

HHS-Developed Risk Adjustment Model Algorithm “Do It Yourself (DIY)” Software
Instructions for the 2018 Benefit Year
December 4, 2018 Update¹

Section 1343 of the Patient Protection and Affordable Care Act (PPACA) provides for a permanent risk adjustment program. To protect against potential effects of adverse selection and help stabilize premiums in the individual and small group markets, the risk adjustment program transfers funds from plans with relatively low risk enrollees to plans with relatively high-risk enrollees. It generally applies to non-grandfathered individual and small group plans inside and outside Exchanges.

The HHS risk adjustment methodology is described in the HHS Notice of Benefit and Payment Parameters for 2014 final rule (78 FR 15410), which was published in the *Federal Register* on March 11, 2013. Modifications to the HHS risk adjustment methodology for the 2018 benefit year are described in the HHS Notice of Benefit and Payment Parameters for 2018 final rule (81 FR 94058) (2018 Payment Notice final rule), which was published in the *Federal Register* on December 22, 2016.² Prescription drug utilization factors were incorporated in the final 2018 benefit year adult risk adjustment models, as well as the new hierarchical condition category (HCC) distinction between Chronic Viral Hepatitis C from other types of Chronic Hepatitis, in the adult, child, and infant models. Additionally, a high-cost risk pool calculation was incorporated into the HHS risk adjustment methodology beginning for the 2018 benefit year. This adjustment will be made for issuers of risk adjustment covered plans³ in the individual⁴ and small group markets, nationally, and will fund 60 percent of an issuer’s costs for enrollees with claims above \$1 million, while assessing a charge as a percent of premium to issuers of risk adjustment covered plans in each market. We note that, because this DIY software calculates enrollees’ risk scores and not issuers’ transfers, the high-cost risk pool transfer portion of the HHS risk adjustment methodology has not been incorporated into the risk score software and is not discussed in these Instructions.

The methodology that HHS will use when operating a risk adjustment program on behalf of a State for the 2018 benefit year⁵ will calculate a plan average risk score for each covered plan based upon the relative risk of the plan’s enrollees, and apply a payment transfer formula in order to determine risk adjustment payments and charges for plans within a State market risk pool. The HHS risk adjustment methodology addresses three considerations: (1) adverse selection in the individual and small group markets; (2) plan metal level differences and permissible rating variation; and (3) the need for risk adjustment transfers that net to zero. The Federally-certified risk adjustment methodology developed by HHS for the 2018 benefit year:

¹ This document provides instructions for the HHS risk adjustment models for the 2018 benefit year, with revisions from the software instructions posted on the CCIIO website on April 6, 2018, available at <https://www.cms.gov/CCIIO/Resources/Regulations-and-Guidance/Downloads/2018-RA-Model-DIY-Instructions.pdf>.

² Also see the Adoption of the Methodology for the HHS-Operated Permanent Risk Adjustment Program for the 2018 Benefit Year proposed rule (83 FR 39644), which was published in the *Federal Register* on August 10, 2018.

³ See 45 CFR 153.20.

⁴ For purposes of the high-cost risk pool calculation, catastrophic plans and merged market plans will be included as part of the individual market. See the 2018 Payment Notice final rule (81 FR 94058 at 94081).

⁵ HHS will operate risk adjustment for the 2018 benefit year in all 50 states and the District of Columbia.

- Is developed on commercial claims data for a population similar to the expected population to be risk adjusted;
- Employs the hierarchical condition category (HCC) grouping logic used in the Medicare risk adjustment program, but with HCCs refined and selected to reflect the expected risk adjustment population;
- Establishes concurrent risk adjustment models, one for each combination of metal level (platinum, gold, silver, bronze, catastrophic) and age group (adult, child, infant);
- Pools catastrophically high-cost enrollees nationally with a portion of the costs funded by a percent of premium charge to issuers of risk adjustment covered plans in each market;
- Results in transfers that net to zero within a State market risk pool ;
- Adjusts transfers for plan metal level, geographic rating area, induced demand, premium assistance Medicaid alternative plans, and age rating, so that transfers reflect health risk and not other cost differences; and
- Transfers funds between plans within a State market risk pool based on differences in relative actuarial risk.

Key Revisions in 2018:

- (April 2018 Revisions [footnote added in November 2018 Revisions]) Revised software to reflect the change in model version from Version 04 (V04) HHS-HCC classification to the Version 05 (V05) HHS-HCC classification. This classification change replaces V04 HCC 37 Chronic Hepatitis with two new V05 HCCs: HCC 37_1 Chronic Viral Hepatitis C and HCC 37_2 Chronic Hepatitis, Except Chronic Viral Hepatitis C. Updated Table 3 ICD-10 to HHS-Condition Categories (CC) Crosswalk, Table 4 HHS-Hierarchical Condition Categories (HCC) Hierarchies, Table 6 Additional Adult Variables, and Table 8 Additional Infant Variables to reflect the V05 classification change.⁶
- (April 2018 Revisions) Added Prescription Drug Categories (RXC) and RXC interactions to the adult models for the 2018 benefit year. Revised Table 1 Model Membership. Created Table 10a RXC to National Drug Code (NDC) Crosswalk, Table 10b RXC to Healthcare Common Procedure Coding System (HCPCS) Crosswalk, and Table 11 Prescription Drug Categories (RXC) Hierarchies.⁷ Revised Section II and Section III instructions to introduce and define the new RXC variables and the new NDC-level and HCPCS-level input files. Revised Table 6 Additional Adult Variables and Section V of the instructions to detail how the RXCs and RXC interaction variables are created.
- (November 2018 Revisions) Revised Section II instructions to clarify that the only acceptable source for NDCs are pharmacy claims. Medical claims are not an acceptable source for NDCs. Clarified that for the Healthcare Common Procedure Coding System (HCPCS)-level input file, inpatient and outpatient claims should be restricted to the same facility bill type codes used for the diagnosis-level file. Updated Tables 10a and 10b to

⁶ We note that in the EDGE reference data we use “HCC 371” and “HCC 372” (no underscore) to identify HCC 37_1 and HCC 37_2, respectively.

⁷ Because of the potential issue of leading zeroes in Excel, Tables 10a and 10b were created as separate “.txt” files in addition to including them in the accompanying Excel file of tables.

contain NDCs and HCPCS codes in the National Library of Medicine's RxNorm dataset as of August 2018. (Tables 10a and 10b will be updated as EDGE reference data updates and posted on REGTAP prior to March 2019 to include the final set of NDC and HCPCS codes for the 2018 benefit year.)

- (April 2018 Revisions) Updated Table 2 to add 2018 CPT/HCPCS codes used for diagnosis filtering, as described in Section II. Retained the 2017 column of code information (used for historical data purposes).
- (November 2018 Revisions) Revised Table 2 to include review of 2018 quarterly updates of CPT/HCPCS codes with effective dates as of October 1, 2018.
- (April 2018 Revisions) Revised Table 3 ICD-10 to HHS-Condition Categories (CC) Crosswalk to include assignments to new V05 HCCs and to remove Fiscal Year (FY) 2017 and Calendar Year (CY) 2017 Medicare Code Editor (MCE) columns.
- (November 2018 Revisions) Revised Table 3 to contain FY2018 and FY2019 ICD-10 diagnosis codes and FY2018 and FY2019 Medicare Code Editor (MCE) age and sex conditions. Updated ICD-10 code labels to reflect changes in FY2019. Updated CC assignments to account for new FY2019 ICD-10 codes. Updated the combined set of MCE age and sex conditions to be used for Calendar Year (CY) 2018 that covers both fiscal years (FY2018 and FY2019). Revised explanatory text in Sections II and V to clarify the use of FY2018 and FY2019 ICD-10 diagnosis codes and MCE code edits.
- (April 2018 Revisions) Updated Table 9 Model Factors for the 2018 benefit year (using 2013, 2014, and 2015 MarketScan® data). Revised Table 9 Model Factors for the 2018 benefit year to include V05 HCC variables for the adult and child models and to include new RXCs and RXC interactions for the adult models.

