant Status/Complications • HCC 34 Liver Transplant Status/Complications • HCC 41 Intestine Transplant Status/Complications • HCC 128 Heart Assistive Device/Artificial Heart • HCC 129 Heart Transplant • HCC 158 Lung Transplant Status/Complications • HCC 251 Stem Cell, Including Bone Marrow, Transplant Status/Complications	Transplant Stability Constraint 1 (S1) • HCC 18 Pancreas Transplant Status • HCC 34 Liver Transplant Status/Complications • HCC 183 Kidney Transplant Status/Complications Transplant Stability Constraint 2 (S2) • HCC 41 Intestine Transplant Status/Complications • HCC 128 Heart Assistive Device/Artificial Heart • HCC 129 Heart Transplant Status/Complications • HCC 158 Lung Transplant Status/Complications • HCC 251 Stem Cell, Including Bone Marrow, Transplant Status/Complications

Potential changes included in the V06a child model and their impact (including HCCs affected by within disease group hierarchy violations)[31]:

V05 Child Model				V06a Child Model			
HCC	Count	Parameter Estimate	Constraint	HCC	Count	Parameter Estimate	Constraint
18 Pancreas Transplant Status / Complications	11	$123,735	S1, H3	18 Pancreas Transplant Status	11	$66,050	S1
46 Chronic Pancreatitis	189	$123,735	H3	46 Chronic Pancreatitis	193	$98,466	
34 Liver Transplant Status / Complications	320	$123,735	S1, H4	34 Liver Transplant Status / Complications	320	$66,050	S1, H3
				35.1 Acute Liver Failure/Disease, Including Neonatal Hepatitis	129	$66,050	H3
35 End Stage Liver Disease	199	$123,735	H4	35.2 Chronic Liver Failure/End Stage Liver Disorders	176	$66,050	H3
38 Acute Liver Failure/Disease, Including Neonatal Hepatitis	113	$49,686					
41 Intestine Transplant Status / Complications	17	$123,735	S1	41 Intestine Transplant Status / Complications	17	$142,510	S2
128 Heart Assistive Device/Artificial Heart	18	$123,735	G14, S1	128 Heart Assistive Device/Artificial Heart	18	$142,510	G14, S2
129 Heart Transplant	214	$123,735	G14, S1	129 Heart Transplant Status / Complications	214	$142,510	G14, S2
158 Lung Transplant Status / Complications	32	$123,735	S1, H9	158 Lung Transplant Status / Complications	32	$142,510	S2, H9
159 Cystic Fibrosis	1,217	$123,735	H9	159 Cystic Fibrosis	1,217	$142,510	H9
183 Kidney Transplant Status	400	$58,700		183 Kidney Transplant Status / Complications	400	$66,050	S1
251 Stem Cell, Including Bone	590	$123,735	S1	251 Stem Cell, Including Bone	590	$142,510	S2

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[31] We may re-examine hierarchy violation constraints for non-transplant HCCs in the child model that affect the predicted costs of the transplant set. For example, we may allow *HCC 159 Cystic Fibrosis*, which has high associated drug costs, to have higher predicted costs than HCC *158 Lung Transplant Status/Complications* which excludes it. Currently because of a hierarchy violation constraint, HCC 159 is constrained with the transplant set and increases the transplant set's predicted costs.

Marrow, Transplant Status / Complications				Marrow, Transplant Status / Complications			

Constraint Column Note: G=Group; H=Hierarchy violation constraint; S=Transplant stability constraint

4.2.3   Infant Categorical Model Changes

The V06a reclassification retains the V05 HHS-HCC infant categorical model's structure, interacting five birth maturity categories with five disease severity categories as described in Section 2.3. Working within that structure, we reviewed code level and HCC level assignments to categories.

Newborn HCCs and Maturity Categories

In the context of maturity categories, we examined the diagnosis codes and DXGs within the newborn HCCs 242-249. We identified a subset of weeks gestation codes that were underpredicted in the V05 classification. ICD-10 diagnosis codes for weeks gestation identify a single week, whereas ICD-9 codes grouped pairs of weeks (e.g., 27-28 weeks which straddled the ICD-10 categories distinguishing between extreme immaturity and preterm). We would reassign a subset of ICD-10 weeks gestation codes, 27-30 weeks, to better align their cost implications by maturity with those of the corresponding low birthweight codes within the newborn HCCs.

