The following is an overview of software for the CMS-ESRD risk-adjustment model.

Software Description.

The software includes a SAS program – **E2112H1P** that calls several SAS Macros to create HCC score variables using coefficients from the following regression models:

- CMS-HCC Dialysis
- CMS-HCC Dialysis for New Enrollees
- CMS-HCC Community for Functioning Graft
- CMS-HCC Institutional for Functioning Graft
- CMS New enrollee for Functioning Graft.

The software consists of a main program, **E2112H1P**, which supplies user parameters to the main SAS Macro program **E2112H1M**. This Macro program reads in two input files and assigns HCCs for each person.

The program first crosswalks diagnoses to Condition Categories (CCs), using SAS formats which were previously stored in the FORMAT library. The program then creates Hierarchical Condition Categories (HCCs) by imposing hierarchies on the CCs. For persons without claims, zeros are assigned to all HCCs.

The program contains a modified version of the CMS-HCC model for persons who have functioning kidney grafts. This model, based on the model for the general population, excludes HCCs for kidney transplant status and dialysis status but includes add-on payments depending on months post transplant.

After HCCs are created the program computes predicted scores from the five regression models.

The main Macro, **E2112H1M**, uses 6 external SAS Macro programs:

- %AGESEXV2 - create age/sex, originally disabled, disabled variables
- %V20EDIT1 - perform edits to ICD9 codes
- %V21H87M1 - assign one ICD9 code to multiple CCs in some cases
- %V20H87L1 - assign labels to HCCs
- %V20H87H1 - set HCC=0 according to hierarchies
- %SCOREVAR - calculate a score variable

The main program, main macro and 6 external macros have a .txt extension to make the files easier to view. Please rename them to have .sas extension before running the software.

Steps performed by the software:

step1: include external macros
step2: define internal macro variables
step3: merge person and diagnosis files outputting one record per person, for each input person level record
step3.1: declaration section
step3.2: bring in regression coefficients
step3.3: merge person and diagnosis files
step3.4: for the first record for a person, set CC to 0 and create person's age
step3.5: if there are any diagnoses for a person
then do the following:

- create CC using format specified in FMNAME macro parameter (please see the ***Files supplied by the software*** section below for details on format library and formats specific to this version of software)
- perform ICD9 edits using macro V20EDIT1
- create additional CC using V21H87M1 macro

step3.6: for the last record for a person, do the following:

- create demographic variables needed for score calculation (macro AGESEXV2)
- create HCC using hierarchies (macro V20H87H1)
- create HCC interaction variables
- create HCC by non-aged interaction variables
- set to 0 HCCs and interaction variables if there are no diagnoses for a person
- create score variables

step4: data checks and proc contents

PART 1. Files supplied by the software.

The following SAS programs and files are included in this software:

- **E2112H1P –** main program that has all the parameters supplied by a user (see below for parameter and variable list). It calls main macro **E2112H1M**
- **E2112H1M** - main macro that creates HCC and SCORE variables by calling other external macros
- **AGESEXV2** - create age/sex, originally disabled, disabled variables
- **V20EDIT1** - performs edits to ICD9 code. Medicare Code Editor (MCE) is source of edits.
- **V21H87M1** - assigns ICD9 diagnosis code to multiple CCs where required
- **V20H87L1** - assigns labels to HCCs
- **V20H87H1** - sets HCC=0 according to hierarchies
- **SCOREVAR** - calculates a score variable
- **F2112H1R.TXT** – a txt version of the format that has a cross-walk from ICD9 codes to V21[1] CC categories (use for reference only). This format contains ICD9 codes valid in FY2011 or FY2012.
- **F2112H1R –** format library containing all the formats for the software. Format names should be specified as main macro parameters in main program as follows:
  I21121Y11Y12RC – version V21[1] crosswalk from ICD9 codes to CC categories that are transformed to HCC categories by the software -- contains ICD9 codes valid in FY2011 or FY2012. Should be specified in macro parameter **FMNAME.**
  AGEY11Y12MCE - format to crosswalk ICD9 to acceptable age range in case MCE edits on ICD9 are to be performed. Should be specified in macro parameter **AGEFMT.**
  SEXY11Y12MCE - format to crosswalk ICD9 to acceptable sex in case MCE edits on ICD9 are to be performed. Should be specified in macro parameter **SEXFMT.**
- **D2111H2R** – relative coefficients for 5 regression models created on CY2006/2007 data using the denominators 75,564.91 (1/10/2011, sent by CMS and used for dialysis and transplant) and 8,034.71 (1/18/2010, sent by CMS and used for functioning graft)

Format library and coefficients file are SAS transport files, which may be used on any platform running SAS. The user should use the following program to convert them to SAS format files.