The HHS risk adjustment methodology consists of concurrent risk adjustment models, one for each combination of metal level (platinum, gold, silver, bronze, and catastrophic) and age group (adult, child, infant). This document provides the detailed information needed to simulate the calculation of risk scores given individual diagnoses. Please direct questions regarding these instructions to HHS HCC Risk Adjustment Models at hshccraops@cms.hhs.gov. This mailbox will be used only to answer questions pertaining to operations of the HHS risk adjustment models. We look forward to assisting with inquiries pertaining to your risk adjustment program operations using the HHS-HCC risk adjustment models for the 2018 benefit year.

CMS has created two versions of software (SAS software and HHS-developed risk adjustment model algorithm "Do It Yourself [DIY]" software) and software instructions for issuers to use with their enrollment data to simulate their enrollee populations' 2018 benefit year risk scores within the HHS-HCC risk adjustment models. **This software is being issued only as a supplemental tool for issuers of risk adjustment covered plans to better understand and simulate the calculation of plan liability risk scores for their enrollees.**

This software is not a required prerequisite to submitting claims data to the EDGE server for risk adjustment, nor is it a requirement of the HHS-operated risk adjustment program. Furthermore, issuers should not use this software to filter their own claims prior to submitting claims data to the EDGE server. The EDGE server software may have several additional layers of operational rules. The algorithm software merely provides a simulation

tool for issuers to calculate enrollees' risk scores. Because risk adjustment transfers are dependent on the data submitted by other issuers within the State market risk pool, an issuer that wishes to use this information to assist with estimating its 2018 benefit year transfer(s) should do so with caution and in combination with other data.

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Terminology: The abbreviations ICD-10 and ICD-10-CM are used interchangeably in this document to refer to the International Classification of Diseases, 10th Revision, Clinical Modification. The abbreviations CC and HCC used in these instructions refer to the HHS-HCC risk adjustment models. These are different HCCs from those used in the CMS-HCC risk adjustment model for Medicare Part C.

I. Introduction

The risk adjustment program established under section 1343 of PPACA transfers funds from lower than average risk plans to higher than average risk plans using a specified methodology. The HHS risk adjustment methodology generally includes risk adjustment models, a determination of plan average actuarial risk, and a calculation of payments and charges.⁸ The latter two elements are referred to by HHS as the state payment transfer formula. This document provides a detailed description of the HHS risk adjustment models, and enables interested parties to develop software to determine risk scores given individual diagnoses.

This document should be viewed as a supplemental tool to the 2018 benefit year methodology changes finalized in the HHS Notice of Benefit and Payment Parameters for 2018 final rule (81 FR 94058).⁹ Please note that the models described herein were finalized in this final rule.

⁸ The HHS-operated risk adjustment program also includes a data collection approach, data validation procedures, and a schedule for program operation. These elements are not discussed in this document.

⁹ Also see the Adoption of the Methodology for the HHS-Operated Permanent Risk Adjustment Program for the 2018 Benefit Year proposed rule (83 FR 39644).

The following is a description of the HHS risk adjustment models for the 2018 benefit year. This description includes a narrative and accompanying tables for calculating the risk scores from diagnoses in the HHS risk adjustment models. The HHS risk adjustment models calculate risk scores by summing an enrollee's factors (age/sex, HCCs, RXCs, enrollment duration, and interaction terms). This description shows, in detail, how individual diagnoses are assigned to HCCs and NDCs/HCPCS codes are assigned to RXCs, and then allows the user to build individual risk scores from those inputs.

These instructions outline the steps needed to produce individual risk scores from the HHS risk adjustment models.

The HHS risk adjustment methodology includes risk adjustment models based on age, as detailed in Table 1 Model Membership. Adult scores are calculated for enrollees whose age is equal to or greater than 21 using the adult model set. Child scores are calculated for enrollees age 2 – 20 using the child model set. Infant scores are calculated for enrollees age 0 – 1 using the infant model set. Because HHS models predict plan liability, there are 5 models within each age group model set – one each for platinum, gold, silver, bronze, and for the individual market only, catastrophic plans.

The following five sections describe the algorithm for creating risk scores. Any algorithm developed to calculate risk scores should prepare the diagnosis-level file and use it to assign HCCs for each person. This is described in Section II and includes the list of acceptable CPT/HCPCS codes listed in Table 2.¹⁰ Additionally, Section II describes how to prepare NDC-level and HCPCS-level files for use in creating RXCs. Section III and Section IV, respectively, identify data inputted to and outputted from the applicable risk adjustment model. Finally, Section V describes the algorithm to produce risk scores (i.e., outputs). First, the algorithm should crosswalk acceptable diagnoses to Condition Categories (CCs). Then the algorithm should create Hierarchical Condition Categories (HCCs) by imposing hierarchies on the CCs. The algorithm should also crosswalk acceptable NDCs and HCPCS codes to RXCs. For persons without claims or encounter records, zeros are assigned to all CCs, HCCs, and RXCs. After HCCs and RXCs are created, the algorithm should compute predicted scores using the factors from the adult, child, and infant HHS risk adjustment regression models. This information is referenced in Tables 3-11.

The factors from the following regression models are used to produce risk scores:

- Adult regressions
 - Adult platinum
 - Adult gold
 - Adult silver
 - Adult bronze
 - Adult catastrophic
- Child regressions
 - Child platinum
 - Child gold

¹⁰ Definitions taken directly from the Current Procedural Terminology (CPT®) codes and the Healthcare Common Procedure Coding System (HCPCS) code set.

- Child silver
- Child bronze
- Child catastrophic
- Infant regressions
 - Infant platinum
 - Infant gold
 - Infant silver
 - Infant bronze
 - Infant catastrophic

II. Creation of diagnosis-level file, NDC-level file, and HCPCS-level file

A. Diagnosis-level file. The diagnosis-level input file (Section III) should include ICD-10-CM diagnosis codes used for risk adjustment, listed in Table 3, ICD-10 to Condition Categories (CC) Crosswalk. The user must evaluate each claim or encounter record to determine whether the claim or record's diagnoses are included in the diagnosis file to be inputted to the algorithm or software. Encounter records normally report dates, provider or bill types, diagnoses and procedures, and other information, though they may not have payment information.

This section on the diagnosis file preparation explains how each record is evaluated to determine whether or not the record's diagnoses are to be used for CC/HCC creation. It is the user's responsibility to create the diagnosis-level file according to the filtering logic below. This document provides filtering instructions and a list of the 2017 (for historical data purposes) and 2018 CPT/HCPCS codes that define service or procedure types that identify acceptable sources of diagnoses for risk adjustment. However, the user must create the diagnosis-level file for input to the risk adjustment algorithm; the data set is not created by the algorithm.

NOTE: CMS stated that supplemental diagnosis codes may be submitted in certain circumstances. These instructions and the software do not address the addition of supplemental diagnosis codes. Therefore, risk score output from this software will not account for inclusion of supplemental diagnoses.

Only ICD-10 diagnosis codes from sources allowable for risk adjustment should be included in the diagnosis-level file. ICD-10 codes that are not listed in Table 3 may be included in the diagnosis-level file but are ignored by the algorithm.¹¹ The steps below provide logic to determine which diagnoses are allowable. Note that Steps 1 and 3 refer to Table 2, CPT/HCPCS Included List for Diagnosis Code Filtering, which provides the 2017 and 2018 CPT/HCPCS codes used to define service or procedure types that are acceptable sources of diagnoses for risk adjustment.

- The CPT/HCPCS codes marking services with diagnoses allowable for risk adjustment are listed in column A of Table 2.
- Column B lists the short description of the CPT/HCPCS codes.
- Columns C and D, respectively, indicate whether a CPT/HCPCS code is acceptable in 2017 or 2018.