ICD-10 Code Set	V05 HHS-HCC	V05 Maturity Category	V06a HHS-HCC	V06a Maturity Category
P0726 extreme immaturity of newborn, gestational age 27 completed weeks P0720 extreme immaturity of newborn, unspecified gestational weeks	245	Immature	244	Extremely Immature
P0732 preterm newborn, gestational age 29 completed weeks P0733 preterm newborn, gestational age 30 completed weeks	246	Immature	245	Immature

Disease HCCs and Severity Level Categories

As described earlier in Sections 4.2.1 and 4.2.2, we made some code level changes, payment status changes, and hierarchy changes to several HCCs that are applicable to all models (adult, child, infant). We summarize below changes in potential V06a HCCs where the net change in the infant model sample size for an individual HCC or set of HCCs was 50 or greater. Note, however, that unlike the adult and child models, the infant model is categorical, not additive. Thus, the highest severity level of any disease HCCs that an infant has is the determining factor as to which interacted category group the infant will be assigned.

V05 HHS-HCC	V06a HHS-HCC	Description of PotentialV06a HCC Changes and Infant Model Impact
HCC 47 Acute Pancreatitis/Other Pancreatic Disorders and Intestinal Malabsorption	HCC 47 Acute Pancreatitis	HCC 47 was reconfigured from its V05 version, removing intestinal malabsorption and other pancreatic disorders and retaining acute pancreatitis codes. This led to a large decrease in its sample size in the infant model as few infants have acute pancreatitis. Because the V05 severity level for HCC 47 is the lowest severity level (Level 1), which is also where infants without any disease HCCs are assigned, there would be no change in severity level assignment for an infant who had only HCC 47 in V05 and then because of this HCC's reconfiguration had 0 payment HCCs in V06a.
HCC 81 Drug Psychosis HCC 82 Drug Dependence	HCC 81 Drug Use with Psychotic Complications HCC 82 Drug Use Disorder, Moderate/ Severe, or Drug Use with Non-Psychotic Complications HCC 83 Alcohol Use with Psychotic Complications HCC 84 Alcohol Use Disorder, Moderate/ Severe, or Alcohol Use with Specified Non-Psychotic Complications HCC 85 Drug Use Disorder, Mild, Uncomplicated, Except Cannabis	V05 drug use disorder payment HCCs 81-82 were reconfigured and two alcohol use disorder HCCs and one drug use disorder HCC were added to the V06a payment models. Most infants with substance use disorder HCCs are coded with Chapter P (Certain Conditions Arising in the Perinatal Period) ICD-10 diagnosis codes rather than Chapter F (Mental, Behavioral, and Neurodevelopmental Disorders) diagnosis codes. In V05, the P codes mapping to substance use disorders (e.g., P04 set, newborn affected by noxious substances transmitted via placenta or breast milk; P96.1-P96.2 neonatal withdrawal symptoms) mapped to HCC 81. In V06a, we remapped that newborn P code set to HCC 82, which is clinically more appropriate, and added a code that had previously been excluded (*P040 newborn affected by maternal anesthesia analgesia in pregnancy, labor, and delivery*). In V06a, a subset of accidental poisoning (drug overdose) codes were also added to HCC 82. The net effect of these changes was an increase in the number of infants with substance use disorders HCCs. Although these HCCs are clinically distinct in the infant model, all substance use payment HCCs are assigned to the same severity level.
HCC 114 Spina Bifida and Other Brain/Spinal/Nervous System Congenital Anomalies HCC 121 Hydrocephalus	HCC 114 Spina Bifida and Other Brain/Spinal/Nervous System Congenital Anomalies HCC 121 Hydrocephalus	In V06a, we added a hierarchy exclusion so that a person coded with HCC 114 could not additionally be coded with HCC 121. In the infant model, this led to a decrease in the sample size for HCC 121. We also raised the severity level assignment of HCC 114 to be equal to that of HCC 121 (shown in the table below). Thus, any infants who went from having HCCs 114 and 121 in V05 to having only HCC 114 in V06a will not see a change in category assignment related to this hierarchy change.
HCC 130 Congestive Heart Failure	HCC 130 Heart Failure	In V06a, we remapped ICD-10 diagnosis code *P290 neonatal cardiac failure* from a nonpayment HCC to HCC 130. This led to an increase in the sample size for HCC 130.
HCC 161 Asthma	HCC 161.1 Severe Asthma HCC 161.2 Asthma, Except Severe	We reconfigured the single V05 asthma HCC as two HCCs in V06a to delineate severity. We placed HCC 161.1 in a higher severity level than HCC 161.2 (shown in the table below). This resulted in ~300 infants, or 8% of the infant sample with asthma, being assigned to HCC 161.1.
	HCC 219 Major Skin Burn or Condition	In V06a, we reconfigured HCC 219, remapping skin conditions such as staphylococcal scalded skin syndrome and epidermolysis bullosa to the HCC, and newly added HCC 219 to the payment models. Of the new payment V06a HCCs related to burns or injuries (218, 219, 223, 228, 234), only HCC 219 has an infant sample size greater than 50.