Code for converting coefficients transport file to SAS file:

```
filename inc  "C:\user defined location of the transport file\ D2111H2R";
libname incoef  "C:\user defined location of the sas coefficients file";
proc cimport data=incoef.hcccoefn infile=inc;
run;
```

Code for converting formats transport file to SAS file:

```
filename inf  "C:\user defined location of the transport file\F2112H1R";
libname library  "C:\user defined location of the sas formats file";
proc cimport library=library infile=inf;
run;
```

If you are operating in an MVS or z/OS environment, the transport files should be uploaded using the following parameters:
RECFM(F or FB) LRECL(80) BLKSIZE(8000)

PART 2. Files supplied by a user.

Two SAS input files needed for the software must be presorted in ascending order by the person ID variable

1) **PERSON** file--a person-level file of demographic and enrollment information
2) **DIAG** file--a diagnosis-level input file of diagnoses

[1] V21 has a revised set of HCCs which are numbered differently from the HCCs used in prior years. The functioning graft models have coefficients that are constrained to 0 or to values in the non-ESRD models. The latter values come from the V21 non-ESRD models.

Data requirements for the SAS input files. The variable names listed are required by the programs as written:

1) **PERSON** file
   - **HICNO** (or other person identification variable. It must be set in the macro variable IDVAR)
     -character or numeric type and unique to an individual

   - **SEX**
     - one character, 1=male; 2=female

   - **DOB**
     - SAS date format, date of birth

   - **MCAID**
     -numeric, =1 if number of months in Medicaid in *base* year >0,
     =0 otherwise

   - **NEMCAID**
     - numeric, =1 if a new Medicare enrollee and number of months in Medicaid in *payment* year>0;
     =0 otherwise

   - **OREC**
     - one character, original reason for entitlement with the following values:
     0 - OLD AGE (OASI)
     1 - DISABILITY (DIB)
     2 - ESRD
     3 - BOTH DIB AND ESRD

2) **DIAG** file--a diagnosis file with at least one record per person-specific unique diagnosis.
   - **HICNO** (or other person identification variable that must be the same as in PERSON file)
     - person identifier of character or numeric type and unique to an individual

   - **DIAG**
     - ICD-9-CM diagnosis code, 5 character field, no periods, left justified. The user may include all diagnoses or limit the codes to those used by the model. Codes should be to the greatest level of available specificity. Diagnoses should be included **only** from providers and physician specialties allowable for risk adjustment reporting (as specified in CMS notices).

Part 3. Parameters supplied by a user:

The user must supply the following:
- **INP** - SAS input person dataset name
- **IND** - SAS input diagnosis dataset name
- **OUTDATA** - SAS output dataset name
- **IDVAR –** variable name for Beneficiary ID (HICNO for Medicare data)
- **KEEPVAR** - variables kept in the output dataset. There is a list of KEEP variables in the program, but the user can alter the list.
- **SEDITS** - a switch that controls whether to perform edits on ICD9
  1-YES, 0-NO
- **DATE_ASOF -** reference date to calculate age. Set to February 1 of the payment year for consistency with CMS.
- **FMNAME –** format name (crosswalk ICD9 codes to V21 CCs). For this version of the software it is ***I21121Y11Y12RC***.
- **AGEFMT –** format name (crosswalk ICD9 to acceptable age range in case MCE edits on ICD9 are to be performed). For this version of the software it is ***AGEY11Y12MCE.***
- **SEXFMT -** format name (crosswalk ICD9 to acceptable sex in case MCE edits on ICD9 are to be performed). For this version of the software it is ***SEXY11Y12MCE.***
- **DF_DG -** normalization factor set by CMS used to multiply dialysis and transplant scores (currently set to 1 by default)
- **DF_POSTG -** normalization factor set by CMS used to multiply functioning graft scores (currently set to 1 by default)