¹¹ If the user conducts fiscal year code validity checks described later in this section, only codes valid for risk adjustment will be included in the final diagnosis-level file.

- Column E identifies applicable footnotes on the CPT/HCPCS codes.
- Notes begin on row 6543 of the Excel table with the line “Notes:” and should not be imported by any program.

The diagnosis-level input file should include diagnoses from claims/encounter records with **discharge dates or through dates** within the benefit year. Though the term “claim” is used in the steps below, the steps apply equally to encounter records. For the EDGE server, only claims with discharge diagnoses are used for HHS risk adjustment.

1. Professional source of diagnosis
 - a. For professional records, use diagnoses from records that have at least one line item with an acceptable CPT/HCPCS code (Table 2). If there is at least one acceptable line on the record, use all the header diagnoses. There are three possible values for CPT/HCPCS codes in columns C and D:
 - i. yes = code is acceptable in that calendar year
 - ii. no = code is not acceptable in that calendar year
 - iii. N/A = code is not in existence in that calendar year
 - b. For professional records, if a line item has an acceptable CPT/HCPCS code, use all diagnoses from the line item.
 - c. If there are no acceptable service lines on the record, do not use any of the diagnoses for risk adjustment.
2. Inpatient facility source of diagnosis
 - a. Use all header diagnoses from records where facility bill type code equals one of the following:
 - i. 111 (inpatient admit through discharge); or
 - ii. 117 (inpatient replacement of prior claim).
 - b. There is no procedure screen for inpatient facility record types.
3. Outpatient facility source of diagnosis
 - a. Restrict records to those with facility bill type code equal to:
 - i. 131 (hospital outpatient admit through discharge); or
 - ii. 137 (hospital outpatient replacement of prior claim); or
 - iii. 711 (rural health clinic admit through discharge); or
 - iv. 717 (rural health clinic replacement of prior claim); or
 - v. 761 (community mental health center admit through discharge); or
 - vi. 767 (community mental health center replacement of prior claim); or
 - vii. 771 (federally qualified health center admit through discharge); or
 - viii. 777 (federally qualified health center replacement of prior claim); or
 - ix. 851 (critical access hospital admit through discharge); or
 - x. 857 (critical access hospital replacement of prior claim).
 - b. For records with at least one acceptable CPT/HCPCS code (Table 2) on a service line, use all header diagnoses. Otherwise, do not use the diagnoses for risk adjustment.

Fiscal year code validity: Section III further describes the diagnosis-level input data file. After creating that file, the user will have the variables needed to conduct fiscal year validity checks. Table 3 identifies the fiscal year(s) in which the diagnosis codes used for risk adjustment are

valid. The user should check that for a given diagnosis (variable DIAG) and service date (variable DIAGNOSIS_SERVICE_DATE), the diagnosis code has a Y in the corresponding Table 3 Code Valid column. ICD-10 diagnosis codes with service dates of January 1, 2018-September 30, 2018 should have a Y in the Code Valid in FY2018 column; otherwise, the user should exclude them. ICD-10 diagnosis codes with service dates of October 1, 2018-December 31, 2018 should have a Y in the Code Valid in FY2019 column; otherwise, the user should exclude them.

Note on bundled claims for mother and newborn infant: In practice, some hospital claims for childbirth include both the mother's record and the newborn infant's record on the same claim (diagnoses and procedure codes). Because there are separate adult, child, and infant risk adjustment models and some of the diagnosis codes may not be distinguishable between mother and infant on bundled claims, **any bundled claims should be redefined as two separate records whenever possible (mother and infant, each with a separate ID, sex, and age) in order for the diagnoses to be appropriately included in the input dataset and used for appropriately calculating risk scores.**

The user will need to independently create a program to detect any bundled claims and redefine them (i.e., it is not part of these instructions). For example, a bundled claim detection program would need to identify enrollees with a claim containing the following elements:

Mother is the enrollee:

- AGE_LAST \geq 2 (an age corresponding to the child or adult models; more specifically age should be appropriate for a maternity diagnosis)¹² and
- ICD-10 diagnoses corresponding to a completed pregnancy HCC (HCC 207 or 208 or 209) and
- ICD-10 diagnoses corresponding to a newborn HCC (HCC 242 or 243 or 244 or 245 or 246 or 247 or 248 or 249).

Infant is the enrollee:

- AGE_LAST = 0 (an age corresponding to the infant model; more specifically age is appropriate for a newborn diagnosis at birth) and
- ICD-10 diagnoses corresponding to a completed pregnancy HCC (HCC 207 or 208 or 209) and
- ICD-10 diagnoses corresponding to a newborn HCC (HCC 242 or 243 or 244 or 245 or 246 or 247 or 248 or 249).

See Table 3, ICD-10 to Condition Categories (CC) Crosswalk, for diagnosis codes corresponding to the completed pregnancy and newborn HCCs.

For purposes of creating the diagnosis-level input file (refer to Section III), if bundled claims will not be detected and redefined, enrollees with bundled claims should be included. If the enrollee is a female with an age appropriate for a maternity diagnosis, then the diagnoses on the bundled claim are assumed to correspond to the mother's enrollee ID. If the enrollee is age 0, then the

¹² Section III of this document identifies the two age variables used in the software and specifies when each is used. Section V includes the detailed algorithm for creation of HCCs.

diagnoses on the bundled claim are assumed to correspond to the infant's enrollee ID. All diagnoses on a bundled claim that could apply to either the mother or the infant (i.e., diagnoses that do not require passing an age/sex edit) are assumed to apply to the enrollee's ID. All HCCs that are valid for the mother or infant (based on diagnoses that pass or do not require age/sex edits) will be used to compute the enrollee's risk score; and all diagnoses that do not passage/sex edits (i.e., newborn diagnosis codes for the mother; pregnancy diagnosis codes for the infant) will be ignored.¹³ Table 1, rows 11-20, provides an algorithm for including these enrollees.

Infants with a record in the person-level file (refer to Section III) that cannot be matched with a claim or who do not have claims will have no diagnoses in the diagnosis-level file. Infants without diagnoses will be assigned to the lowest severity category and the Age 1 maturity category for infants as detailed in Table 8, rows 123, 125, and 130. Age 0 infants with diagnoses but who lack a newborn HCC will be assigned to the corresponding severity category and the Age 1 maturity category for infants as detailed in Table 8, rows 5-123 and 130. Male infants will also have the male demographic factor assigned. Age 0 male infants who lack a newborn HCC will have their demographic factor reassigned to Age 1, as detailed in Table 8, row 135.

B. NDC-level file. The National Drug Code (NDC)-level input file (Section III) should include NDCs used for risk adjustment, listed in Table 10a RXC to NDC Crosswalk. Only pharmacy claims (not medical claims) are the acceptable source for NDCs. The user must evaluate each claim to determine whether the claim's NDCs are included in the NDC file to be inputted to the algorithm or software.

The NDCs are to be used for RXC creation. It is the user's responsibility to create the NDC-level file for input to the risk adjustment algorithm; the data set is not created by the algorithm.

The NDC-level input file should include NDCs from pharmacy claims with **prescription filled dates** within the benefit year. NDC codes should be in the 11 digit, no dashes, HIPAA format to match the format required for EDGE submission.¹⁴ (Note: Table 10a in the Excel file contains the NDC codes formatted as text, not numbers, to retain any leading zeroes needed for 11-digit codes. Table 10a is also included as a ".txt" file if the user prefers that format for using codes with leading zeroes.) NDC codes that are not listed in Table 10a may be included in the NDC-level file but are ignored by the algorithm and are not included in RXCs for the adult risk adjustment models' risk score calculations.