For the disease severity categories, we made initial placements of new V06a HHS-HCCs based on clinical severity. We then conducted severity level analyses for V06a HHS-HCCs, comparing the four data year samples: 2016 enrollee-level EDGE, 2017 enrollee-level EDGE, 2016 MarketScan®, and 2017 MarketScan®. We began by calculating mean total expenditures for the highest severity level HCCs only (Level 5). Excluding infants with any Level 5 HCCs, we then calculated mean total expenditures for the next highest severity level HCCs (Level 4). We continued this process, each time excluding infants already assigned to higher severity levels until we had mean total expenditures for each of the HCCs in each of the five severity levels. We then reviewed HCC placement to determine if any HCCs empirically fit better in a higher or lower severity level, considering clinical face validity of results and sample size. Sample size was important because many of the HCCs have very small sample sizes and could be affected by outlier costs for a single infant.

Following our review, potential V06a changes to Severity Level assignments for these HCCs would include:

V06a HHS-HCC	V05 Severity Level	V06a Severity Level
HCC 35.1 Acute Liver Failure/Disease, Including Neonatal Hepatitis	3	4
HCC 35.2 Chronic Liver Failure/End-Stage Liver Disorders	5	4
HCC 73 Combined and Other Severe Immunodeficiencies	4	3
HCC 81 Drug Use with Psychotic Complications	2	3
HCC 82 Drug Use Disorder, Moderate/Severe, or Drug Use with Non-Psychotic Complications	2	3
HCC 83 Alcohol Use with Psychotic Complications	new	3
HCC 84 Alcohol Use Disorder, Moderate/Severe, or Alcohol Use with Specified Non-Psychotic Complications	new	3
HCC 85 Drug Use Disorder, Mild, Uncomplicated, Except Cannabis	new	3
HCC 114 Spina Bifida and Other Brain/Spinal/Nervous System Congenital Anomalies	2	3
HCC 218 Extensive Third Degree Burns	new	3
HCC 223 Severe Head Injury	new	3
HCC 226 Hip and Pelvic Fractures	4	3
HCC 228 Vertebral Fractures without Spinal Cord Injury	new	3
HCC 47 Acute Pancreatitis	1	2
HCC 161.1 Severe Asthma	new split (1)	2
HCC 162 Fibrosis of Lung and Other Lung Disorders	3	2
HCC 188 Chronic Kidney Disease, Severe (Stage 4)	1	2
HCC 219 Major Skin Burn or Condition	new	2
HCC 161.2 Asthma, Except Severe	new split (1)	1
HCC 234 Traumatic Amputations and Amputation Complications	new	1

5.0 Overall Impact of Potential V06a Changes

In addition to V06a HCC and disease group changes and impacts detailed in the previous section, we looked at broader impacts.