Part 4. Variables output by the software.
The software outputs a person level file. Any variables that the user wants to keep in it should be specified in the main program, **E2112H1P**, in the **KEEPVAR** parameter of Macro **E2112H1M** call. The following variables can be specified:

1) Any person level variables from the original person level file
2) Demographic variables created by the software:
   AGEF ORIGDS DISABL
   F0_34 F35_44 F45_54 F55_59 F60_64 F65_69
   F70_74 F75_79 F80_84 F85_89 F90_94 F95_GT
   M0_34 M35_44 M45_54 M55_59 M60_64 M65_69
   M70_74 M75_79 M80_84 M85_89 M90_94 M95_GT
   NEF0_34 NEF35_44 NEF45_54 NEF55_59 NEF60_64
   NEF65 NEF66 NEF67 NEF68 NEF69
   NEF70_74 NEF75_79 NEF80_84 NEF85_89 NEF90_94
   NEF95_GT
   NEM0_34 NEM35_44 NEM45_54 NEM55_59 NEM60_64
   NEM65 NEM66 NEM67 NEM68 NEM69
   NEM70_74 NEM75_79 NEM80_84 NEM85_89 NEM90_94
   NEM95_GT
3) **HCC**'s defined in the main program **E2112H1P** by the macro variable &**HCCV21_list87**
4) **CC**'s (condition categories assigned before hierarchies are applied) defined in the main program **E2112H1P** by the macro variable &**CCV21_list87**
5) Score variables:

   - **SCORE_DIAL** - dialysis
   - **SCORE_DIAL_NE** - dialysis for new enrollees

Kidney transplant scores

   - **SCORE_TRANS_KIDNEY_ONLY_1M** - first month
   - **SCORE_TRANS_KIDNEY_ONLY_2M** - second moth
   - **SCORE_TRANS_KIDNEY_ONLY_3M** - third month

4-9 months duration of functioning graft scores

   - **SCORE_GRAFT_COMM_DUR4_9_GE65 –** community aged for Functioning Graft
   - **SCORE_GRAFT_COMM_DUR4_9_LT65 –** community non-aged for Functioning Graft
   - **SCORE_GRAFT_INST_DUR4_9_GE65** – institutional aged for Functioning Graft
   - **SCORE_GRAFT_INST_DUR4_9_LT65** – institutional non-aged for Functioning Graft
   - **SCORE_GRAFT_NE_DUR4_9_GE65** - new enrollee aged for Functioning Graft
   - **SCORE_GRAFT_NE_DUR4_9_LT65** - new enrollee non-aged for Functioning Graft

10 or more months duration of functioning graft scores

   - **SCORE_GRAFT_COMM_DUR10PL_GE65 -** community aged for Functioning Graft
   - **SCORE_GRAFT_COMM_DUR10PL_LT65 -** community non-aged for Functioning Graft
   - **SCORE_GRAFT_INST_DUR10PL_GE65** – institutional aged for Functioning Graft
   - **SCORE_GRAFT_INST_DUR10PL_LT65** – institutional non-aged for Functioning Graft
   - **SCORE_GRAFT_NE_DUR10PL_GE65** - new enrollee aged for Functioning Graft
   - **SCORE_GRAFT_NE_DUR10PL_LT65** - new enrollee non-aged for Functioning Graft

6) Normalization factors:
   - **DF_DG** - normalization factor set by CMS, used to multiply dialysis and transplant scores (currently set to 1 by default)
   - **DF_POSTG -** normalization factor set by CMS, used to multiply functioning graft scores (currently set to 1 by default)

If a beneficiary receives a kidney transplant, the plan is paid using the transplant model for the month of the transplant and the two subsequent months, regardless of whether the beneficiary returns to dialysis status during that time period. The transplant model uses the Medicare costs for these months to assign a factor to each of the months.

   - Month 1 - payment for transplant stay
   - Months 2 and 3 - payment for first two months after stay

After Month 3 a person receives a Functioning Graft score based on the non-ESRD model for the person plus an add-on factor for post-graft status that depends on the age of a beneficiary and duration of the graft.

The user should determine which of the seventeen scores is appropriate for the beneficiary depending upon the status of that beneficiary in each month.