¹³ This software does not flag or otherwise identify diagnoses that do not pass age/sex edits. Software users may want to create a diagnosis-level flag for bundled claims that identifies rejected diagnoses, or create a person-level flag for bundled claims that identifies enrollees with at least one rejected diagnosis submitted.

¹⁴ The source for the NDC codes is the U.S. Food and Drug Administration's Comprehensive NDC SPL Data Elements File: <https://www.fda.gov/ForIndustry/DataStandards/StructuredProductLabeling/ucm240580.htm>. The NDCs are validated as current prescriptions through the U.S National Library of Medicine's RxNorm dataset: <https://www.nlm.nih.gov/research/umls/rxnorm/>. The RxNorm Technical Documentation includes an algorithm the user can access to normalize NDC codes to the 11 digit, no dashes HIPAA format. The source for the NDC start dates is the U.S. Food and Drug Administration's Orange Book: <https://www.accessdata.fda.gov/scripts/cder/ob/index.cfm>.

C. HCPCS-level file. The Healthcare Common Procedure Coding System (HCPCS)-level input file (Section III) should include HCPCS codes used for risk adjustment RXCs, listed in Table 10b RXC to HCPCS Crosswalk. Inpatient, outpatient, and professional medical claims are acceptable sources for HCPCS codes. Inpatient and outpatient claims should be restricted to the same facility bill type codes used for the diagnosis-level file (see Part II.A.2.a. and 3.a). HCPCS should only be used for medications when an NDC is not available from a pharmacy claim. The user must evaluate each claim to determine whether the claim’s HCPCS codes are included in the HCPCS file to be inputted in the algorithm or software.

The HCPCS codes in the HCPCS-level input file are to be used for RXC creation. It is the user’s responsibility to create the HCPCS-level file for input to the risk adjustment algorithm; the data set is not created by the algorithm.

The HCPCS-level input file should include HCPCS codes from inpatient, outpatient, and professional medical claims with discharge dates or through dates within the benefit year. HCPCS codes that are not listed in Table 10b may be included in the HCPCS-level file but are ignored by the algorithm and are not included in RXCs for the adult risk adjustment models’ risk score calculations.

III. Input data files for CC/HCC and RXC variable creation

This section describes the four input data files needed to create CC and HCC grouping and regression variables, RXC and RXC interaction variables, and all other regression variables: a person-level file, a diagnosis-level file, an NDC-level file, and a HCPCS-level file. It is the responsibility of the user to create these input data files with the variables listed in this section.

Note on CSR_INDICATOR

In operations, cost-sharing reduction (CSR) plan variations and premium assistance Medicaid Alternative plans (i.e., private options) will be identified by the Health Insurance Oversight System (HIOS) variant ID. Listed below are the codes that will be used to identify the plan variation.¹⁵ Please note that unlike the risk adjustment software person-level CSR indicator, the HIOS variant ID is a plan-level indicator.

Cost-Sharing Reduction (CSR) Level	HIOS Variant ID	CSR RA Factor	RA Software Person-level CSR Indicator
CSR: 94% AV Silver Plan Variation	06	1.12	1
CSR: 87% AV Silver Plan Variation	05	1.12	2
CSR: 73% AV Silver Plan Variation	04	1.00	3
CSR: Zero Cost Sharing – Platinum	02	1.00	4
CSR: Zero Cost Sharing – Gold	02	1.07	5

¹⁵ We note that Massachusetts CSR variant plans have a state-specific CSR factor table, as discussed in the 2017 Payment Notice final rule (81 FR 12204 at 12228). In addition to the CSR variants listed with factors of 1.12, plan variants of 04 are also 1.12 in Massachusetts only.

CSR: Zero Cost Sharing – Silver	02	1.12	6
CSR: Zero Cost Sharing – Bronze	02	1.15	7
CSR: Limited Cost Sharing – Platinum	03	1.00	8
CSR: Limited Cost Sharing – Gold	03	1.07	9
CSR: Limited Cost Sharing – Silver	03	1.12	10
CSR: Limited Cost Sharing – Bronze	03	1.15	11
CSR: Premium Assistance Medicaid Alternative Plan w/94% AV Silver Plan	36	1.12	12
CSR: Premium Assistance Medicaid Alternative Plan w/Zero Cost Sharing – Silver	32	1.12	13
Non-CSR/unknown CSR	00	1.00	0

Note on Enrollment Duration

The adult models include enrollment duration factors for months enrolled when an enrollee’s enrollment period in an issuer’s plans is less than 12 months. There are two steps involved in creating the enrollment duration indicator variables:

STEP 1: For the PERSON file, the user should create an ENROLDURATION variable for each enrollee with 12 possible values corresponding to 1-12 months based on an enrollee’s total number of days enrolled in the plan in the benefit year as described below and in Table 1, rows 22-23. Although ENROLDURATION will only be used to create variables needed for the adult models, we recommend it be constructed for *all* enrollees to maintain consistency in the variables present in the PERSON file. The created ENROLDURATION variable can be ignored for enrollees in the child or infant models.

STEP 2: The monthly enrollment duration indicator variables (ED_1- ED_11) will be created only for adult enrollees by the algorithm as described in Section V and in Table 6, rows 106-116.

1. PERSON file – a person-level file of demographic and enrollment information
 - a. ENROLID (or another person identification variable)
 - i. character or numeric type and unique to an individual
 - b. SEX
 - i. one character, 1=male; 2=female
 - c. DOB
 - i. 8-character numeric field, provides the enrollee’s date of birth
 - ii. Used to calculate AGE_AT_DIAGNOSIS for MCE diagnosis code age edits
 - d. AGE_LAST
 - i. Age as of last day of enrollment in benefit year
 - ii. Used for all risk adjustment purposes except MCE diagnosis code age edits
 - iii. For infants born in the previous year but not discharged until the benefit year, users should substitute Age 0 for Age 1 in AGE_LAST.
 - e. METAL
 - i. Enrollee’s metal level

- ii. Allowable values: platinum, gold, silver, bronze, catastrophic (only 1 of these values)
- f. CSR_INDICATOR
- i. Person-level indicator. Enrollees who qualify for cost-sharing reductions or those enrolled in premium assistance Medicaid alternative plans will be assigned CSR_INDICATOR =1-13. Non-CSR recipients will be assigned CSR_INDICATOR = 0.
 - 1. 1 = Enrollees in 94% AV Silver Plan Variation
 - 2. 2 = Enrollees in 87% AV Silver Plan Variation
 - 3. 3 = Enrollees in 73% AV Silver Plan Variation
 - 4. 4 = Enrollee in Zero Cost Sharing Plan Variation of Platinum Level QHP
 - 5. 5 = Enrollee in Zero Cost Sharing Plan Variation of Gold Level QHP
 - 6. 6 = Enrollee in Zero Cost Sharing Plan Variation of Silver Level QHP
 - 7. 7 = Enrollee in Zero Cost Sharing Plan Variation of Bronze Level QHP
 - 8. 8 = Enrollee in Limited Cost Sharing Plan Variation of Platinum Level QHP
 - 9. 9 = Enrollee in Limited Cost Sharing Plan Variation of Gold Level QHP
 - 10. 10 = Enrollee in Limited Cost Sharing Plan Variation of Silver Level QHP
 - 11. 11 = Enrollee in Limited Cost Sharing Plan Variation of Bronze Level QHP
 - 12. 12 = Enrollee in a Premium Assistance Medicaid Alternative Plan with 94% AV Silver Plan Variation
 - 13. 13 = Enrollee in a Premium Assistance Medicaid Alternative Plan with Zero Cost Sharing Plan Variation of Silver Level QHP
 - 14. 0 = Non-CSR recipient and enrollees with unknown CSR
- g. ENROLDURATION
- i. Person-level enrollment duration variable. Although it is for use in adult models only, it is recommended the user create it for all enrollees for consistency in PERSON file preparation. Values will be ignored for enrollees in child or infant models.
 - ii. Allowable values are 1-12 based on months enrolled in plan in benefit year as defined by days:
 - 1 = 1–31 days enrolled
 - 2 = 32–62 days enrolled
 - 3 = 63–92 days enrolled
 - 4 = 93–123 days enrolled
 - 5 = 124–153 days enrolled
 - 6 = 154–184 days enrolled
 - 7 = 185–214 days enrolled
 - 8 = 215–245 days enrolled