While these HCC updates slightly improve model prediction and fit, the changes outlined in Section 4.0 from the current V05 classification to the potential V06a classification would increase the

overall number of enrollees with one or more payment HCCs in the HHS-HCC adult and child models, as shown below. The estimated overall number of infants with one or more payment HCCs would decrease slightly (one-half of one percent). These differences between models reflect both the number and type of HCCs added to the potential V06a models and revisions to continuing HCCs. As introduced in the Executive Summary Table ES.1, the potential adult model has 17 HCCs added, the child model has 12 HCCs added, and the infant model has only 8 HCCs added. Thus, we would expect the overall impact to show greater increases in HCC counts for the adult model. Of the new HCCs added, the sets for pregnancy and for substance use disorders had the greatest number of enrollees. Those HCCs are either restricted to the adult and child models (pregnancy) or the new conditions added are more common in the adult and child populations (substance use disorders). Some HCC reconfigurations (e.g., HCC 47 Acute Pancreatitis) and changes to hierarchies (e.g., cerebral palsy and spina bifida) resulted in decreases in HCC counts in each of the models (adult, child, and infant). Finally, as was noted earlier in this paper, because the infant model is categorical, decreases (or increases) in an enrollee's count of HCCs may not affect the severity level to which an infant is assigned. The severity level is determined by the highest severity level HCC an infant has. For example, it is possible for infant enrollees to change from one or more HCCs in V05 to 0 HCCs in V06a and remain in the same severity level if their highest V05 HCC had been assigned to Severity Level 1.

Payment HHS-HCC Counts Between Current V05 and Potential V06a

	V05 Enrollee Counts	**V06a Enrollee Counts**
Adult HHS-HCC Model		
Total	21,674,903	21,674,903
0 Payment HCCs	17,629,163	17,413,381
1+ Payment HCCs	4,045,740	4,261,522
Child HHS-HCC Model		
Total	4,701,421	4,701,421
0 Payment HCCs	4,285,874	4,279,919
1+ Payment HCCs	415,547	421,502
Infant HHS-HCC Model		
Total	440,000	440,000
0 Payment HCCs	253,458	254,592
1+ Payment HCCs	186,542	185,408

At an individual level, there is little movement between the payment HCC count categories described above. Most enrollees remain in the same 0 payment HCC count or 1+ payment HCC count category following the potential changes from the current V05 classification to the potential V06a classification. For those enrollees who do switch categories, more adult and child enrollees enter the 1+ payment HCC count category (1.16% and 0.25%, respectively), while more infants enter the 0 payment HCC count category (0.29%).

Detailed Enrollee Payment HHS-HCC Counts Between Current V05 and Potential V06a

Category	Adult Model		Child Model		Infant Model	
	Frequency	Percent of population	Frequency	Percent of population	Frequency	Percent of population
Enrollees who had 0 payment HCCs in both V05 and V06a	17,378,509	80.18%	4,274,177	90.91%	253,299	57.57%
Enrollees who had 1+ payment HCCs in both V05 and V06a	4,010,868	18.50%	409,805	8.72%	185,249	42.10%
Enrollees who went from 0 payment HCCs in V05 to 1+ payment HCCs in V06a	250,654	1.16%	11,697	0.25%	159	0.04%
Enrollees who went from 1+ payment HCCs in V05 to 0 payment HCCs in V06a	34,872	0.16%	5,742	0.12%	1,293	0.29%
Total Enrollees	21,674,903	100.00%	4,701,421	100.00%	440,000	100.00%

Looking at total payment HCC count rather than the 0 versus 1+ payment HCC categories, a higher percentage of adult enrollees see a change in their total payment HCC count (2.74%) than child enrollees (0.87%) and infant enrollees (0.86%) due to the potential changes from the current V05 classification to the potential V06a classification. More adult and child enrollees see their total payment HCC count increase, whereas more infant enrollees see their total payment HCC count decrease.

Enrollee Level Payment HHS-HCC Counts Between Current V05 and Potential V06a

Category	Adult Model		Child Model		Infant Model	
	Frequency	Percent of population	Frequency	Percent of population	Frequency	Percent of population
Enrollees whose total payment HCC count increased V05 to V06a	511,807	2.36%	29,529	0.63%	492	0.11%
Enrollees whose total payment HCC count decreased V05 to V06a	82,211	0.38%	11,274	0.24%	3,312	0.75%
Enrollees whose total payment HCC count stayed the same V05 to V06a	21,080,885	97.26%	4,660,618	99.13%	436,196	99.14%
Total Enrollees	21,674,903	100.00%	4,701,421	100.00%	440,000	100.00%

6.0   Other Potential Risk Adjustment Model Changes

In addition to the updates to the HHS-HCC classification detailed in this paper, we have continued to evaluate other ways to improve the risk prediction of the HHS risk adjustment models. These include various approaches to model estimation that might better account for the non-linearities in plan liability as referenced in the 2016 Risk Adjustment White Paper.[32]

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[32] Available at https://www.cms.gov/CCIIO/Resources/Forms-Reports-and-Other-Resources/Downloads/RA-March-31-White-Paper-032416.pdf.