- 9 = 246–275 days enrolled
- 10 = 276–306 days enrolled
- 11 = 307–335 days enrolled
- 12 = 336–366 days enrolled

2. DIAG file – a diagnosis-level input file of diagnoses
 - a. ENROLID (or another person identification variable that must be the same as in PERSON file)¹⁶
 - i. person identifier of character or numeric type and unique to an individual
 - b. DIAG
 - i. ICD-10-CM diagnosis code, 7-character field, no periods, left justified. Codes should be to the greatest level of available specificity. (Age and sex edits for diagnoses are applied in Part V, step 1 to ensure diagnoses are appropriate for the age and sex of the enrollee.) Only diagnoses from allowable sources (Part II) should be included in the diagnosis-level file.
 - c. DIAGNOSIS_SERVICE_DATE
 - i. 8-character numeric field, provides the date of the diagnosis
 - ii. As described in Part II, this variable can be used with DIAG and Table 3 to check that a diagnosis code is valid for a given fiscal year.
 - d. AGE_AT_DIAGNOSIS
 - i. Age as of the diagnosis service date, calculated using DOB from PERSON file and DIAGNOSIS_SERVICE_DATE
 - ii. Used only for MCE diagnosis code age edits

3. NDC file – an NDC-level input file of drug codes
 - a. ENROLID (or another person identification variable that must be the same as in PERSON file)
 - i. person identifier of character or numeric type and unique to an individual
 - b. NDC
 - i. NDC normalized drug code (11-digit, no dashes HIPAA standard format), 11-character field, left justified. This format matches the format required for submission to the EDGE server. Only NDCs from pharmacy claims filled in the benefit year (Part II) should be included in the NDC-level file.

4. HCPCS file – a HCPCS-level input file of drug codes
 - a. ENROLID (or another person identification variable that must be the same as in PERSON file)
 - i. Person identifier of character or numeric type and unique to an individual
 - b. HCPCS
 - i. HCPCS drug code, 5-character field, left justified. Only HCPCS drug codes from inpatient, outpatient, or professional medical claims from allowable sources (Part II) and with discharge or through dates in the benefit year (Part II) should be included in the HCPCS-level file.

IV. Variables output by the algorithm

¹⁶ Please note that in operation, this information can not include personally identifiable information.

This section describes the variables that are outputted by the HHS risk adjustment model. Any software or algorithms developed from the tables output a person-level file and need to be capable of adding any person-level variables that the user wants to keep.

The following variables can be specified:

1. Any person-level variables from the original person-level file
2. Demographic age/sex variables created by the algorithm
3. HCCs created by the algorithm
4. CCs (condition categories assigned before hierarchies are applied)
5. HCC groups and HCC interactions created by the algorithm
6. RXCs and RXC interactions created by the algorithm
7. Infant model maturity categories, reassigned age/sex variables, severity level categories, and maturity by severity level interactions created by the algorithm
8. Adult model enrollment duration variables created by the algorithm
9. Score variables:
 - a. Adult Models
 - i. SCORE_ADULT_PLATINUM
 - ii. SCORE_ADULT_GOLD
 - iii. SCORE_ADULT_SILVER
 - iv. SCORE_ADULT_BRONZE
 - v. SCORE_ADULT_CATASTROPHIC
 - b. Child Models
 - i. SCORE_CHILD_PLATINUM
 - ii. SCORE_CHILD_GOLD
 - iii. SCORE_CHILD_SILVER
 - iv. SCORE_CHILD_BRONZE
 - v. SCORE_CHILD_CATASTROPHIC
 - c. Infant Models
 - i. SCORE_INFANT_PLATINUM
 - ii. SCORE_INFANT_GOLD
 - iii. SCORE_INFANT_SILVER
 - iv. SCORE_INFANT_BRONZE
 - v. SCORE_INFANT_CATASTROPHIC
10. CSR-adjusted score variables:
 - a. Adult Models
 - i. CSR_ADJUSTED_SCORE_ADULT_PLATINUM
 - ii. CSR_ADJUSTED_SCORE_ADULT_GOLD
 - iii. CSR_ADJUSTED_SCORE_ADULT_SILVER
 - iv. CSR_ADJUSTED_SCORE_ADULT_BRONZE
 - v. CSR_ADJUSTED_SCORE_ADULT_CATASTROPHIC
 - b. Child Models
 - i. CSR_ADJUSTED_SCORE_CHILD_PLATINUM
 - ii. CSR_ADJUSTED_SCORE_CHILD_GOLD
 - iii. CSR_ADJUSTED_SCORE_CHILD_SILVER
 - iv. CSR_ADJUSTED_SCORE_CHILD_BRONZE
 - v. CSR_ADJUSTED_SCORE_CHILD_CATASTROPHIC

- c. Infant Models
 - i. CSR_ADJUSTED_SCORE_INFANT_PLATINUM
 - ii. CSR_ADJUSTED_SCORE_INFANT_GOLD
 - iii. CSR_ADJUSTED_SCORE_INFANT_SILVER
 - iv. CSR_ADJUSTED_SCORE_INFANT_BRONZE
 - v. CSR_ADJUSTED_SCORE_INFANT_CATASTROPHIC
11. Final unadjusted and CSR-adjusted score variables depending on the enrollee’s metal level and CSR indicator, including enrollment in premium assistance Medicaid alternative plans.
- a. Adult scores
 - i. SCORE_ADULT
 - ii. CSR_ADJUSTED_SCORE_ADULT
 - b. Child scores
 - i. SCORE_CHILD
 - ii. CSR_ADJUSTED_SCORE_CHILD
 - c. Infant scores
 - i. SCORE_INFANT
 - ii. CSR_ADJUSTED_SCORE_INFANT

The user should determine which of the scores is appropriate for the enrollee depending upon the age and plan benefit design of that enrollee.

V. Algorithm to produce output

This section describes the process by which the outputs identified in Section IV are created. The algorithm to produce risk scores can be segmented into five parts—CC, HCC, and RXC creation model; variable creation; access factors table; unadjusted score calculation; and CSR-adjusted score calculation.

Step 1A: CC and HCC creation. This first step should use Table 3 for CC creation and Table 4 for HCC creation.

Table 3 crosswalks ICD-10 codes to the Condition Categories (CCs) in the risk adjustment models. This table incorporates the ICD-10 Medicare Code Edits (MCEs) for age and sex, the further specified CC age and sex splits, and the creation of CCs and additional CCs.¹⁷ Explanations of the fields in Table 3 are provided below:

- OBS (column A): Observations, numeric count from 1 to 8,319 of the code list.
- ICD10 (column B): Only ICD-10 codes assigned to HCCs in the risk adjustment models are included in this crosswalk. All other ICD-10 codes correspond to HCCs not included in the risk adjustment models and are not used to calculate risk scores.
- ICD10 Label (column C): Full ICD-10 code labels.
- Code Valid columns (columns D and E): Identifies the fiscal year(s) (column D FY2018; column E FY2019) in which the ICD-10 codes are valid. There are two possible values in columns D and E:

¹⁷ The CC age and sex splits relate to how specific conditions are reclassified by age or sex within the full HCC classification. These reassignments are not related to age or sex coding guidelines.

- Y = Yes, code is valid ICD-10 code in that fiscal year
- N = No, code is not valid ICD-10 code in that fiscal year; code may not yet be in existence or code was deleted in that fiscal year; the code should not be used for risk adjustment in that fiscal year period
- FY2018 MCE Age Condition [use AGE_AT_DIAGNOSIS] (column F), FY2019 MCE Age Condition [use AGE_AT_DIAGNOSIS] (column H), and CY2018 (FY18/FY19) MCE Age Condition [use AGE_AT_DIAGNOSIS] (column J): Checks that a person with a diagnosis code has the appropriate age for the diagnosis. The specific fiscal year versions are presented for informational purposes. The user should use the CY2018 version which covers both fiscal years (column J) to match the MCE Age Condition version being used in Operations. Conditions listed in this column are required for the CC to be assigned.
 - Newborn diagnosis: Age of 0 years
 - Pediatric diagnosis: Age range is 0-17 years inclusive
 - Maternity diagnosis: Age range is 12-55 years inclusive
 - Adult diagnosis: Age range is 15 years or older
- FY2018 MCE Sex Condition (column G), FY2019 MCE Sex Condition (column I), and CY2018 (FY18/FY19) MCE Sex Condition (column K): Checks that a person with a diagnosis code has the appropriate sex for the diagnosis. The specific fiscal year versions are presented for informational purposes. The user should use the CY2018 version which covers both fiscal years (column K) to match the MCE Sex Condition version being used in Operations. Conditions listed in this column are required for the CC to be assigned.
 - Female indicates the diagnosis is only appropriate for females.
 - Male indicates the diagnosis is only appropriate for males.
- CC Age Split [use AGE_LAST] (column L): Identifies diagnosis codes whose assignments to CCs in the risk adjustment models change depending on the age of the enrollee. ICD-10 codes assigned by age to more than one CC in the risk adjustment models are listed more than once. In those cases, the age splits are mutually exclusive and enrollees are assigned to only one CC for the given diagnosis.
- CC Sex Split (column M): Identifies diagnosis codes whose assignments to CCs in the risk adjustment models change depending on the sex of the enrollee. ICD-10 codes assigned by sex to more than one CC in the risk adjustment models are listed more than once. Enrollees are assigned to only one CC for the given diagnosis.
- CC (column N): Identifies the CC in the risk adjustment models that a person with the ICD-10 code who meets the MCE conditions and CC splits is assigned.
- Additional CC (column O): Identifies the additional CC in the risk adjustment model that a person with the ICD-10 code who meets the MCE conditions and CC Age or Sex splits is assigned. Additional CCs are assigned when the ICD-10 code is assigned to more than one HCC in the risk adjustment models because it contains more than one clinical concept (such as an ICD-10 diagnosis code that encompasses both diabetes and a complication of diabetic peripheral angiopathy with gangrene).
- Footnote (column P): Identifies applicable footnotes for the ICD-10 code. Notes begin on row 8325 of the Excel table with the line “Notes:” and should not be imported by any program.

Table 4 provides the hierarchy rules to apply to the CCs to create HCCs. Explanations of the fields in Table 4 are provided below:

- OBS (column A): Observations, numeric count from 1 to 128 of HCCs in the HHS risk adjustment models.
- V05 HCC (column B): Only HCCs in the risk adjustment models are identified. HCCs are created when hierarchies are applied to CCs.
- Set to 0 HCCs (column C): Hierarchy exclusions for each HCC are listed. Users should set the HCCs in this column to 0 when a person has the HCC listed in column B.
- HCC Label (column D): Full HCC labels.

Use Table 3 and Table 4 to create CCs and HCCs:

1. Create CC and HCC 0/1 indicator variables for each HCC in the risk adjustment models listed in Table 4 (Example: CC001, CC002, CC003, CC004, CC006, CC008 ... CC254; HHS_HCC001, HHS_HCC002 ... HHS_HCC254). Initially, set CCs and HCCs to 0 for each person.
2. If there are any acceptable diagnoses for a person, then:
 - a. Perform ICD-10 Medicare Code Edits (MCEs) for age and sex (use CY2018 MCE Age Condition and MCE Sex Condition columns in Table 3). Use AGE_AT_DIAGNOSIS for applying MCE age edits.
 - b. If a person meets the MCE conditions, apply CC Age Split and CC Sex Split to create CC (set to 1) using crosswalk of ICD-10 to CCs (use CC Age Split, CC Sex Split, and CC columns in Table 3). Use AGE_LAST for CC age splits.
 - c. Create additional CCs (set to 1) using Additional CC column.
3. Create HCCs after all diagnoses for a person are processed and CC variables are created using hierarchies provided in Table 4.
 - a. Set HCC to 1 when corresponding CC is set to 1.
 - b. Set the HCCs in column C to 0 when a person has the HCC listed in column B set to 1.

Step 1B: RXC creation. This step should use Tables 10a/10b and Table 11 for RXC creation.

Table 10a crosswalks National Drug Codes (NDCs) to the Prescription Drug Categories (RXC) in the adult risk adjustment models. This table identifies the subset of NDCs used in the creation of RXCs. Explanations of the fields in Table 10a are provided below:

- RXC (column A): Identifies the RXC number in the risk adjustment models that a person with the NDC is assigned.
 - RXCs 1-10 are included in the adult risk adjustment models as stand-alone variables and as interactions, each with risk factors included in a person's risk score.
 - RXCs 11-12 are created as variables, but are included only through RXC interactions in the adult risk adjustment models. (Only the interactions involving RXCs 11 and 12 have risk factors included in a person's risk score; RXC 11 and RXC 12 do not have risk factors.)
- RXC_Label (column B): Provides the label of each RXC.

- NDC (column C): Only NDCs assigned to RXCs in the adult risk adjustment models are included in this crosswalk. All other NDCs do not map to an RXC and are not used to calculate risk scores. NDCs are stored in string (character) to avoid dropping of leading zeroes.

Table 10b crosswalks Healthcare Common Procedure Coding System (HCPCS) codes to the Prescription Drug Categories (RXC) in the adult risk adjustment models. This table identifies the subset of HCPCS codes used in the creation of RXCs. Explanations of the fields in Table 10b are provided below:

- RXC (column A): Identifies the RXC number in the risk adjustment models that a person with the NDC is assigned. (See Table 10a description above for information about RXCs 1-12.)
- RXC_Label (column B): Provides the label of each RXC.
- HCPCS (column C): Only HCPCS codes assigned to RXCs in the adult risk adjustment models are included in this crosswalk. All other HCPCS drug codes do not map to an RXC and are not used to calculate risk scores.

Table 11 provides the hierarchy rules to apply to the RXCs. Explanations of the fields in Table 11 are provided below:

- RXC (column A): RXCs in the risk adjustment models are identified.
- Set to 0 RXC (column B): Hierarchy exclusions for each RXC are listed. Users should set the RXCs in column B to 0 when a person has the RXC listed in column A.
- RXC_Label (column C): Provides the label of each RXC in column A.

Use Tables 10a/10b and Table 11 to create RXCs:

1. Create 12 RXC 0/1 indicator variables for each RXC in the risk adjustment models listed in Table 10a (Example: RXC_01, RXC_02, RXC_03 ... RXC_11, RXC_12). Initially, set RXCs to 0 for each person.
2. Using Table 10a, if there are any acceptable NDCs for a person, then set to 1 the corresponding RXC(s) using the RXC and NDC columns in the crosswalk.
3. Using Table 10b, if there are any acceptable HCPCS codes for a person, then set to 1 the corresponding RXC(s) using the RXC and HCPCS columns in the crosswalk.
4. Using hierarchies provided in Table 11, set the RXCs in column B to 0 when a person has the RXC listed in column A set to 1.

The RXC interactions will be created in a later step.

Step 2: Model variable creation.

This step should use Table 5 for demographic variable creation, Table 6 for additional adult model variables including enrollment duration, Table 7 for additional child model variables, and Table 8 for additional infant model variables.

Explanations of the fields in Tables 5-8 are provided below:

- Column A identifies the model set in which the variable is used (adult, child or infant).
- Column B identifies the variable name.