6.1   Other Long-Term Potential Risk Adjustment Model Changes

As noted in the 2020 Payment Notice[33], we are examining non-linear and count model specifications, which could help address the underprediction in plan liability expenditures in the current HHS-HCC risk adjustment models for enrollees with no HCCs or RXCs. One option for a non-linear model would be to add a coefficient-weighted sum of HCCs raised to a power to the linear specification. The non-linear term would be added as the exponentiated *p* term in the following formula: Plan liability = Current Model + $(\Sigma\beta_iHCC_i)^p$, where $\Sigma\beta_iHCC_i$ is the sum of HCCs weighted by their parameter estimates and p, like the βs, is estimated by the model. This added non-linear term can be interpreted as a measure of overall disease burden in which having combinations of conditions can have a larger effect than the sum of the individual conditions. This also allows the demographic terms for enrollees with no HCCs to be better estimated. The count model, on the other hand, includes eight indicator variables corresponding to 1 to 8-or-more payment HCCs. The count model that we are considering is similar to the recently proposed Medicare Advantage risk adjustment model incorporating payment HCC counts.[34] The non-linear or count models could allow the incremental effect of payment HCCs on plan liability to vary with the total number of payment HCCs (or overall disease burden).

Our recent analyses on the enrollee-level EDGE data suggest that the non-linear and count models yield considerable gains in predictive accuracy across several groups compared to the current linear model. We continue to evaluate these alternative modeling approaches while considering several important trade-offs in making improvements to risk prediction and providing consistency for issuers in the HHS-operated risk adjustment program.

We are also continuing to evaluate the incorporation of enrollment duration factors in the adult models, and possibly including enrollment duration factors in the child and infant models. Partial-year enrollment is more common in the individual and small group markets than in the MarketScan® commercial data population reflecting the large group market. With recently available 2016 and 2017 enrollee-level EDGE data, we are able to investigate heterogeneity (variations) in the relationship between partial-year enrollment and predicted expenditures. We have explored heterogeneity according to the presence of certain diagnoses, market (individual or small group), and enrollment circumstances, such as enrollment beginning later in the year or ending before the end of the year. Our preliminary analysis of 2017 enrollee-level EDGE data found that solved enrollment duration factors are driven mainly by enrollees with HCCs, that is, partial year enrollees with HCCs have higher expenditures on average whereas partial year enrollees without HCCs have similar expenditures to their full year counterparts. In comparison, differences in enrollment duration factors by market or enrollment timing (e.g., enrollment at the beginning of the year compared to after open enrollment period or drop in enrollment before the end of the year) appeared much more minor. Our analysis also found that separate enrollment duration factors by market in the adult model may be warranted, given the differences in risk profiles of partial year enrollees between the individual and small group

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[33] See 84 FR at 17483.

[34] Advance Notice of Methodological Changes for Calendar Year (CY) 2020 for the Medicare Advantage (MA) CMS-HCC Risk Adjustment Model. December 20, 2018. https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Advance2020Part1.pdf.

markets. However, due to certain enrollee-level EDGE data limitations for the 2016 and 2017 benefit years for non-calendar year enrollees in the small group market, we recognize that additional analysis is needed.

6.2   Next Steps

Our intention is to consider implementation of the potential V06a HHS-HCC classification updates or similar changes to the risk adjustment model for the 2021 benefit year or beyond. Through this paper we wanted to familiarize stakeholders with the scope and depth of our work related to V06a HHS-HCC updates and other potential longer-term risk adjustment model changes being considered. We intend to solicit future comment on these types of HHS-HCC changes in rulemaking as part of our discussion on annual model updates.