- Column C gives a variable description.
- Column D indicates if the variable is used in the model.
- Column E defines the variable creation.

Variables must be assigned values in the same order as defined in Tables 5, 6, 7, and 8. For example, in Table 6, assign a value to variable SEVERE_V3 first, then the HCC group variables, then the severe illness interactions, then the severe illness interaction groups.

Variable creation:

1. Create demographic variables needed for score calculation using Table 5.
 - a. A person's age and sex are used to create 1 of 28 mutually exclusive age-sex variables (18 for adult models, 8 for child models, 2 for infant models). Use AGE_LAST.
 - b. Because the infant model is computed with females as the reference group for the age-sex demographic variables, there are no separate age-sex demographic variables for females age 0 or 1. Note that if male age 0 infants are assigned to Age 1 because they lack a newborn HCC, their age/sex demographic variable will be reassigned to Age 1 using Table 8.
 - c. Adult age-sex variables are listed in rows 8-25.
 - d. Child age-sex variables are listed in rows 27-34.
 - e. Infant age-sex variables are listed in rows 36 and 37.
2. For the adult model, create the severe illness indicator variable using Table 6.
 - a. The severe illness indicator variable, SEVERE_V3, is created when an adult has at least 1 of 8 HCCs that indicate a severe illness. Rows 5-12 of column E in Table 6 identify these 8 HCCs.
 - i. SEVERE_V3 is initially set to 0 for each adult and is set equal to 1 if the adult has at least 1 of the 8 HCCs.
3. For the adult and child models – create HCC groups using Tables 6 and 7.
 - a. HCC groups are effectively treated as single HCCs in the models. The HCC groups are assigned variables GXX, where XX is the group number.
 - b. For the adult models:
 - i. There are 17 adult HCC groups. The group variable names are listed in rows 14-67 of column B of Table 6.
 - ii. Initially create the 17 HCC groups for adults and set to 0 for each person.
 - iii. The HCCs in an HCC group are listed in column E of Table 6 starting in row 14.
 - iv. A variable for an HCC group is set to equal 1 if an adult has at least one of the HCCs in a given adult HCC group.
 - c. For the child models:
 - i. There are 17 child HCC groups. The HCC group variable names are listed in rows 5-59 of column B of Table 7.
 - ii. Initially create the 17 HCC groups for children and set to 0 for each person.
 - iii. The HCCs in an HCC group are found in column E of Table 7 starting in row 5.

- iv. A variable for an HCC group is set to equal 1 if a child has at least one of the HCCs in a given child HCC group.
4. For the adult models – create HCC interaction variables using Table 6.
 - a. The variable SEVERE_V3 is used to create the severe illness indicator in HCC or HCC group interactions. There are 16 interactions identified in rows 71-86 of Table 6.
 - i. Interaction variables are initially set to 0 for each adult.
 - ii. The variable for an interaction is set to 1 if an adult has SEVERE_V3=1 and the HCC or HCC group in the interaction =1.
 - b. The interactions are aggregated to create two severe illness interaction groups based on the predicted expenditures of the interactions that are in the models.
 - i. Variables INT_GROUP_H and INT_GROUP_M are set to 0 for each adult.
 - ii. INT_GROUP_H is set to 1 if an adult has at least 1 of the 9 high-cost interactions. The variable and interactions are found in rows 88-96 of Table 6.
 - iii. INT_GROUP_M is set to 1 if an adult has at least 1 of the 7 medium-cost interactions and INT_GROUP_H is set to 0. The variable and interactions are found in rows 98-104 of Table 6.
 5. For the adult models – create enrollment duration variables using Table 6.
 - a. The variable ENROLDURATION is used to create the 11 mutually-exclusive (0/1) enrollment duration indicators for adult enrollees who have partial year enrollment. The variables are identified in rows 106-116 of Table 6.
 - i. The enrollment duration variables ED_1–ED_11 are initially set to 0 for each adult.
 - ii. An enrollment duration variable (ED_X) is set to 1 if an adult has ENROLDURATION equal to the corresponding number (X). For example, ED_1 = 1 if ENROLDURATION = 1, ED_2 = 1 if ENROLDURATION = 2, and so on.
 - iii. Enrollees who have ENROLDURATION = 12 (indicating 12-month enrollment) will have all 11 ED variables set to 0. All other adult enrollees will have exactly 1 ED variable set to 1.
 6. For the adult models – create RXC interaction variables using Table 6.
 - a. The HCCs and the RXC variables (RXC_01-RXC_12) created earlier in Step 1B are used to create the 15 (0/1) RXC interaction variables. The RXC interaction variables are identified in rows 131-145 of Table 6.
 - i. Create the 15 RXC interaction variables listed in rows 131-145 in column B (e.g., RXC_01_X_HCC001) and initially set to 0 for each adult. These interactions are based on RXCs listed in rows 118-129 of Table 6.
 - ii. An RXC interaction variable (e.g., RXC_01_X_HCC001) is set to 1 if an adult has both the corresponding RXC set to 1 and the HCC(s) set to 1 as listed in column E of Table 6 starting in row 131.
 - iii. There are 5 RXC interactions that include a single HCC (rows 131, 133, 138, 140-141).

- iv. There are 9 RXC interactions that include a set of HCCs in which only 1 HCC of the set must be set to 1 (rows 132, 134-137, 142-145).
 - v. There is 1 RXC interaction (RXC_09_X_HCC056_057_AND_048_041 in row 139) that includes two sets of HCCs in which at least 1 HCC in each set must be set to 1.
7. For the infant models – create maturity and severity categories, reassign age-sex variable if needed, and create maturity by severity level interaction variables using Table 8.
- a. Table notation: Severity category and maturity category variables (which are not included in the regression, but are used to create regression interaction variables) use the “IHCC_” prefix designating them as Infant variables. Examples: IHHC_Severity5; IHCC_Extremely_Immature.
 - b. Create 5 severity level category 0/1 indicator variables based on HCC flags (See Table 8, rows 5-117). Set to 1 if any of the corresponding HCC variables is set to 1.
 - i. Severity Level 5 (Highest)
 - ii. Severity Level 4
 - iii. Severity Level 3
 - iv. Severity Level 2
 - v. Severity Level 1 (Lowest)
 - c. Apply hierarchies so that each age 0 or age 1 infant has only a single severity level variable, the highest qualifying level, set to 1 (see Table 8, rows 119-123). Note that infants lacking any of the HCCs corresponding to severity levels are assigned to Severity Level 1 (Lowest).
 - d. Create 5 maturity category 0/1 indicator variables set to 1 based on age only if age 1, and on age as well as newborn HCC flags if age 0 (see Table 8, rows 125-130). Note that age 0 infants lacking a newborn HCC (242-249) are assigned to Age 1.
 - i. Age 1
 - ii. Extremely Immature
 - iii. Immature
 - iv. Premature/Multiples
 - v. Term
 - e. Apply hierarchies so that that each age 0 or age 1 infant has only a single maturity variable set to 1 (see Table 8, rows 131-133).
 - f. Reassign male age 0 infants lacking a newborn HCC to the Age 1 age-sex variable (see Table 8, row 135).
 - g. Create 25 maturity by severity level interactions (0/1) using the 5 maturity category variables and 5 severity level category variables (see Table 8, rows 137-161). These are mutually-exclusive interactions—each infant will have only one maturity by severity level interaction set to 1.
 - i. Extremely_Immature_x_Severity5
 - ii. Extremely_Immature_x_Severity4
 - iii. Extremely_Immature_x_Severity3
 - iv. Extremely_Immature_x_Severity2

- v. Extremely_Immature_x_Severity1
- vi. Immature_x_Severity5
- vii. Immature_x_Severity4
- viii. Immature_x_Severity3
- ix. Immature_x_Severity2
- x. Immature_x_Severity1
- xi. Premature_Multiples_x_Severity5
- xii. Premature_Multiples_x_Severity4
- xiii. Premature_Multiples_x_Severity3
- xiv. Premature_Multiples_x_Severity2
- xv. Premature_Multiples_x_Severity1
- xvi. Term_x_Severity5
- xvii. Term_x_Severity4
- xviii. Term_x_Severity3
- xix. Term_x_Severity2
- xx. Term_x_Severity1
- xxi. Age1_x_Severity5
- xxii. Age1_x_Severity4
- xxiii. Age1_x_Severity3
- xxiv. Age1_x_Severity2
- xxv. Age1_x_Severity1

Step 3: Access factors in Table 9.

1. For the adult models, use adult factors in rows 4-204 for each of the metal levels (columns D-H).
2. For the child models, use child factors in rows 206-358 for each of the metal levels (columns D-H)
3. For the infant models, use infant factors in rows 360-386 for each of the metal levels (columns D-H)

Step 4: Unadjusted score calculation (using directions in Tables 6-8, variables created in Tables 5-8, and factors from Table 9).

1. For each adult, create an adult model score for the metal level in which that adult is enrolled (corresponding to scores in Part IV).
 - a. Create scores for each metal level using directions in rows 147-155 in Table 6.
 - i. SCORE_ADULT_PLATINUM
 - ii. SCORE_ADULT_GOLD
 - iii. SCORE_ADULT_SILVER
 - iv. SCORE_ADULT_BRONZE
 - v. SCORE_ADULT_CATASTROPHIC
 - b. The score for each of the above variables is the sum of the factors of the corresponding metal level in Table 9 for all variables set to 1 for that adult: demographic variable, any HCCs, any HCC groups, a severe illness interaction group if applicable, an enrollment duration variable if applicable, RXCs 1-10, and RXC interactions.

- i. SCORE_ADULT_PLATINUM uses factors from column D
 - ii. SCORE_ADULT_GOLD uses factors from column E
 - iii. SCORE_ADULT_SILVER uses factors from column F
 - iv. SCORE_ADULT_BRONZE uses factors from column G
 - v. SCORE_ADULT_CATASTROPHIC uses factors from column H
 - c. Identify the metal level in which the adult is enrolled (Table 1 row 27).
 - d. Create an adult model score SCORE_ADULT for the metal level in which the adult is enrolled using directions in rows 178-179 in Table 6.
- 2. For each child create a child model score for the metal level in which that child is enrolled (corresponding to scores in Part IV).
 - a. Create scores for each metal level using directions in rows 63-67 in Table 7.
 - i. SCORE_CHILD_PLATINUM
 - ii. SCORE_CHILD_GOLD
 - iii. SCORE_CHILD_SILVER
 - iv. SCORE_CHILD_BRONZE
 - v. SCORE_CHILD_CATASTROPHIC
 - b. The score for each of the above variables is the sum of the factors of the corresponding metal level in Table 9 for all variables set to 1 for that child: demographic variable, any HCCs, and any HCC groups.
 - i. SCORE_CHILD_PLATINUM uses factors from column D
 - ii. SCORE_CHILD_GOLD uses factors from column E
 - iii. SCORE_CHILD_SILVER uses factors from column F
 - iv. SCORE_CHILD_BRONZE uses factors from column G
 - v. SCORE_CHILD_CATASTROPHIC uses factors from column H
 - c. Identify the metal level in which the child is enrolled (Table 1 row 27).
 - d. Create a child model score SCORE_CHILD for the metal level in which the child is enrolled using directions in rows 90-91 in Table 7.
- 3. For each infant create an infant model score for the metal level in which that infant is enrolled (corresponding to scores in Part IV) using directions starting at row 163 of Table 8, infant variables created in Tables 5 and 8, and factors from Table 9.
 - a. Unadjusted infant risk score is the sum of (0/1 variable x factor) over all the following:
 - i. 0/1 age-sex categories for INFANT models
 - ii. 0/1 maturity x severity level interactions for INFANT models
 - b. The unadjusted score is the sum of the factors of the corresponding metal level in Table 9 for all variables set to 1 for that infant.
 - i. SCORE_INFANT_PLATINUM uses factors from column D
 - ii. SCORE_INFANT_GOLD uses factors from column E
 - iii. SCORE_INFANT_SILVER uses factors from column F
 - iv. SCORE_INFANT_BRONZE uses factors from column G
 - v. SCORE_INFANT_CATASTROPHIC uses factors from column H
 - c. Females will have a single maturity level x severity level interaction set to 1 and that factor will be their score. Males will have a single maturity level x severity level interaction set to 1 and a single age-sex variable set to 1; the sum of the factors for those two variables will be their score.
 - d. Identify the metal level in which the infant is enrolled (Table 1 row 27).

- e. Create an infant model score SCORE_INFANT for the metal level in which the infant is enrolled using directions in rows 190-191 in Table 8.

Step 5: CSR-adjusted score calculation (using instructions in Tables 6-8).

1. For each adult, create an adult model CSR-adjusted score for the metal level in which that adult is enrolled (corresponding to CSR-adjusted scores in Part IV).
 - a. Each adult will have one of the following CSR-adjusted risk scores that corresponds to his/her metal level. CSR-adjusted scores are created using directions in rows 157-176 in Table 6.
 - i. CSR_ADJUSTED_SCORE_ADULT_PLATINUM
 - ii. CSR_ADJUSTED_SCORE_ADULT_GOLD
 - iii. CSR_ADJUSTED_SCORE_ADULT_SILVER
 - iv. CSR_ADJUSTED_SCORE_ADULT_BRONZE
 - v. CSR_ADJUSTED_SCORE_ADULT_CATASTROPHIC
 - b. Identify the metal level in which the adult is enrolled (Table 1).
 - c. Create an adult model score CSR_ADJUSTED_SCORE_ADULT for the metal level in which the adult is enrolled using directions in rows 181-183 in Table 6.
2. For each child, create a child model CSR-adjusted score for the metal level in which that child is enrolled (corresponding to CSR-adjusted scores in Part IV).
 - a. Each child will have one of the following CSR-adjusted risk scores that corresponds to his/her metal level. CSR-adjusted scores are created using directions in rows 69-88 in Table 7.
 - i. CSR_ADJUSTED_SCORE_CHILD_PLATINUM
 - ii. CSR_ADJUSTED_SCORE_CHILD_GOLD
 - iii. CSR_ADJUSTED_SCORE_CHILD_SILVER
 - iv. CSR_ADJUSTED_SCORE_CHILD_BRONZE
 - v. CSR_ADJUSTED_SCORE_CHILD_CATASTROPHIC
 - b. Identify the metal level in which the child is enrolled (Table 1).
 - c. Create a child model score CSR_ADJUSTED_SCORE_CHILD for the metal level in which the child is enrolled using directions in rows 93-95 in Table 7.
3. For each infant, create an infant model CSR-adjusted score for the metal level in which that infant is enrolled (corresponding to CSR-adjusted scores in Part IV).
 - a. Each infant will have one of the following CSR-adjusted risk scores that corresponds to his/her metal level. CSR-adjusted scores are created using directions in rows 169-188 in Table 8.
 - i. CSR_ADJUSTED_SCORE_INFANT_PLATINUM
 - ii. CSR_ADJUSTED_SCORE_INFANT_GOLD
 - iii. CSR_ADJUSTED_SCORE_INFANT_SILVER
 - iv. CSR_ADJUSTED_SCORE_INFANT_BRONZE
 - v. CSR_ADJUSTED_SCORE_INFANT_CATASTROPHIC
 - b. Identify the metal level in which the infant is enrolled (Table 1).
 - c. Create an infant model score CSR_ADJUSTED_SCORE_INFANT for the metal level in which the infant is enrolled using directions in rows 193-195 in Table 8.

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